

Crystalline Amino Acid Use in Grow-Finish Diets

Pressure is being brought on the swine industry to reduce nutrient excretion into the environment. We are already accomplishing this task for some nutrients, most notably phosphorus. Using the phytase enzyme in feed reduces phosphorus excretion by pigs on the order of 25 to 30% (Akey Swine Newsletter, January 2001).

For some producers, nitrogen (N) excretion is also problematic due to limited acreage available for effluent application. To reduce N excretion, we must reduce crude protein (CP) levels in grow-finish (GF) diets. We reduce CP by utilizing crystalline amino acids (AA) such as L-lysine in place of intact proteins in soybean meal (SBM). For many years, Akey has used 3 to 3.5 lb/ton of L-lysine in GF diets. At current commodity prices (\$180/ton SBM, \$2.80/bu corn, \$0.85/lb L-lysine), using 3.5 lb/ton of L-lysine saves \$1.70/ton of complete feed. In addition, we reduce SBM (48% CP) level by 108 lb/ton of complete feed. This results in a reduction in dietary CP of two percentage points. For every one percentage point reduction in dietary CP, N excretion by swine decreases ~10%. Consequently, we have reduced N excretion by 20%.

Use of higher levels of crystalline lysine in swine feeds has been limited by two considerations: 1) cost of other synthetic AA and 2) lack of knowledge regarding optimal AA ratios to lysine for different phases of growth. Once we go beyond 3 to 3.5 lb/ton of L-lysine, other AA such as methionine and threonine become limiting (Akey Swine Technical Report, July 2001). Up until now, cost of DL-methionine and especially L-threonine were too high to make their use routine in GF diets, so we were forced to cap usage of L-lysine.

A dramatic reduction in the cost of L-threonine occurred with the opening of a new manufacturing facility in Eddyville, IA this fall. It may now be cost effective to supplement L-threonine and higher levels of L-lysine in GF diets, depending on cost of AA, corn and SBM. Interestingly, price of corn has a large impact on the economics of L-threonine use. When corn costs increase, L-threonine becomes less cost effective (Table 1).

Table 1. Effect of Corn Price on the Economics of L-Threonine Use in Grow-Finish Diets

Item	-----Corn price, \$/bu-----					
	1.75		2.25		3.00	
Threonine included	---	+++	---	+++	---	+++
Phase of production	-----Diet cost, \$/ton-----					
Grower	110.66	109.58	122.04	121.63	139.10	139.70
Finisher	82.73	82.10	97.90	97.54	120.65	120.69

Assumes ingredient costs of SBM (48), \$180/ton; L-lysine, \$0.85/lb; L-threonine, \$1.20/lb; DL-methionine, \$1.40/lb.

A conventional diet formulated with 3.5 lb/ton of L-lysine is compared to the same diet formulated with high levels of L-lysine (Table 2). Adding an extra 2.5 lb/ton of L-lysine plus other AA results in 78 lb/ton less SBM, 2 lb/ton less fat, 76 lb/ton more corn and a further reduction in dietary CP of 1.4 percentage points. Added to the reduction in N excretion we achieve by using 3.5 lb/ton of L-lysine, using 6 lb/ton of L-lysine vs. none results in a total reduction in N excretion of 34%.

Table 2. Comparable Diets With and Without High AA Levels.

Ingredient	Amount, lb/ton	
	Corn	1273
SBM, 47.5	574	496
Fat	96	94
Vitamin-mineral sources	54	54
L-Lysine	3.5	6.0
Other AA	---	1.6

Akey has conducted numerous research trials over the past two years evaluating AA ratios to lysine in diets for GF pigs. Using the results from our research, we have established what we believe to be optimal levels of crystalline AA in GF diets. Based on Akey AA ratios, growth and carcass performance of pigs fed high levels of crystalline lysine were similar to that of pigs fed more conventional levels of L-lysine (Table 3).

Table 3. Performance of GF Pigs Fed Different Levels of Crystalline Amino Acids.

Item	Crystalline lysine added, lb/ton				SEM
	2	4	6	8	
Initial wt, lb	74.7	74.4	74.2	74.6	.42
Final wt, lb	248.0	249.3	247.1	247.6	1.45
ADG, lb	1.72	1.74	1.72	1.72	.015
ADFI, lb	4.69	4.73	4.73	4.77	.033
F/G ^a	2.73	2.73	2.77	2.79	.002
Yield, %	75.9	76.4	76.0	76.2	.29
Lean yield, %	54.1	53.6	53.6	53.6	.22
Backfat, in	.70	.74	.74	.74	.015

Akey trial GF_02_03.

^a Linear response to added L-lysine level, P<.01.

An added benefit to using higher levels of crystalline AA to reduce dietary CP is that it may allow pigs to maintain better growth performance in hot environments (Table 4). In this study, specialized chambers were used to create controlled environments. Addition of fat to the diet of heat stressed pigs brought gain up to 87% of that of pigs in a thermoneutral environment. This compares favorably to gain that was 71% of maximum for heat stressed pigs without fat in the diet. When fat added diets were also supplemented with high levels of crystalline AA to reduce CP, gain was improved to 94% of maximum (Table 4).

Table 4. Effects of Nutritional Modification of Late Finisher Diets in a Heat Stress Environment.

Environment	Neutral	Heat stressed		
		C-SBM	C-SBM/fat	C-SBM/fat/AA
Diet	C-SBM	C-SBM	C-SBM/fat	C-SBM/fat/AA
ADG, lb	2.66 ^h	1.89 ^{a,i}	2.31 ^{b,i}	2.51 ^{b,h}
ADFI, lb	8.86 ^h	6.75 ⁱ	6.79 ⁱ	6.60 ⁱ
F/G	3.33 ^h	3.57 ^{a,h}	2.94 ^{b,hi}	2.63 ^{b,i}

Adapted from Spencer et al., 1999. J. Anim. Sci. 77 (Suppl.1):52 (Abstr.).

^{ab} Means within a row with different superscripts differ (P<.05).

^{hi} Means within a row with different superscripts differ (P<.05).

Akey observed similar responses to high crystalline AA diets in the summer of 2002 in a commercial setting. Based on historical data, ADG was expected to decrease 10-15% in the period of June to September. High crystalline AA diets were implemented in June, and ADG from June through September decreased only 5%.

Care must be taken when formulating diets with high levels of crystalline AA so that all objectives can be met. For some producers, a slight increase in diet cost may be warranted in order to reduce N excretion or maintain growth performance during periods of heat stress. For other producers, the economics of using higher levels of crystalline AA may not be attractive because of ingredient costs. The Akey Technical Staff will be working closely with customers to ensure proper diet formulation and best-cost scenarios with this new technology. If you have questions, please contact your Akey Account Manager or the Technical Staff at (800) 392-8324.