Optimal Paylean® Sequence (Step-up/Step-down) When Fed to Late-finishing Swine

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Introduction

Previous research trials that were conducted at Purdue University with Paylean have shown that even though growth performance parameters of pigs fed Paylean stay at levels above conventionally fed pigs, performance parameters peak and slowly decline 4 to 6 weeks after animals are fed this product. Average daily gain (ADG) peaks, then plateaus until approximately day 21, followed by a decline, and lean accretion is affected in a similar way. Fat deposition rate in pigs fed Paylean declines immediately and remains lower the first 10-14 days on Paylean. During subsequent time on Paylean, fat deposition rates are lower but parallel control pigs. The effects explained above are enhanced as the level of Paylean is increased. Although the effects seen in fat deposition are desired, questions have been raised as to why growth performance and protein accretion parameters plateau and then decline. Possible explanations may include:

1) Receptors to this product begin to be desensitized when feeding a constant level of Paylean and
2) As the animal's growth potential begins to decline, so does the responsiveness to the product.

With the recent approval of Paylean to be fed to pigs from 150-240 lb of body weight (BW), multiple feeding regimes are being examined to identify which will maximize growth performance and carcass characteristics while minimizing cost to the producer. Most pigs receiving Paylean are fed a constant level between 4.5-18 g/ton of feed. This trial was designed to determine whether the response to Paylean could be enhanced or maintained if fed at increasing and/or decreasing intervals during the finishing phase compared to pigs that were fed a constant level throughout the finishing stage. Specific objectives of this trial were to determine whether the response could be extended if Paylean dose were increased throughout the finishing phase, and whether the response to Paylean would be maintained if Paylean dose were decreased throughout the finishing trial.

Therefore, a late-finishing study (last six weeks) was conducted to evaluate the effects of feeding a constant level of Paylean vs. a phase-feeding treatment of varying Paylean levels on ADG, average daily feed intake (ADFI), feed efficiency (F:G), fat and loin depth, carcass weight, premiums, percent yield, percent lean, and lean cut weights. This trial was conducted over a six-week period from June to July, 2000.

Experimental Procedure

Four dietary treatments were fed during the six-week period. Treatments 1 and 4 were fed constantly throughout the six-week trial, while treatments 2 and 3 were changed every two weeks. Treatments were as follows:

1) Control diet containing no Paylean
2) Step-down diet sequence: 18 g/ton Paylean weeks 1 and 2; 9 g/ton Paylean weeks 3 and 4; and 4.5 g/ton Paylean weeks 5 and 6

3) Step-up diet sequence: 4.5 g/ton Paylean weeks 1 and 2; 9 g/ton Paylean weeks 3 and 4; and 18 g/ton Paylean weeks 5 and 6

4) Constant diet containing 10.5 g/ton Paylean

Gilts and barrows were fed the same treatments but with different dietary lysine levels. Gilts were fed a 19.6% CP diet with a 1.2% lysine level while barrows were fed an 18.5% CP diet with a 1.1% lysine level. Swine yellow grease was added to all diets at a 5% level. Diet formulations can be seen in Tables 1a and 1b.

Eighty barrows and 80 gilts (PIC 355 x YxL) were blocked by weight and sex into 32 pens (5 pigs/pen; 11 ft^2/pig). Each pen within a block, was randomly assigned one of the four dietary treatments. Pigs were weighed and feed intakes were recorded weekly for the six-week period to determine ADG and ADFI, from which F:G was calculated. Backfat and loin eye areas were measured every two weeks on all pigs using real-time ultrasound (Aloka 500). Pigs were marketed after six weeks on test, at which time fat and loin depth, percent yield, percent lean, carcass weight, and carcass premium data were collected on 96 pigs (3/pen, 24/treatment) at a commercial slaughter facility. Pigs sent to the commercial slaughter facility were killed approximately three days after being weighed off their treatment diet and pigs were maintained on their final diet until they were harvested. Sixty-four pigs (2/pen, 16/treatment) were brought to the Purdue University meat lab, where fat and loin depths were taken with real-time ultrasound and Fat-O-Meter technologies. In addition, fat thickness, loin eye area, carcass length, pork quality characteristics, and primal and sub-primal cut weights were also collected.

Statistical analysis of the data collected was performed using the GLM procedure of SAS. Pigs were blocked by initial body weight. Dietary treatment, pig sex, and interaction were examined to determine their effects on growth and carcass characteristics. No treatment x sex interactions were detected ($P > .10$), therefore only treatment main effects are reported.

Results and Discussion

All pigs in the trial had very good growth performance. The control pigs grew faster than expected (2.09 lb/d vs. 1.9 lb/d), which led to the control and treated pigs being 5 to 10 pounds heavier than projected at the end of the trial. Potential reasons for this increase in performance are:

1) The test was conducted during a time when high temperatures usually decrease performance, but lower than normal summer temperature's were observed during the time pigs were on test.

2) Pigs were potentially under less disease pressure than is normally observed in the facility.

