

## Lysine Level Required for Optimal Performance of Late Finishing Swine Fed Paylean®

### Introduction

Paylean® is the trade name for the  $\beta$ -agonist, ractopamine hydrochloride. When added to the diet of late finishing pigs, it stimulates muscle growth and inhibits fat synthesis. Paylean® has been available to producers for use since May 2000. Dose-response studies have been conducted to evaluate the optimum Paylean® level. However, little work has been performed to determine the lysine requirement necessary to optimize performance to Paylean® in modern lean-genetic pigs.

### Objective

This study was designed to determine the lysine level that allowed full growth expression to Paylean® fed at 9 g/ton and to determine if pigs fed diets formulated with synthetic amino acids performed similarly to pigs fed diets with intact protein.

### Experimental Procedures

At an average initial weight of 203±.7 lbs, 399 PIC 337 x C22 barrows and gilts were allotted to one of seven dietary treatments (**Table 1**). Pigs were allotted by gender and weight (42 pens, 9-10 pigs/pen) and fed *ad-libitum* for 28 days. Individual pig weights were taken at the start and at the end of the trial. Pens of pigs were weighed every 7 days for ADG, ADFI, and FCR calculations.

Meal diets were prepared using analyzed corn and SBM values. Corn-soy diets were formulated to 0.78% total lysine without Paylean® (Control – Diet 1) and with Paylean® (Diets 2-5) having 0.78, 0.90, 1.02, or 1.14% total lysine from intact protein. Diets 6 and 7 also contained Paylean®, but were formulated to 0.90 and 1.02% total lysine using 4.5 lbs L-Lysine, DL-Methionine, L-Threonine, and L-Tryptophan. Minimum ideal protein ratios were 60%, 70% and 20% for M+C:Lys, Thr:Lys and Trp:Lys, respectively. The composition and calculated nutrient values of the diets are shown in **Table 2**.

**Table 1. Dietary Treatments**

1. Corn – SBM Control	0.78% T Lysine*
2. Corn – SBM + 9 g/ton PAYLEAN®	0.78% T Lysine*
3. Corn – SBM + 9 g/ton PAYLEAN®	0.90% T Lysine
4. Corn – SBM + 9 g/ton PAYLEAN®	1.02% T Lysine
5. Corn – SBM + 9 g/ton PAYLEAN®	1.14% T Lysine
6. Corn – SBM + 9 g/ton PAYLEAN® + 4.5 lbs L-Lys + 0.60 M+C + 0.70 Thr	0.90% T Lysine
7. Corn – SBM + 9 g/ton PAYLEAN® + 4.5 lbs L-Lys + 0.60 M+C + 0.70 Thr	1.02% T Lysine

**6 Pens of 9-10 pigs each for a total of 57 pigs per treatment (3 Pens F, 3 Pens M / treatment)**

\*0.78% Total lysine or (0.67% TID Lysine). 0.78% Lysine was used to ensure the Control diet was not nutritionally limiting for the Control group.

**Table 2. Diet Composition for Control (1), Lysine Dose Response Curve (2-5) and Synthetic Counterparts (6,7)**

		Dietary Ingredient Composition, lbs/ton						
Ingredient		CON 0.78 (1)	PL 0.78% (2)	PL 0.90% (3)	PL 1.02% (4)	PL 1.14% (5)	PL-Syn 0.90 (6)	PL-Syn 1.02 (7)
Corn	lbs	1518.3	1517.3	1427.8	1334.8	1240.5	1552.2	1464.5
Soybean Meal 48	lbs	385	385	470	560	650	345	430
Fat-CWT	lbs	40	40	45	49	54	37	40
Dicalcium Phosphate	lbs	25.5	25.5	25.5	25	24.5	26	25.5
Limestone	lbs	17	17	16.5	16	15.5	17.5	17
Salt	lbs	8	8	8	8	8	8	8
L-Lysine	lbs						4.5	4.5
DL-Methionine	lbs						0.4	0.8
L-Threonine	lbs					0.3	1.7	2
L-Tryptophan	lbs						0.5	0.5
Vit-Tr. Mineral Premix	lbs	4	4	4	4	4	4	4
CuSO <sub>4</sub>	lbs	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Tylan 40	lbs	1	1	1	1	1	1	1
Premix PAYLEAN®	lbs	0	1	1	1	1	1	1
<b>TOTAL</b>	<b>lbs</b>	<b>2000</b>	<b>2000</b>	<b>2000</b>	<b>2000</b>	<b>2000</b>	<b>2000</b>	<b>2000</b>
<b>Nutrient Specification</b>								
NRC ME	Mcal/lb	1.54	1.54	1.55	1.55	1.56	1.54	1.54
Modified ME	Mcal/lb	1.49	1.49	1.49	1.49	1.49	1.49	1.49
Crude Protein	%	15.44	15.44	17.09	18.84	20.60	14.94	16.62
Total Lysine	%	0.78	0.78	0.90	1.02	1.14	0.90	1.02
TID Lysine	%	0.68	0.68	0.78	0.90	1.01	0.80	0.91
Total M+C	%	0.54	0.54	0.59	0.64	0.68	0.54	0.61
Total Threonine	%	0.58	0.58	0.64	0.71	0.80	0.63	0.71
Total Tryptophan	%	0.17	0.17	0.20	0.22	0.25	0.18	0.21
Total Isoleucine	%	0.63	0.63	0.71	0.79	0.88	0.59	0.67
Calcium	%	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Available Phosphorus	%	0.30	0.30	0.30	0.30	0.30	0.30	0.30

