

Effect of Nutritional Level While Feeding Paylean™ to Late-Finishing Swine

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Introduction

Over the last ten years, the swine industry has selected to increase percent lean in pigs in response to consumer demand. In search of technology to improve percent lean, Paylean™ (ractopamine hydrochloride) has been shown to increase carcass leanness while improving growth performance when fed to finishing pigs. It has been documented that average daily gain (ADG) and feed efficiency (F:G) are improved when feeding Paylean™ to finishing hogs, and these improvements increase as the dose of Paylean™ is increased when pigs are fed a constant 16% crude protein (CP) diet. It has also been documented that improvements in carcass leanness are also seen, and these improvements increase as the dose of Paylean™ is increased while feeding a constant 16% CP diet.

With today's leaner genetics, with higher lean accretion rates, the question of a 16% CP diet needs to be re-evaluated as being adequate for today's pigs when being fed Paylean™. In today's swine industry, most pigs are also being phase fed to improve growth rates, leanness, and cost efficiency. A phase feeding program that would match the projected lean accretion curve expected with Paylean™ may yield even greater growth and leanness response compared to the old flat 16% CP diets while feeding Paylean™.

Therefore, a late-finishing study (last six weeks) was conducted to evaluate the effect of feeding a constant dietary protein level or a phase feeding program of varying protein levels, designed to meet the projected lean growth curve (Schinckel et al., 2000), on ADG, average daily feed intake (ADFI), F:G, fat and loin depth, carcass weight, premiums, and percent lean while pigs were being fed Paylean™. This trial was conducted over a six-week period from April to May, 2000.

Experimental Procedure

Four dietary treatments were formulated for this study to be fed over a six-week period; treatments 1-3 were fed throughout the six-week trial, while treatment 4 changed weekly. Treatments were as follows: 1) 16% CP control diet (no Paylean™) with a .82% lysine level; 2) 16% CP diet containing 18 g/ton of Paylean™, with a .82% lysine level; 3) 18% CP diet containing 18 g/ton of Paylean™, with a .97% lysine level; and 4) a phase fed diet sequence containing 18% CP with a 1.08% lysine level during weeks one and four, a 20% CP diet containing 1.22% lysine during weeks two and three, a 16% CP diet containing a .94% lysine level during week five, and a 16% CP diet containing a .82% lysine level during week six. All diets in treatment 4 contained 18 g/ton of Paylean™. This phase feeding (CP, lysine) sequence was designed to match the previous lean accretion curves, where pigs fed Paylean™ increased fat-free lean gain by 50% in weeks two and three and then the Paylean™ response declined to 11% by week six on Paylean™. Swine yellow grease was added to all diets at a 5% level. Diet formulations can be seen in Table 1.

Ninety-six barrows (PIC 337 x C22) were blocked by weight into 24 pens (4 pigs/pen; 10 ft²/pig). One of the four dietary treatments was randomly assigned to each pen within a block. Pigs were weighed and feed intakes were recorded every week for the six-week period to determine ADFI and ADG, from which F:G was calculated. Backfat and loin eye areas were measured weekly on all pigs using real-time ultrasound (Aloka 500). Pigs were marketed when the block average reached 240 lbs, at which time fat and loin depth, carcass length, percent lean, carcass weight, carcass premium, 10th rib loin eye area, fat thickness, and pork quality characteristics were collected at a commercial slaughter facility in Indiana or at the Purdue University meat lab. Fifteen pigs/treatment for treatments 1, 2, and 4 had one side of the carcass frozen for later dissection to determine wholesale and retail cut weights and total lean and fat contents to determine accretion rates.

Statistical analysis of the data collected was performed using the GLM procedure of SAS. Pigs were blocked by initial body weight, and dietary treatment was examined to determine its effect on growth and carcass characteristics.

Results and Discussion

Results of the performance data can be seen in Table 2. ADG and F:G were improved during weeks one, two and three, as CP and lysine levels were increased while feeding PayleanTM. Pigs grew 15% faster in week one ($P<.05$) while decreasing ADFI by 5.2% ($P<.05$) and F:G by 16% ($P<.05$) when comparing the control diet to the phase fed + PayleanTM diet. During the second week, pigs grew 14.1% faster ($P<.05$) while decreasing ADFI by 6.7% ($P<.05$) and F:G by 18.4% ($P<.05$) when comparing the phase fed + PayleanTM treatment to the control treatment. During weeks three and four, ADFI was significantly decreased ($P<.05$) when comparing the control and phase fed + PayleanTM diets; however, only numerical improvements were seen in ADG and F:G. No significant differences were observed in week five; however, all pigs fed PayleanTM had numerically reduced ADG compared to the control pigs, and pigs on the phase fed diet showed the greatest decrease in growth performance.