During period 1 (weeks 1 and 2), all pigs fed Paylean had improved ADG and F:G compared to those pigs fed no Paylean. Average daily gain was increased by an average of 22.9% ($P < .05$) for pigs fed Paylean compared to the control pigs, while F:G was improved by an average of 27.5% ($P < .05$). An average decrease of .15 lb/d (2.5%) ADFI was observed when comparing those pigs on Paylean treatments to control pigs. It should be noted that no significant differences were observed in ADG and F:G among those pigs fed the varying Paylean treatments, even though three different levels were being fed during this stage (Step-up = 4.5 g/ton; Step-down = 18 g/ton; Constant = 10.5 g/ton). This would indicate that at this stage of growth, animals may experience maximal sensitivity near the 4.5 g/ton level, and this level of Paylean will return approximately 80% of the growth performance as the higher levels of Paylean.

During period 2 (weeks 3 and 4), a continued improvement in growth performance was observed for pigs fed Paylean compared to those fed no Paylean, and differences between phase-feeding treatments also were seen even though pigs were fed similar Paylean levels (Step-down = 9 g/ton; Step-up = 9 g/ton; Constant = 10.5 g/ton). No significant differences were observed in ADG between the control pigs and those on the step-down treatment. However, the step-up and constant treatments had a significant increase in ADG (.29 lb/d; P < .05) compared to the control pigs. The step-up treatment also had a 10.8% increase in ADG (P < .05) compared to the step-down treatment. No significant difference in ADG was observed between the step-up and constant treatments during period 2. The step-up and step-down treatments also had an average decrease in ADFI of 7.2% (P < .05) compared to the control pigs. All pigs fed Paylean had a 15.5% improvement in F:G (P < .05) compared to the controls, while the step-up treatment had a 11.4% improvement (P < .05) in F:G compared to the average of the step-down and constant treatments.

During period 3 (weeks 5 and 6), the step-up treatment had a significant increase in ADG of .36 lb/d (P < .05) compared to the step-down treatment, and an average increase of .17 lb/d (P < .05) compared to the constant and the control treatment fed pigs. Pigs on the step-up and constant treatments had an average decrease in ADFI of .83 lb/d compared to the control pigs, but only a numerical difference in ADFI compared to the step-down treatment. During period 3, F:G was improved by 16.4% (P < .05) for pigs fed the step-up and constant treatments compared to the step-down and control treatments.

Overall, ADG increased 10.4% for pigs fed a Paylean treatment (P < .05) compared to those fed the control diet. In addition, the step-up treatment had a 6.3% (P < .05) increase in ADG compared to the step-down treatment. No significant difference in ADG was observed between the step-up treatment and those pigs fed a constant diet containing 10.5 g/ton throughout the trial. The step-up treatment was the only feeding program in this trial that significantly decreased overall ADFI (8.1%) compared to the control pigs. A 17.4% (P < .05) average improvement in F:G was observed for those pigs fed the step-up and constant treatments compared to the control pigs, and a 7.3% improvement (P < .05) in F:G over the step-down treatment. No significant difference was detected between the step-up and constant treatments for overall F:G. This data would indicate that the step-down treatment will not maintain the growth-performance response of Paylean, but the step-up treatment improves some aspects of growth performance over the constant level of 10.5 g/ton Paylean.

As expected, cost per ton of feed increased as Paylean levels were increased in the diet (Table 1a & 1b). Cost per lb of gain however did not necessarily increase (Table 2). A significant decrease in cost/lb of live weight gain was observed in period 1 (14.4%; P < .05) when comparing the step-up treatment to the step-down and control treatments, and during period 2 (11.4%; P < .05) when comparing the step-up treatment to the other three treatments. This is a good indication that the 4.5g/ton level is the most cost-effective level (the step-down treatment was an 18 g/ton level and the constant treatment was a 10.5g/ton level during the first two weeks on trial) for the first two weeks of feeding Paylean. The significance observed during period 2 may indicate that the level of Paylean must be increased the longer the animals are fed Paylean to maintain or extend the growth response and maintain cost effectiveness of the product. Cost/lb of gain was numerically higher during period 3 in all pigs fed Paylean compared to the control animals. This is due to the decline in Paylean response observed in the growth performance parameters during the 5th and 6th week on Paylean and the increase diet cost due to the added Paylean, especially with the step-up program fed 18 g/ton at this time. Overall cost/lb of gain was significantly lower ($0.0169) in the step-up and constant treatments compared to the step-down treatment (P < .05), and numerically lower ($0.0005) than the control pigs. The pigs on the step-up and constant treatments were 11.2 lb heavier than the control group in the same amount of time, and showed improved carcass characteristics with this decrease in cost per lb of gain.

The economics of Paylean need to be further evaluated compared to a lower dietary CP, more traditional feeding program. A more traditional feeding program, footnoted in Table 2, has significantly lower expected overall feed cost/lb of gain ($0.1710/lb vs. $0.2215/lb) for the control treatment animals. This feeding program included a .80% dietary lysine level for the first two weeks, and a .60% dietary lysine level for the last four weeks. These lysine levels were verified by using the Nutrient Requirement of Swine (NRC) computer model, included in the 1998 publication. A midpoint weight 175 lb for the first two weeks was used; feed intake used to calculate this lysine level was determined by taking the actual feed intake of the control treatment for the first two weeks and subtracting 7.5% estimated feed wastage to estimate actual nutrient intakes, and then matching ADG (2.26 lb/d) with this intake (5.66 lb/d) and feed efficiency (2.5 F:G). Lean gain determined by the model was 346 g/d for gilts and 316 g/d for barrows. The performance observed in this trial for the controls would need a .74% dietary lysine level, determined by the model, a level very close to the .80% lysine level suggested for the first two weeks.

