Economic Analyses of Feeding 18 g per ton PAYLEAN® to Crosses of the NE Index Line

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Summary and Implications

Economic returns per pig for F_1 and terminal cross barrows and gilts of the NE Index line when fed a diet with or without PAYLEAN® at 18 g per ton for 28 d before slaughter were compared. Although not significant, terminal cross pigs with 25% Line I genes were more profitable than F_1 pigs with 50% Line I genes and gilts were more profitable than barrows. Several scenarios were modeled to evaluate the economic returns from feeding PAYLEAN®. Increased profits were similar across lines and sexes but varied depending on whether in-transit death losses were considered treatment effects. The best estimates of the increased income per pig from feeding PAYLEAN® were $5.33 ± 1.56 for the scenario with no in-transit losses and $1.54 ± 4.83 when in-transit losses were assumed to be related to feeding PAYLEAN®.

Introduction

As a result of the superiority of the NE Index line in reproduction documented in the NPPC Maternal Line Evaluation project it is now being used broadly in industry breeding programs. Its value would be further enhanced from improvements in growth, food conversion and carcass value. In the previous report we show that feeding a diet with PAYLEAN® at 18 g per ton during the last 28 days before slaughter significantly improved growth and carcass merit of Line I cross pigs. PAYLEAN® is a relatively expensive product and these improvements must more than offset its cost to justify feeding it. The purpose of this report is to estimate the economic effects of differences in growth, feed conversion, and carcass value in pigs with 25% and 50% Line I genes and to determine the economic value of feeding these pigs a diet with 18 g/ton PAYLEAN®.

Materials and Methods

Details of the experiment are described in the preceding paper. Briefly, a growth test of 305 pigs with average beginning age of 68.6 days and weight of 56.4 lb and final weight of approximately 240 lb was conducted. A corn-soybean meal diet formulated to contain 18% crude protein, 0.95% lysine, and 1,506 kcal/lb ME was fed to all pigs throughout the experiment. One-half of the pigs were randomly assigned to receive this diet with PAYLEAN® at the rate of 18 g per ton during the last 28 days before slaughter. Two crossbred types of pigs were studied, an F_1 of Danbred™ USA Landrace and Line I, pigs with 50% Line I genes, and a terminal cross (T) from L x I females mated with Danbred™ USA Duroc-Hampshire sires, pigs with 25% Line I genes.

Sixty-six pigs were housed and fed in a building (IFU) with individual feeding pens and half were fed PAYLEAN®. The rest were in another building (MOF) penned according to genetic line, sex, and diet treatment (with or without PAYLEAN®) with 10 pigs per pen. Body weight of each pig was recorded at the beginning of the test, 28 days before slaughter when half the pigs began to receive the diet with PAYLEAN®, and at the end of the test. Feed intake for each pig in the IFU and each pen in the MOF was recorded for the intervals from the beginning of the test to 28 days before slaughter and the last 28 days before slaughter. Pen-fed pigs were assigned the average feed intake of the pen. Each pig was scanned 28 days before slaughter and at final weight with an Aloka 500 instrument to estimate tenth rib backfat thickness and longissimus muscle area.

The objective was to feed pigs in the IFU to a final weight between 240 and 260 lb and pens of pigs in the MOF to final average weights between 240 and 250 lb with all pigs in the pen weighing at least 215 lb. Each pig was weighed at 21, 42 and 63 days after being placed on test. Slaughter date was designated for each pig or pen of pigs based on previous growth rate and weight on day 63 of the test. The final 28-day period for each pig began 63, 70 or 77 days after being placed on test. Because of the goal to market all pigs in a pen on the same day, five pigs in the MOF projected to not weigh 215 lb after another 28 days were removed from test. In addition, four pigs were removed from test earlier, two that were crippled and two with hernias. One pig died between day 0 and 63 of the test. Pigs were transported to SiouxPreme Packing Co. the day they were removed from test and slaughtered the next morning. Percentage carcass lean was estimated with TOBEC and pigs were valued on the SiouxPreme payment matrix. Four pigs died in-transit. The distribution of pigs across genetic line/sex/treatment is shown in Table 1.

Production Costs and Pig Value

Costs of production from when pigs were placed on test to delivery to the packing plant were calculated for each pig. Initial cost of pigs was set at $.814 per lb based on local feeder pig prices during February and March, 2001. Cost of the 18%-protein diet was set at