Four and five-week overall performance is shown in Table 3. From 0-4 weeks, ADG and F:G were all improved as the level of CP and % lysine were increased. Phase fed + PayleanTM pigs showed significant improvements ($P<.05$) in ADG and F:G compared to the control and control + PayleanTM treatments. From 0-5 weeks, significant improvements were not seen in ADG as CP and % lysine levels increased, due to the greatly reduced performance during week 5 by the 18% CP + PayleanTM and phase fed + PayleanTM pigs. However, F:G was still better for the pigs fed 18% CP + PayleanTM and the phase fed feeding program compared to the control and the control + PayleanTM treatments ($P<.05$). A trend was seen in ADG as CP and % lysine levels were increased to 18% CP + PayleanTM or fed the phase fed + PayleanTM diets compared to the control and control + PayleanTM treatments. These four and five week summaries would indicate that significant improvements are made when feeding the phase fed + PayleanTM diet, compared to the other three treatments, during the first four weeks on PayleanTM. But, these improvements are lost during the fifth week when PayleanTM is fed in conjunction with this phase feeding program to yield a similar response as the 18% CP + PayleanTM treatment.

Along with the performance data shown in Tables 2 and 3, cost/lb of gain and grams of lysine consumed per day (g lys/day) are also shown. As expected, g lys/day and cost per pound

of feed increased as the CP and % lysine levels were increased in the diets (Table 1). Cost/lb of gain, however, did not show this. A significant decrease (\$.0147) in cost/lb of gain ($P<.05$) was observed in weeks one and two, while numerical decreases were seen in weeks three and four when comparing the control diet to the phase fed diet containing Paylean™ (Table 2). When looking at overall cost/lb gain through week 4 (Table 3), an incremental decrease of \$.009/lb was observed for the phase fed + Paylean™ treatment compared to the control pigs. When looking at the week five data, this decrease in cost/lb of gain was lost in the Paylean™-fed pigs compared to the pigs that were on the control diet containing no Paylean™. However, the pigs fed Paylean™ with the phase feeding program were 5.1 lbs heavier in the same amount of time, and were leaner with this similar diet cost per pound of gain.

Pigs that were fed Paylean™ had reduced 10th rib fat depth ($P<.05$) and increased % lean ($P<.05$; Table 4). LEA and % yield were significantly higher ($P<.05$) in those pigs that were fed the phase fed treatment containing Paylean™ when compared to the control treatment. Paylean™-fed pigs also showed no change in pork quality measurements (loin eye color, firmness, and marbling) compared to the control treatment. A subset (15 pigs/treatment) of the control, control + Paylean™, and phase fed + Paylean™ treatments had loin pH, drip loss, and Hunter color values determined (Table 5). Dietary treatment had no effect on any of these loin characteristics.

This data would indicate that the improvement seen in ADG and F:G while pigs are fed Paylean™ compensates for the increase in the cost of these high CP and % lysine diets, and that improvements in carcass characteristics are predicted to be able to compensate for the cost of Paylean™ in the diet.

Table 6 shows feed cost for the last 90 lbs of gain during a five-week period and the premiums received for the pigs on test. HCW was calculated using the % yield observed in all four treatments, and these values were applied to a 240 lb market animal. All pigs which were fed Paylean™ showed a lower feed cost for the last 90 lbs of gain. Due to the decrease in performance of the phase fed treatment during week five, these pigs had a higher feed cost calculated when compared to the other two treatments that were fed Paylean™, but this was still cheaper than the controls. In addition, all pigs fed Paylean™ yielded a higher premium/cwt of carcass, thus resulting in a higher premium/pig. Pigs which were fed the 16 and 18% CP diets containing Paylean™ returned approximately \$2.00/pig more over the control treatment, and the animals that were on the phase fed treatment containing Paylean™ returned nearly \$3.00/pig more than the control animals in total carcass premiums.

Application

Results from this trial would indicate that a four-week late-finishing program feeding Paylean™ in conjunction with the phase fed treatment would yield the best return on investment. Performance improvements during these four weeks would compensate for the higher diet costs and result in a lower cost/lb of gain, compared to the control pigs. The increase in carcass premium/pig of nearly \$3.00 would then be expected to pay for the Paylean™ added to the diet.

References

NPPC. 1991. Procedures To Evaluate Market Hogs (3rd Ed.). National Pork Producers Council. Des Moines, IA.

Schinckel, A.P., B.T. Richert, and D.C. Kendall. 2000. Modeling the response to Paylean and dietary lysine requirements. Purdue University Swine Day Report. p. 75.

Table 1. Experimental diets.