A midpoint weight of 215 lb was used for the next four weeks. Feed intake used in the model was 6.22 lb/d (actual minus 7.5% feed wastage) and ADG during this stage was 1.97 lb/d, with a 3.16 feed efficiency. Lean gain determined by the model was 244 g/d for gilts and 214 g/d for barrows. A .46% dietary lysine level was calculated by the program for the performance observed by the control pigs in the trial during this time period. A .6% dietary lysine level was used in determining the cost/lb gain during this time period as it is more typical of the industry and would provide some formulation cushion for mixing errors and ingredient variation. A dietary energy level of 1605 kcal/lb of DE was also used in the model for both weight periods. This DE level was the actual level fed throughout this trial.

When calculating the requirements for the constant treatment during these time periods using the NRC model, a 1.13% lysine level was calculated for the first weight period using a weight of 178 lb, ADG of 2.83 lb/d, and feed intake minus 7.5% feed wastage of 5.6 lb/d for a feed efficiency of 1.98. Lean gain for gilts was 530 g/d and lean gain for barrows was 500 g/d.

Calculations for the second weight period was done using a live weight of 226 lb, ADG of 2.09 lb/d, and feed intake minus 7.5% feed wastage was 5.67 lb/d, resulting in a feed efficiency of 2.71. Lean gain for the gilts was 360 g/d and lean gain for barrows was 330 g/d. The NRC model calculated a .72% lysine level would be required for the second weight period for the constant treatment.

This reduction in cost/lb gain for the control pigs fed a more typical phase feeding program would yield approximately $4.28 less in total feed cost for the control pigs. This reduction in actual feed cost assumes that the control treatment pigs would gain similarly and have similar carcass characteristics if fed the reduced lysine levels and is for discretionary purposes only. However, it does raise added cost pressure to the Paylean product to be cost effective.

Carcass Data

Table 3 reports the values for those animals slaughtered at the Purdue University meat lab. Tenth rib backfat was decreased by .185 in ($P < .05$) and LEA was increased by .89 in ($P < .05$) for those pigs fed the step-up and constant treatments compared to the step-down and control treatments. Percent lean was increased by an average of 2.75 percentage units (56.05% vs 53.3%; $P < .05$) when comparing the step-up and constant treatments to the step-down and control treatments, and % yield was increased in all pigs fed Paylean by 1.73 percentage units (76.94 vs

75.21; P < .05). A significant increase in % yield (77.16 vs 76.5; P < .05) was also observed between the step-up and constant treatments and those animals fed the step-down treatment. The constant program had significantly decreased color compared to the control treatment. However, no other significant changes in pork quality parameters (marbling, firmness) were observed due to Paylean.

Data in Table 4 is a combination of the ultrasound data collected for those pigs slaughtered at the Purdue University meat lab (64 hd) and a commercial slaughter facility (95 hd). All pigs fed Paylean had an average increase in hot carcass weight (HCW) of 5.1% (P < .05) compared to those pigs fed the control diet, and the step-up treatment had an increase in HCW of 3.4% compared to the step-down treatment. All pigs fed Paylean had an average decrease of 10.3% (P < .05) in 10^{th} rib fat depth compared to the control, and the constant treatment had a decrease of 11.5% (P < .05) in 10^{th} rib fat depth compared to the step-down treatment. Paylean fed pigs had an average increase of .24 in (P < .05) in loin depth compared to the controls, and the step-up and constant treatments had an average increase in loin depth of .18 in (P < .05) compared to the step-down treatment. The step-up and constant treatment had an average increase in percent lean of 1.93 percentage units (54.9 vs 53.0%; P < .05) compared to the step-down and control treatments, and all pigs fed Paylean had an average increase in carcass yield of 1.39 percentage units (77.29 vs 75.9%; P < .05) compared to the control fed pigs.

The primal and sub-primal cut data, collected from the 64 pigs slaughtered at the Purdue University meat lab, is shown in Table 5. Rough cut shoulder weights were increased by an average of 7.6% (P < .05) in all pigs fed Paylean compared to the control treatment, and the step-up treatment had a 5.5% increase in roughcut shoulder weight (P < .05) compared to the step-down and constant treatments. The step-up and constant treatments had an average increase of 9.0% (P < .05) in boston butt weight compared to the step-down and control treatments, and the step-up treatment had a .95 lb increase (P < .05) compared to the step-down and control fed pigs.

All pigs fed Paylean had a .93 lb increase in picnic weight (P < .05) compared to the control treatment. The step-up and constant treatments had an average increase of 7.2% (P < .05) in rough cut loin weight, and an average increase of 1.55 lb (P < .05) in boneless loin weight, when compared to the step-down and control treatments. Tenderloin weight was increased by 13.1% (P < .05) by those pigs fed the step-up and constant diets compared to the control treatment, and the step-up treatment had an increase in tenderloin weight of 16% (P < .05) when compared to the step-down and control fed pigs. No significant differences were observed in babyback rib or belly weights among treatments.