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$.0586 per lb, the actual cost of the diet delivered to the bin at the experimental swine farm. The amount of PAYLEAN® consumed by pigs receiving it was calculated from their feed intake during the last 28 days of the trial and a PAYLEAN® cost per pig was assigned assuming it cost $3.11 per g. A fixed cost of $12.36 was assigned to each pig beginning the test as if this was a cost per pig space. Costs in this amount were derived from production costs assigned to lines in the NPPC MLP (Dhuyvetter K. and T. Schroeder, 2000, Maternal Line Genetic Evaluation Program (MLP) Economic Analysis; in Maternal Line National Genetic Evaluation Program Results, April, 2000) and included professional fees ($.53), interest on the sum of one-half the variable cost per pig plus the cost of the feeder pig ($2.46), depreciation on buildings and equipment ($4.52), interest on buildings and equipment ($3.78), and insurance/taxes on buildings and equipment ($1.07). A variable cost for each pig was calculated from the number of days it was on test at a rate of $.0512 per day. This cost was calculated from the report cited above and included the sum of average costs per pig for building and equipment repairs ($1.28), utilities, fuel and oil ($.33), veterinary supplies ($1.00), and labor ($2.99), divided by 109.4, the average number of days in the finisher for MLP pigs. A marketing cost of $4.00 was assigned to each pig marketed. All costs were summed to obtain total production costs for each pig.

A value was assigned to each pig based on its hot carcass weight and percentage lean estimated by TOBEC at SiouxPreme Packing Co. The base carcass price of $.67/lb received for these pigs was used. Profit for each pig was calculated as market value minus total costs.

Economic Analyses

Economic analyses were conducted in a 2x2x2 factorial arrangement that included two assumptions about in-transit death losses, two alternatives for calculating feed costs, and two assumptions about causes for death/removal of pigs before slaughter.

Table 1. Distribution of pigs across genetic line, sex, and diet, and number removed or died during the experiment or in-transit to slaughter.

				Removed during experiment				Died in-transit
Line[a]	Sex[b]	PAYLEAN®	Day 0	Cripple	Hernia	Died	Small[c]	
F_1	G	-	39				1	
F_1	B	+	38				1	
F_1	G	-	38			1		1
F_1	B	+	39					1
T	G	-	38	1			1	1
T	B	+	38				1	
T	G	-	37		2		1	
T	B	+	38	1				1

[a] F_1 = Landrace x Index, 50% Line I genes; T = Duroc-Hampshire sires x (L x I), 25% Line I genes.
[b] G = gilt, B = barrow.
[c] Pigs removed during the experiment because their projected weight at slaughter date was less than 215 lb.

In-transit Death Losses

Pigs that died in-transit could be treatment effects or these losses could be independent of treatments. Analyses were completed making both assumptions. In analyses assuming that pigs that died in–transit were random and not related to genetic line, sex or PAYLEAN®, value of pigs that died in-transit was assigned based on predicted hot carcass weight and percentage carcass lean. Hot carcass weight was assigned based on live weight on the day pigs were marketed and the average dressing percentage for their line/sex/diet subclass. Percentage lean was predicted from final scan backfat and longissimus muscle area and regression coefficients of percentage lean on backfat and longissimus muscle area calculated from the complete data set.

Analyses assuming that in-transit losses were related to genetic line/treatment effects were performed assuming these pigs incurred all production costs but had value of $0 when marketed.

Feed Costs

Feed costs were calculated in two ways: 1) as the trial was conducted in which all pigs received an 18%-protein diet throughout the trial with feed costs of $0.0586/lb, and 2) an assumption that corn was substituted for soybean meal to reduce protein to 16% in the diet fed the last 28 days to pigs not receiving PAYLEAN® without affecting growth or carcass traits. Feed consumed during this period by these pigs was set at $0.0551/lb, the actual cost of this feed being fed concurrently to other pigs at the experimental farm.

Pigs Died or Removed During the Trial

Economic returns for each of the four combinations of assumptions about in-transit losses and feed costs were calculated based on 1) all 305 pigs that entered the trial, and 2) only those pigs that reached market weight. The first of these assumes that causes of pigs not completing the test, those that died or were removed early, were related to genetic line, sex and diet. Full costs until the day a pig was removed from test or until it died were included and these pigs were assigned market value of $0. Pigs that were removed from test and those that died during the test were not included in analyses of only those pigs that reached market weight.

In each of the eight combinations, value of pigs marketed, total production costs, profit, and carcass lean premium as a percentage of base price for each pig were fitted to a model that accounted for random effects of pen and litter, fixed effects of building, line, sex, and PAYLEAN® treatment, and two-factor interactions among fixed effects. Two-factor interactions among line, sex and PAYLEAN® treatment were not significant in any analysis. Pig value, production costs, profit, and

Table 2. Income, production costs, net profit, and carcass premium (± SE[a]) for different scenarios of feeding PAYLEAN® at 18 g/ton 28 days before slaughter to crosses of the NE Index line.