Diet	16% CP	16% CP+ Paylean™	18% CP+ Paylean™	18% CP+ Paylean™ + Lys ^a	20% CP+ Paylean™ + Lys ^a	16% CP+ Paylean™ + Lys ^a
<u>Ingredient, %</u>						
Corn	71.82	71.70	66.68	66.50	61.48	71.52
SBM, 48%	21.14	21.16	26.24	26.28	31.36	21.19
Fat	5.00	5.00	5.00	5.00	5.00	5.00
Vit/Min	2.05	2.06	1.99	1.99	1.92	2.06
Lysine (HCl)	0.0	0.0	0.0	0.15	0.15	0.15
Paylean ^b	0.0	0.1	0.1	0.1	0.1	0.1
Lys, %	.82	.82	.97	1.08	1.22	.94
ME, Kcal/lb	1618	1616	1616	1614	1614	1614
Ca, %	.55	.55	.55	.55	.55	.55
P, %	.45	.45	.45	.46	.47	.45
Cost ^c , \$/ton	125.33	125.29	132.51	134.09	141.32	126.94

^a Diets used in the phase feeding treatment.

^b 18 g/ton level of Paylean™ was deducted from corn when formulating diets.

^c Ingredient prices used in calculation: Corn, \$.04/lb; SBM, 48%CP, \$.113/lb; Fat, \$.12/lb; Vit/Min, \$3.87; Lysine (HCl), \$.55/lb.

Note: No diet cost was added for Paylean™ as the price has yet to be determined.

Table 2. Effect of Paylean™ and dietary crude protein levels on weekly ADG, ADFI, and F:G in late-finishing pigs.

	16% CP (Control)	16% CP+ Paylean™	18% CP+ Paylean™	Phase+ Paylean™	Std. Error
Initial Weight	153.1 ^a	153.1 ^a	153.3 ^a	154.5 ^a	.827
Week 1					
ADG	2.72 ^b	2.82 ^b	3.07 ^a	3.13 ^a	.078
ADFI	6.40 ^a	6.20 ^a	6.10 ^a	6.07 ^a	.136
F:G	2.25 ^a	2.13 ^a	1.94 ^b	1.89 ^b	.045
g Lys/day	24.0	23.1	26.9	29.8	
BW	172.2 ^b	172.8 ^b	174.8 ^{ba}	176.5 ^a	.809
Cost/lb gain, \$	.1410 ^a	.1324 ^{ab}	.1282 ^b	.1263 ^b	.004
Week 2					
ADG	2.56 ^b	2.48 ^b	2.71 ^{ba}	2.92 ^a	.083
ADFI	6.67 ^a	6.41 ^a	6.28 ^a	6.22 ^a	.143
F:G	2.61 ^a	2.61 ^a	2.32 ^b	2.13 ^b	.071
g Lys/day	25.0	23.9	27.7	34.5	
BW	190.1 ^b	190.1 ^b	193.7 ^{ba}	196.9 ^a	1.07
Cost/lb gain, \$	.1633 ^{ab}	.1680 ^a	.1538 ^b	.1507 ^b	.005
Week 3					
ADG	2.43 ^a	2.53 ^a	2.56 ^a	2.61 ^a	.066
ADFI	6.44 ^a	6.19 ^a	6.33 ^a	6.11 ^a	.185
F:G	2.67 ^a	2.45 ^a	2.49 ^a	2.34 ^a	.078
g Lys/day	24.2	23.1	27.9	33.8	
BW	207.1 ^b	207.6 ^a	211.6 ^a	215.2 ^a	1.12
Cost/lb gain, \$	.1673 ^a	.1530 ^a	.1651 ^a	.1656 ^a	.006
Week 4					
ADG	2.38 ^a	2.38 ^a	2.48 ^a	2.43 ^a	.117
ADFI	6.32 ^a	5.93 ^{ba}	5.60 ^b	5.55 ^b	.144
F:G	2.69 ^a	2.50 ^a	2.27 ^a	2.31 ^a	.106
g Lys/day	23.7	22.1	24.7	27.2	
BW	224.6 ^a	224.2 ^a	229.0 ^a	232.1 ^a	1.81
Cost/lb gain, \$	.1626 ^a	.1570 ^a	.1506 ^a	.1465 ^a	.009
Week 5					
ADG	2.09 ^a	1.88 ^a	1.86 ^a	1.67 ^a	.118
ADFI	6.34 ^a	5.65 ^a	5.48 ^a	5.94 ^a	.264
F:G	3.20 ^a	3.21 ^a	3.09 ^a	3.58 ^a	.129
g Lys/day	23.8	21.1	24.2	25.4	
BW	238.7 ^a	237.4 ^a	241.9 ^a	243.8 ^a	2.28
Cost/lb gain, \$	.2000 ^a	.2012 ^a	.2050 ^a	.2273 ^a	.010

^{a,b} Means in a row with different superscripts differ (P<.05).