All pigs fed Paylean had an average increase in rough cut ham weight of 8.8% (P < .05) compared to the control treatment, and the step-up and constant treatments had an average increase in rough cut ham weight of 2.83 lb (P < .05) compared to the step-down treatment. The semimembranosis muscle of the ham was increased in weight by 11.1% (P < .05) for those pigs fed the step-up and constant treatments. All pigs fed Paylean had an average increase of 20.6% (P < .05) in the bicep femoris muscle of the ham compared to the control treatment, and the step-up and constant treatments had an average increase of 11.1% (P < .05) in the bicep femoris muscle compared to the step-down treatment. The quadriceps femoris muscle of the ham was increased by 16.6% (P < .05) by all pigs fed Paylean when compared to the control treatment, and the step-up and constant treatments had an average increase of .35 lb (P < .05) in the same muscle compared to the step-down treatment. The step-up and constant treatments also had an average increase of 16.4% (P < .05) in the semitendinosis muscle of the ham compared to the control fed pigs.

Pigs fed the step-up and constant treatments had a numerically lower 42-day total feed cost of $0.72 and $0.19, respectively, compared to the control treatment (Table 6). In addition, the step-up, constant, and control treatments had a significantly lower 42-day feed cost when compared to the step-down treatment.

All pigs fed Paylean had a higher premium/cwt of carcass, thus resulting in a higher premium/pig received. The step-up and constant treatments had a significantly higher premium/cwt of $5.79 and $5.57, respectively, compared to the control treatment ($2.79). All Paylean fed pigs increased total $/pig. The step-down treatment received $5.78 more compared to the controls. A further improvement was observed with the step-up and constant treatment, which received $14.41 and $12.73, respectively. The greatest returns were achieved with the step-up program.

Predicted ADG and tissue accretion curves can be seen in Figures 1 through 3. The ADG response of all Paylean fed pigs is higher during the first four weeks of Paylean treatment compared to the control curve (Figure 1). Beyond week 4 (day 127), the step-up treatment is the only Paylean treatment that sustains ADG response above the control treatment for the remainder of the trial. Figure 2 indicates that predicted daily fat-free lean accretion of all Paylean fed pigs is higher for the six weeks period compared to the control curve. The step-up treatment, however, increases its daily fat-free lean accretion compared to the control treatment, while the constant treatment maintains a steady lean accretion rate above the control treatment. The step-down treatments fat-free lean accretion curve declines throughout the six weeks time period, and is equal to the control treatment by approximately d 125, and parallels the controls until the end of the trial.

All Paylean fed pigs have increased predicted daily fat tissue accretion for approximately the first 4 weeks compared to the control treatment (Figure 3). As ADG response declines in the step-down and constant treatments, their fat accretion rates drop below the control treatment, while the step-up maintains a fat accretion rate above the control curve due to a sustained ADG response to Paylean in the step-up program. These increased fat accretion rates occur because Paylean fed pigs have increased growth rates. This increased growth rate includes both fat-free lean tissue and fat tissue.

Daily lysine requirements (Figure 4) are increased in all Paylean fed pigs (approximately 27 g/d) compared to the control treatment (22 g/d). As ADG response declines in pigs fed Paylean (step-down and constant treatment), so does their daily lysine requirement. If ADG response is maintained (step-up program), lysine requirements of pigs do stay at an increased level compared to the control treatment (17 vs 12 g/d).

Application

The response to Paylean was better maintained when the level of Paylean fed was increased every two weeks (step-up treatment), however, the response to Paylean was not maintained when decreasing the level fed every two weeks. Improvements in ADG and F:G in pigs on the step-up and constant treatments pay for the additional cost of Paylean and the elevated dietary protein levels that must be fed with the Paylean product. These results would indicate that the carcass premiums received from pigs fed the step-up and constant Paylean levels would allow for additional profit over the premiums received from control animals and enhance the economical potential of this product over current, conventional feeding programs.

Table 1a: Experimental diets for barrows

Diet	Control	4.5g/ton Paylean[a]	9g/ton Paylean[a]	10.5g/ton Paylean (Constant)	18g/ton Paylean[a]
Ingredient, %					
Corn	64.66	64.63	64.61	64.60	64.56
SBM, 48%	27.60	27.60	27.60	27.60	27.60
Fat	5.00	5.00	5.00	5.00	5.00
Limestone	.92	.92	.92	.92	.92
Dical.	1.22	1.22	1.22	1.22	1.22
Vit/Min/Salt	.475	.475	.475	.475	.475
Lysine-HCl	.125	.125	.125	.125	.125
Paylean-9[b]	.00	.025	.05	.058	.10
Lys, %	1.1	1.1	1.1	1.1	1.1
ME, Kcal/lb	1606	1606	1605	1605	1605
CP, %	18.47	18.47	18.47	18.47	18.47
Ca, %	.7	.7	.7	.7	.7
P, %	.6	.6	.6	.6	.6
Cost, $/ton[c]	139.29	150.52	161.75	165.35	184.21

[a] Diets used in the step-up and step-down phase feeding treatments
[b] Paylean was deducted from corn based on the control diet formulation
[c] Ingredient prices used in calculation: Corn, $0.04/lb; 48% CP SBM, $0.113/lb; Fat, $0.12/lb; Vit/Min/Salt, $2.30/lb; Limestone, $0.05/lb; Dical, $0.15/lb; Lys., $0.55/lb; Paylean-9, $22.50/lb