CON - Control (no Paylean® was included in the diet)  
 PL - Paylean® was included in the diet  
 TID - True Ileal Digestible

Paylean® was added at the rate of 9 g/ton of diet. This level was selected from Elanco dose-response studies in which 9 g resulted in approximately 85% of maximum ADG response, 80% FCR, 73% of carcass yield and 67% of dissected lean.

At the end of the 28-day test period, pigs were slaughtered (average weight = 283.5±2.2 lbs) and hot carcass weight, FOM backfat thickness, loin depth and percent carcass lean were recorded. Carcass yield was calculated using live weight just prior to shipment and plant hot carcass weight.

Data are presented as least square means using initial weight as a covariate in the analysis of the live animal performance and hot carcass weight as a covariate in the analysis of the carcass traits (except for yield).

## Results

Pigs fed the Control diet had an ADG of 2.41 lbs/d and a FCR (F/G) of 2.93 (Table 3). When Paylean® was added to the 0.78% lysine diet, pigs had a numerical improvement in ADG (2.52 lbs/d, P<.16) and a significant improvement in FCR (2.69, P<.01) compared to Control pigs. Performance (ADG and FCR) continued to improve (linear, P<.05) as lysine level increased in the diets containing Paylean®.

Pigs fed diets with practical levels of synthetic amino acids had identical performance (P>.50) to pigs fed diets with the same lysine level but formulated with intact protein (Figure 1).

**Table 3. Paylean® Response due to Dietary Lysine<sup>a</sup>**

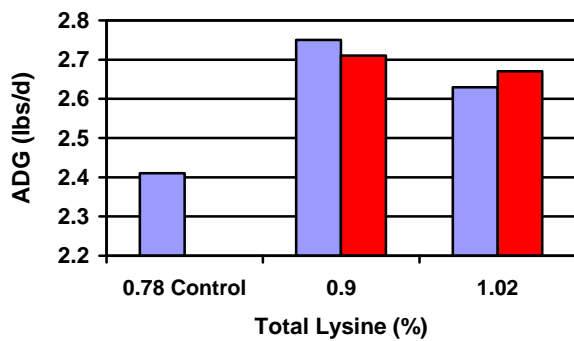
	Lys %	ADG Lbs/d	FCR F/G	ADFI Lbs/d
1. Control <sup>bc</sup>	0.78	2.41	2.93	7.09
2. Paylean <sup>d</sup>	0.78	2.52	2.69	6.79
3. Paylean <sup>d</sup>	0.90	2.75	2.56	7.02
4. Paylean <sup>d</sup>	1.02	2.63	2.53	6.66
5. Paylean <sup>d</sup>	1.14	2.79	2.46	6.88
Pooled SEM	-	0.05	0.04	0.11

<sup>a</sup> 28 d growth assay. Average initial weight 203 ± .7 lbs  
<sup>b</sup> Control vs. Diet 2: ADG, ADFI, P<.16; FCR P<.01  
<sup>c</sup> Control vs. Paylean (diets 2-5): ADG, FCR, P<.01; ADFI P <.08  
<sup>d</sup> Diets 2-5: ADG and FCR, effect due to lysine level linear, P<.05

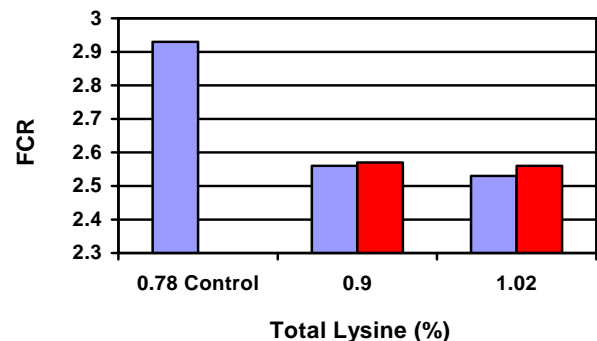
**Figure 2** shows the diminishing response to Paylean® over time. As the response decreased so did the lysine level required to optimize growth performance. However, the performance of pigs fed the synthetic amino acid vs the intact protein diets remained the same each week of the study.