Table 3. Overall performance summary for weeks 0-4 and 0-5 for pigs fed Paylean™ and varying crude protein levels.

Overall	16% CP (Control)	16% CP+ Paylean™	18% CP+ Paylean™	Phase+ Paylean™	Std. Error
Weeks 0-4					
ADG	2.55 ^b	2.54 ^b	2.70 ^{ba}	2.77 ^a	.052
ADFI	6.39 ^a	6.13 ^a	6.03 ^a	5.95 ^a	.124
F:G	2.55 ^a	2.44 ^a	2.26 ^b	2.17 ^b	.034
BW	224.6 ^a	224.2 ^a	229.0 ^a	232.1 ^a	1.81
Cost/lb gain, \$	.1569 ^a	.1515 ^a	.1480 ^a	.1479 ^a	.003
Weeks 0-5					
ADG	2.44 ^a	2.41 ^a	2.53 ^a	2.55 ^a	.052
ADFI	6.38 ^a	6.04 ^a	5.92 ^a	5.94 ^a	.141
F:G	2.68 ^a	2.59 ^a	2.42 ^b	2.45 ^b	.044
BW	238.7 ^a	237.4 ^a	241.9 ^a	243.8 ^a	2.28
Cost/lb gain, \$	.1635 ^a	.1575 ^a	.1552 ^a	.1581 ^a	.003

^{a,b} Means in a row with different superscripts differ (P<.05).

Table 4. Effect of Paylean™ and dietary crude protein on carcass characteristics in late-finishing pigs.

	16 % CP (Control)	16 % CP+ Paylean™	18 % CP+ Paylean™	Phase + Paylean™	Std. Error
Slaughter BW, lbs	248.6 ^b	246.3 ^a	250.5 ^c	251.7 ^d	
HCW, lbs	188.3 ^b	189.2 ^b	188.9 ^b	192.0 ^a	.927
10 th Rib BF*, in	.78 ^a	.64 ^b	.64 ^b	.59 ^b	.035
LEA*, in	7.02 ^b	7.37 ^{ba}	7.23 ^{ba}	7.56 ^a	.162
% Lean*	54.26 ^b	56.31 ^a	56.09 ^a	57.01 ^a	.575
% Yield	75.5 ^b	75.8 ^b	75.7 ^b	77.0 ^a	.370
Color**	2.7 ^a	2.5 ^a	2.8 ^a	2.8 ^a	.123
Marbling**	1.5 ^a	1.7 ^a	1.7 ^a	1.6 ^a	.120
Firmness**	2.7 ^a	2.8 ^a	3.0 ^a	3.0 ^a	.174

^{a,b} Means in a row with different superscripts differ (P<.05).

* Adjusted for live weight.

** Scores determined on a 1-5 scale (NPPC, 1991).

Table 5. Effect of Paylean™ and dietary crude protein on pork quality in late-finishing pigs.

	16 % CP (Control)	16 % CP+ Paylean™	Phase % CP+ Paylean™	Std. Error
45 min. pH	6.11 ^a	6.06 ^a	6.11 ^a	.045
Drip Loss, %	3.79 ^a	4.45 ^a	3.60 ^a	.396
Hunter Colors				
L*	51.01 ^a	51.94 ^a	50.23 ^a	.528
a*	9.59 ^a	8.97 ^a	9.29 ^a	.376
b*	8.81 ^a	8.72 ^a	8.57 ^a	.191

^a Means in a row with different superscripts differ (P<.05).

Note: Data from 45 pigs, from three treatments, brought in to the Purdue University meat lab for slaughter.

Table 6. Effect of Paylean™ and dietary crude protein on Cost/Premium in late-finishing pigs.

	16 % CP (Control)	16 % CP+ Paylean™	18 % CP+ Paylean™	Phase+ Paylean™	Std. Error
HCW*, lbs	181.20	181.92	181.68	184.80	
Cost/lb gain, \$	.1635 ^a	.1575 ^a	.1552 ^a	.1581 ^a	.003
Feed cost last 90 lbs gain, \$	14.72 ^a	14.18 ^a	13.97 ^a	14.23 ^a	.281
Premium/cwt carcass, \$	4.75 ^a	5.90 ^a	5.61 ^a	6.20 ^a	.509
Premium/pig, \$	8.61	10.73	10.19	11.46	
Value over control	\$0.00	\$2.12	\$1.58	\$2.85	

^{a,b} Means in a row with different superscripts differ (P<.05).

* HCW calculated for all diets by multiplying respective % yields by a constant 240 lbs.