Table 1b: Experimental diets for gilts

Diet	Control	4.5g/ton Paylean[a]	9g/ton Paylean[a]	10.5g/ton Paylean (Constant)	18g/ton Paylean[a]
Ingredient, %					
Corn	61.77	61.75	61.72	61.71	61.67
SBM, 48%	30.50	30.50	30.50	30.50	30.50
Fat	5.00	5.00	5.00	5.00	5.00
Limestone	.92	.92	.92	.92	.92
Dical.	1.22	1.22	1.22	1.22	1.22
Vit/Min/Salt	.475	.475	.475	.475	.475
Lysine-HCl	.15	.15	.15	.15	.15
Paylean-9[b]	.00	.025	.05	.058	.10
Lys, %	1.2	1.2	1.2	1.2	1.2
ME, Kcal/lb	1605	1605	1604	1604	1604
CP, %	19.61	19.61	19.61	19.61	19.61
Ca, %	.7	.7	.7	.7	.7
P, %	.6	.6	.6	.6	.6
Cost, $/ton[c]	143.77	155.00	166.23	169.82	188.69

[a] Diets used in the step-up and step-down phase feeding treatments
[b] Paylean was deducted from corn based on the control diet formulation
[c] Ingredient prices used in calculation: Corn, $0.04/lb; 48% CP SBM, $0.113/lb; Fat, $0.12/lb; Vit/Min/Salt, $2.30/lb; Limestone, $0.05/lb; Dical, $0.15/lb; Lys., $0.55/lb; Paylean-9, $22.50/lb

Table 2: Effect of diet on bi-weekly ADG, ADFI, and F:G in late finishing pigs

	Control	Step-down	Step-up	Constant	Std. Error	Barrow	Gilt
# of Pigs, hd.	39	40	40	40		79	80
Initial Weight, lb	158.6	158.2	158.8	158.6	1.63	161.29	155.81
Period 1 (d0-14)							
ADG, lb/d	2.26^{a}	2.80^{b}	2.70^{b}	2.83^{b}	.096	2.79^{y}	2.50^{z}
ADFI, lb/d	6.17^{a}	6.03^{a}	5.96^{a}	6.08^{a}	.190	6.51^{y}	5.62^{z}
F:G	2.78^{a}	2.16^{b}	2.23^{b}	2.15^{b}	.083	2.38	2.28
Cost/lb gain,$*	.1965^{bc}	.2013^{c}	.1702^{a}	.1802^{ba}	.006	.1882	.1859
Period 2 (d14-28)							
ADG, lb/d	2.01^{a}	2.13^{ab}	2.36^{c}	2.24^{bc}	.058	2.19	2.18
ADFI, lb/d	6.61^{a}	6.22^{b}	6.05^{b}	6.33^{ab}	.141	6.64^{y}	5.97^{z}
F:G	3.29^{a}	2.94^{b}	2.56^{c}	2.84^{b}	.090	3.06^{y}	2.76^{z}
Cost/lb gain,$*	.2326^{b}	.2412^{b}	.2100^{a}	.2376^{b}	.007	.2391^{y}	.2216^{z}
Period 3 (d28-42)							
ADG, lb/d	1.92^{b}	1.74^{a}	2.10^{c}	1.94^{b}	.049	1.90	1.95
ADFI	6.85^{a}	6.29^{ba}	6.04^{b}	6.00^{b}	.199	6.54^{y}	6.05^{z}
F:G, lb/d	3.58^{a}	3.62^{a}	2.89^{b}	3.13^{b}	.135	3.47^{y}	3.14^{z}
Cost/lb gain,$*	.2531^{a}	.2766^{a}	.2693^{a}	.2621^{a}	.011	.2758	.2548
Overall (d0-42)							
ADG, lb/d	2.09^{a}	2.22^{b}	2.36^{c}	2.34^{bc}	.043	2.31^{y}	2.19^{z}
ADFI, lb/d	6.54^{a}	6.18^{ab}	6.01^{b}	6.14^{ab}	.155	6.56^{y}	5.88^{z}
F:G	3.13^{a}	2.79^{b}	2.55^{c}	2.62^{c}	.055	2.85^{y}	2.69^{z}
Cost/lb gain,$*	.2215^{ab}	.2334^{b}	.2136^{a}	.2195^{a}	.004	.2255	.2185
Final Wt., lb	243.3^{a}	247.4^{ab}	255.8^{c}	253.2^{bc}	2.56	254.57^{y}	245.31^{z}
Slaughter Wt., lb	246.7^{a}	250.7^{ab}	259.1^{c}	256.4^{bc}	2.35	258.2^{y}	248.2^{z}

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

^{y,z} Sex means with different superscript differ, P < .05 (pdiff)

* Cost of Paylean included for those diets containing Paylean

- Pen is unit of measurement
- Calculated cost/lb gain for control pigs fed a more traditional 0.80% lys during period 1and a 0.60% lys during periods 2 and 3 are: Period 1 = $0.1684, Period 2 = $0.1657, Period 3 = $0.1798, Overall = $0.1710

Table 3: Effect of Paylean on ribbed carcass characteristics in late finishing pigs