Evaluation of the carcass traits (**Table 4**) revealed an improvement of 1.8% in yield and 1.2% for lean. This equates to 9 lbs of extra carcass weight and a leaner carcass, despite the heavier slaughter weight (283.5 lbs). This difference was observed at all dietary lysine levels. As with live animal performance, there was no difference in measured carcass characteristics between carcasses of pigs fed intact protein or synthetic amino acid diets.

**Figure 1. Paylean® Response with Intact Protein vs. Synthetic Amino Acid Diets**  
28 day growth assay

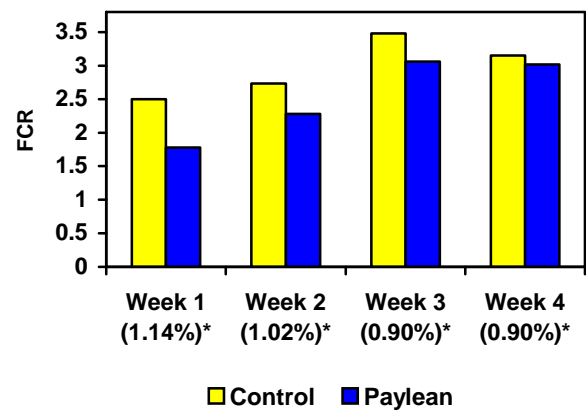
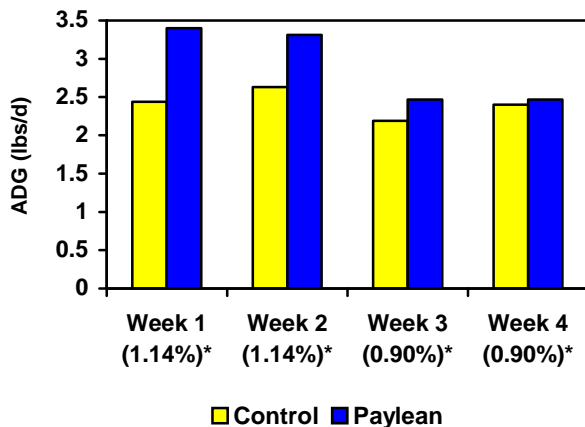


Pooled SEM = 0.05  
Intact vs. Synthetic P>.50



Pooled SEM = 0.04  
Intact vs. Synthetic P>.50

**Figure 2. Change in Paylean® Response over Time**  
(Means derived from lysine level\* that allowed maximum performance)



**Table 4. Carcass Response to Paylean® in Relation to Lysine Level<sup>a</sup>**

Diet	Lysine (%)	Carcass Yield <sup>b,c</sup> (%)	FOM Backfat <sup>b,c</sup> mm <sup>c</sup>	Loin Depth mm	FOM Lean <sup>b,c</sup> (%) <sup>c</sup>
1. Control	0.78	73.6	24.4	60.7	51.3
2. Paylean®	0.78	75.5	22.4	60.9	52.5
3. Paylean®	0.90 – intact	75.4	22.9	59.0	52.0
4. Paylean®	1.02 – intact	75.2	22.4	61.1	52.5
5. Paylean®	1.14	74.1	21.8	60.4	52.8
6. Paylean®	0.90 – synthetic	75.6	21.9	61.6	52.9
7. Paylean®	1.02 - synthetic	76.4	21.6	64.4	53.4

<sup>a</sup>Average slaughter weight = 283.5 lbs  
<sup>b</sup>Control vs. Paylean®, P<.05  
<sup>c</sup>Intact vs. Synthetic amino acids diets, P>.05

## Discussion

This study shows that the impressive ADG and FCR responses when using Paylean® is dependent upon lysine level. When fed the highest lysine level (1.14%), pigs had a 16% improvement in ADG and FCR compared to the control pigs over the 28-day trial period. However, since the lysine level required to optimize growth declines over time (due to the transient response to Paylean®), it is difficult to estimate a single lysine requirement. A practical solution would be to reduce dietary lysine at 14d intervals (shown in Figure 2). Pigs performed equally as well when fed diets with synthetic amino acid compared to intact protein. This is an important observation since FDA guidelines specify a 16% protein diet and intact protein, rather than the more practical and economical approach of formulating to amino acid level. Carcass yield and percent lean increased at all lysine forms and levels with the addition of Paylean® to the diet. The major contributor to net revenue for the producer is expected to result from carcass yield.

## Conclusions

Based on the results of this study, when feeding Paylean® at 9 g/ton the total lysine level to optimize performance is between 0.90 and 1.02% and the same level of performance can be achieved whether this lysine comes from intact protein or the synthetic form.

## Reference

PIC USA Technical Memo No. 245. Response of PIC 337 Progeny to the Metabolism Modifier Paylean®. Boyd, R. D. *et al.*, PIC USA Franklin, KY.

## Disclaimer

Ajinomoto Heartland, Inc. is neutral on the use of Paylean®. This is an individual producer's decision. However, if a producer decides to feed Paylean®, the use of economical synthetic amino acids are an option.