	Control	Step-down	Step-up	Constant	Std. Error	Barrow	Gilt
# of pigs, hd.	16	16	16	16		32	32
Slaughter BW, lb	247.9[a]	251.5[a]	261.7[b]	257.6[b]	2.24	258.6[y]	250.7[z]
HCW, lb	186.3[a]	192.3[b]	201.6[c]	199.1[c]	1.72	197.5[y]	192.2[z]
10[th] Rib BF, in.	.91[a]	.91[a]	.73[b]	.76[b]	.052	.85	.80
LEA, in	7.09[a]	7.33[a]	8.14[b]	8.06[b]	.275	7.75	7.56
% Lean	53.18[a]	53.41[a]	56.22[b]	55.89[b]	.926	54.43	54.92
% Yield	75.21[a]	76.50[b]	77.03[c]	77.29[c]	.414	76.36	76.66
Color[**]	2.47[a]	2.50[a]	2.24[ab]	2.07[b]	.156	2.25	2.39
Marbling[**]	1.97[a]	1.96[a]	1.79[a]	1.68[a]	.160	1.87	1.83
Firmness[**]	2.44[a]	2.19[a]	2.11[a]	1.98[a]	.184	2.20	2.15

[a,b]Means in a row with different superscript differ, P < .05 (pdiff)
[y, z]Sex means with different superscript differ, P < .05 (pdiff)
[**]Scores determined on a 1-5 scale (NPPC, 1991)

Table 4: Effect of Paylean on plant carcass characteristics in late finishing pigs

	Control	Step-down	Step-up	Constant	Std. Error	Barrow	Gilt
# of pigs, hd.	39	40	40	40		79	80
Slaughter BW, lb	246.7[a]	250.7[ab]	259.1[c]	256.4[bc]	2.45	257.3[y]	252.6[z]
HCW, lb	187.2[a]	193.4[b]	200.2[c]	198.3[bc]	2.09	199.1[y]	190.5[z]
10[th] Rib Fat Depth, in.	.81[a]	.78[b]	.71[bc]	.69[c]	.032	.76[y]	.69[z]
Loin Depth, in	2.35[a]	2.47[b]	2.66[c]	2.63[c]	.065	2.49	2.46
% Lean	52.63[a]	53.36[a]	54.89[b]	54.96[b]	.460	53.52	54.45
% Yield	75.90[a]	77.16[b]	77.35[b]	77.33[b]	.428	77.09	76.74

[a,b]Means in a row with different superscript differ, P < .05 (pdiff)
[y, z]Sex means with different superscript differ, P < .05 (pdiff)
-10[th] Rib fat depth and loin depth collected using real time ultrasound

Table 5: Effect of Paylean on primal and sub-primal cuts in late-finishing pigs

	Control	Step-down	Step-up	Constant	Std. Error	Barrow	Gilt
# of pigs, hd.	16	16	16	16		32	32
Shoulder							
Rough Cut Weight, lb	19.55^{a}	20.62^{b}	21.92^{c}	20.94^{b}	.346	21.27^{y}	20.24^{z}
Boston Butt, lb	8.13^{a}	8.53ab	9.28^{c}	8.89^{bc}	.258	8.96^{y}	8.46^{z}
Picnic, lb	6.24^{a}	7.00b	7.44^{b}	7.08^{b}	.211	6.94	6.94
Loin							
Rough Cut Loin, lb	22.66^{a}	23.37^{a}	24.86^{b}	24.48^{b}	.422	24.48^{y}	23.21^{z}
Boneless Loin, lb	8.93^{a}	9.56^{a}	10.83^{b}	10.75^{b}	.262	10.19	9.84
Tenderloin, lb	$.85^{a}$	$.88^{ab}$	1.03^{c}	$.96^{bc}$	.035	.93	.93
Babyback Ribs, lb	1.08^{a}	1.13^{a}	1.17^{a}	1.09^{a}	.053	1.09	1.14
Belly							
Rough Cut Belly, lb	17.64^{a}	17.80^{a}	17.99^{a}	18.22^{a}	.396	18.14	17.69
Spare Ribs, lb	3.42^{a}	3.84^{a}	3.71^{a}	3.77^{a}	.280	3.85	3.53
Trimmed Belly, lb	10.32^{a}	10.09^{a}	10.47^{a}	10.70^{a}	.393	10.46	10.32
Ham							
Rough Cut, lb	23.20^{a}	24.29^{b}	26.21^{c}	25.85^{c}	.395	25.10	24.68
Semimembranosis, lb	4.05^{a}	4.13^{a}	4.67^{b}	4.53^{b}	.134	4.39	4.30
Biceps Femoris, lb	3.89^{a}	4.37^{b}	4.88^{c}	4.83^{c}	.105	4.47	4.52
Quadriceps Femoris, lb	2.62^{a}	2.91^{b}	3.27^{c}	3.25^{c}	.097	3.02	3.01
Semitendinosis, lb	1.13^{a}	1.23^{ab}	1.31^{b}	1.32^{b}	.048	1.28	1.22
Total Ham Lean, lb	16.52^{a}	17.76^{b}	19.84^{c}	19.42^{c}	.418	18.50	18.28

[a,b] Means in a row with different superscript differ, P < .05 (pdiff)
[y, z] Sex means with different superscript differ, P < .05 (pdiff)

Table 6: Effect of Paylean on cost/premium in late finishing pigs

	Control	Step-down	Step-up	Constant	Std. Error	Barrows	Gilts
HCW, lb	187.2[a]	193.4[b]	200.2[c]	195.6[bc]	2.09	199.1y	190.5[z]
Cost/lb gain, $ **	.2215[ab]	.2334[b]	.2136[a]	.2195[a]	.004	.2255	.2185
Feed cost for 42 days on test, $ **	19.94[a]	21.01[b]	19.22[a]	19.75[a]	.404	20.30	19.66
Prem/cwt carcass, $	2.79[a]	3.55[a]	5.79[b]	5.57[b]	.491	4.21	4.64
Prem/pig, $	5.16[a]	7.00[a]	11.65[b]	11.03[b]	1.00	8.44	8.98
Total$/pig	121.50[a]	127.28[b]	135.91[c]	134.23[c]	1.84	132.22[y]	127.24[x]
Value over control, $	0.00	5.78	14.41	12.73			

[a,b] Means in a row with different superscript differ, P < .05 (pdiff)
[y, z] Sex means with different superscript differ, P < .05 (pdiff)
[**] Cost of Paylean included for those diets containing Paylean
- Premiums figured by using % lean and HCW from Table 4, and applying them to a premium grid from a commercial slaughter facility
- Calculated cost/lb gain for control pigs fed a more traditional 0.80% lys diet during period 1 and a 0.60% lys diet during periods 2 and 3 are: Period 1 = $0.1684, Period 2 = $0.1657, Period 3 = $0.1798, Overall = $0.1710

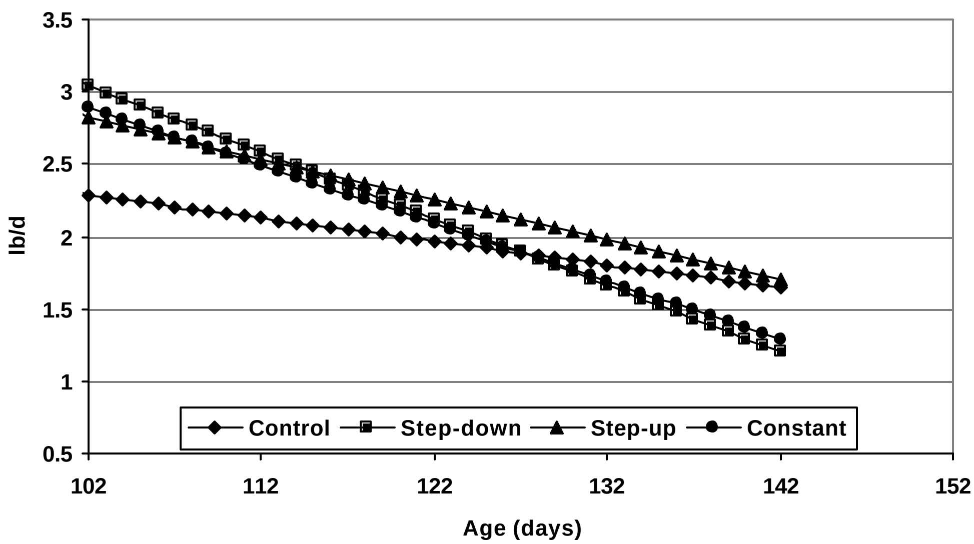

Figure 1. Average daily gain (lb/d) of pigs fed ractopamine (RAC): Control (0 ppm RAC week 1-6), step-down (18 g/ton RAC, week 1 and 2; 9 g/ton RAC, week 3 and 4; 4.5 g/ton RAC, week 5 and 6), step-up (4.5 g/ton RAC, week 1 and 2; 9 g/ton RAC, week 3 and 4; 18 g/ton RAC, week 5 and 6), and constant (10.5 g/ton RAC week 1-6)

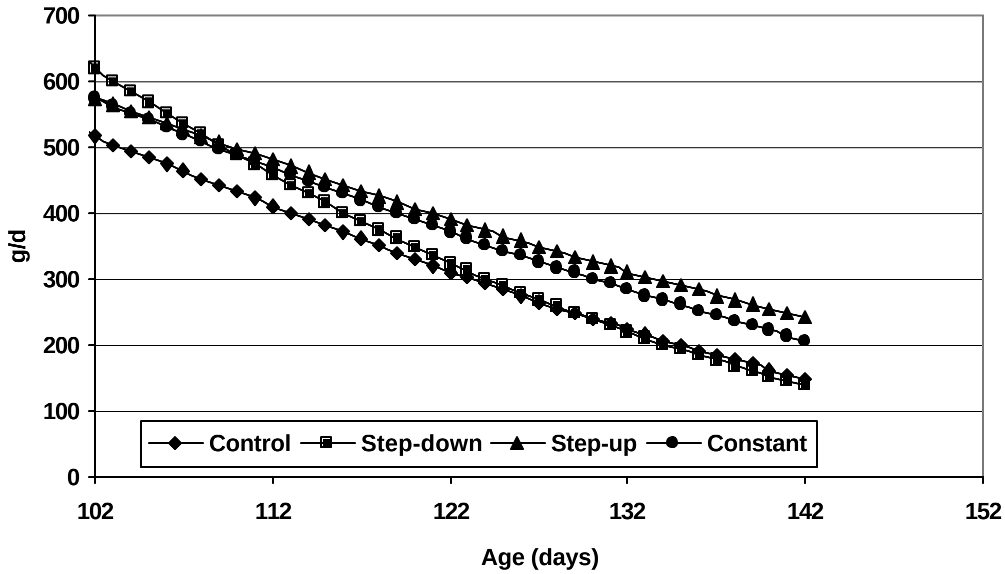

Figure 2. Fat-free lean accretion (g/d) for pigs fed ractopamine (RAC): Control (0 ppm RAC week 1-6), step-down (18 g/ton RAC, week 1 and 2; 9 g/ton RAC, week 3 and 4; 4.5 g/ton RAC, week 5 and 6), step-up (4.5 g/ton RAC, week 1 and 2; 9 g/ton RAC, week 3 and 4; 18 g/ton, week 5 and 6), and constant (10.5 g/ton RAC week 1-6)

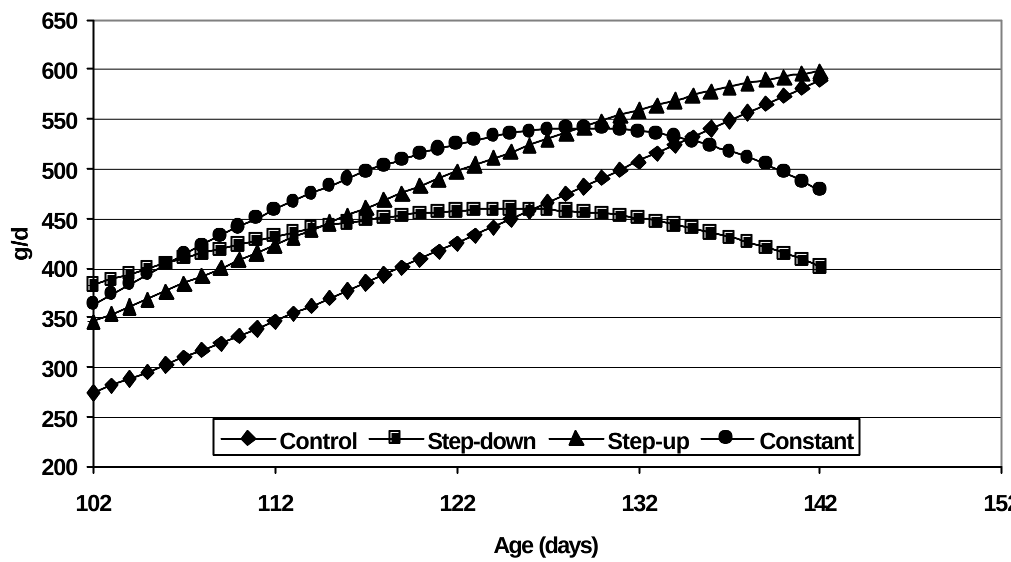

Figure 3. Fat tissue accretion (g/d) for pigs fed ractopamine (RAC): Control (0 ppm RAC week 1-6), step-down (18 g/ton RAC, week 1 and 2; 9 g/ton RAC, week 3 and 4; 4.5 g/ton RAC, week 5 and 6), step-up (4.5 g/ton RAC, week 1 and 2; 9 g/ton RAC, week 3 and 4; 18 g/ton, week 5 and 6), and constant (10.5 g/ton RAC week 1-6)

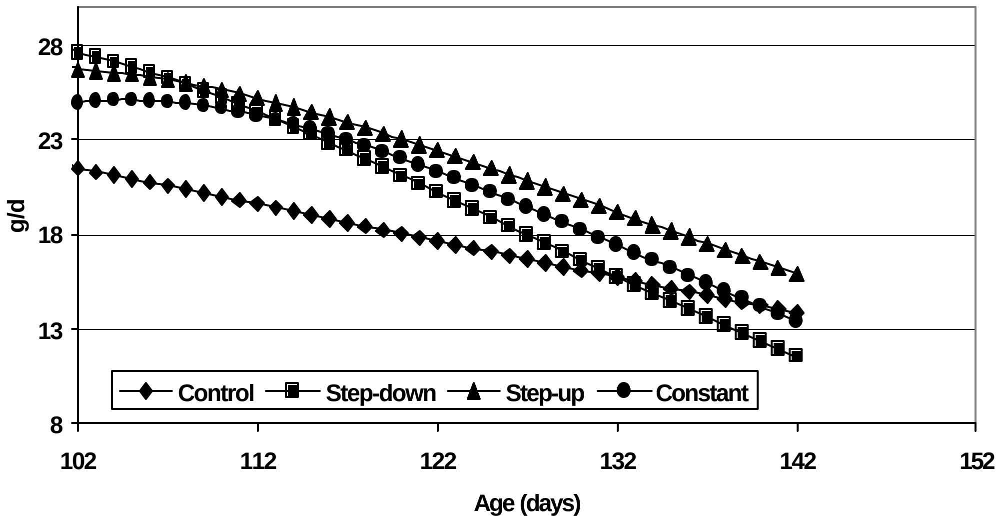

Figure 4. Daily lysine requirements (g/d) for pigs fed ractopamine (RAC): Control (0 ppm RAC week 1-6), step-down (18 g/ton RAC, week 1 and 2; 9 g/ton RAC, week 3 and 4; 4.5 g/ton RAC, week 5 and 6), step-up (4.5 g/ton RAC, week 1 and 2; 9 g/ton RAC, week 3 and 4; 18 g/ton, week 5 and 6), and constant (10.5 g/ton RAC week 1-6)