	All pigs beginning the trial (n = 305)				Final pigs marketed only (n = 295)			
	No mkt loss[b]		Mkt loss[b]		No mkt loss		Mkt loss	
Group[c]	18P[b]	18-16P[b]	18P	18-16P	18P	18-16P	18P	18-16P
Pig value, $/pig								
T-cross	121.64	121.64	120.15	120.15	126.80	126.80	124.59	124.59
F_1	120.17	120.17	118.43	118.43	123.07	123.07	116.67	116.67
Difference	1.47 ± 2.97	1.47 ± 2.97	1.72 ± 3.45	1.72 ± 3.45	3.73 ± 2.19	3.73 ± 2.19	7.93 ± 5.41	7.93 ± 5.41
Barrow	119.72	119.72	117.14	117.14	124.64	124.64	118.65	118.65
Gilt	122.09	122.09	121.44	121.44	125.23	125.23	122.61	122.61
Difference	-2.37 ± 2.97	-2.37 ± 2.97	-4.30 ± 3.45	-4.30 ± 3.45	-0.59 ± 1.53	-0.59 ± 1.53	-3.95 ± 4.78	-3.95 ± 4.78
Paylean	127.06	127.06	125.24	125.24	130.46	130.45	123.67	123.67
No Paylean	114.75	114.75	113.35	113.35	119.41	119.41	117.59	117.59
Difference	12.3 ± 2.97***	12.3 ± 2.97***	11.88 ± 3.45***	11.88 ± 3.45***	11.05 ± 1.49***	11.05 ± 1.49***	6.09 ± 4.46	6.09 ± 4.46
Total cost, $/pig								
T-cross	99.07	98.75	99.07	98.75	100.08	99.75	100.08	99.75
F_1	98.34	98.03	98.34	98.03	98.93	98.62	98.86	98.55
Difference	0.73 ± 1.59	0.73 ± 1.55	0.73 ± 1.59	0.73 ± 1.55	1.15 ± 1.50	1.13 ± 1.50	1.22 ± 1.49	1.21 ± 1.49
Barrow	98.73	98.41	98.73	98.41	100.04	99.71	100.02	99.69
Gilt	98.67	98.37	98.67	98.37	98.98	98.66	98.93	98.61
Difference	0.06 ± 1.17	0.05 ± 1.16	0.06 ± 1.17	0.05 ± 1.16	1.07 ± 0.75	1.05 ± 0.74	1.09 ± 0.74	1.07 ± 0.74
Paylean	101.10	101.10	101.10	101.10	101.77	101.77	101.78	101.78
No Paylean	96.30	95.68	96.30	95.68	97.24	96.6	97.17	96.52
Difference	4.80 ± 1.13***	5.42 ± 1.12***	4.80 ± 1.13***	5.42 ± 1.12***	4.53 ± 0.71***	5.18 ± 0.71***	4.61 ± 0.70***	5.25 ± 0.70***
Profit, $/pig								
T-cross	22.96	23.27	21.48	21.79	26.67	27.00	23.30	23.63
F_1	21.54	21.85	19.43	19.74	23.34	23.66	17.47	17.80
Difference	1.42 ± 2.21	1.42 ± 2.21	2.05 ± 3.05	2.05 ± 3.05	3.33 ± 1.77	3.34 ± 1.77	5.82 ± 5.16	5.83 ± 5.16
Barrow	21.22	21.53	18.3	18.62	24.79	25.12	17.77	18.10
Gilt	23.28	23.58	22.62	22.92	25.22	25.54	23.00	23.32
Difference	-2.06 ± 2.21	-2.05 ± 2.21	-4.32 ± 3.05	-4.31 ± 3.05	-0.43 ± 1.59	-0.42 ± 1.59	-5.24 ± 4.27	-5.22 ± 4.97
Paylean	25.96	25.96	23.71	23.71	27.99	27.99	21.48	21.48
No Paylean	18.54	19.16	17.21	17.83	22.02	22.67	19.30	19.95
Difference	7.41 ± 2.21***	6.79 ± 2.21***	6.50 ± 3.05**	5.88 ± 3.05*	5.97 ± 1.56***	5.33 ± 1.56 ***	2.19 ± 4.83	1.54 ± 4.83
Carcass premium,% of base value								
T-cross	99.16	99.16	97.90	97.90	103.50	103.50	101.01	101.01
F_1	99.6	99.6	98.16	98.16	102.06	102.06	97.35	97.35
Difference	-0.44 ± 2.16	-0.44 ± 2.16	-0.27 ± 2.66	-0.27 ± 2.66	1.24 ± 0.68	1.24 ± 0.68	3.66 ± 3.96	3.66 ± 3.96
Barrow	98.03	98.03	95.90	95.90	102.00	102.00	95.85	95.85
Gilt	100.73	100.73	100.16	100.16	103.36	103.36	102.50	102.50
Difference	-2.71 ± 2.16	-2.71 ± 2.16	-4.26 ± 2.66	-4.26 ± 2.66	-1.35 ± 0.50	-1.35 ± 0.50	-6.65 ± 3.87	-6.65 ± 3.87
Paylean	101.96	101.96	100.48	100.48	104.65	104.65	99.37	99.37
No Paylean	96.80	96.80	95.58	95.58	100.71	100.71	98.99	98.88
Difference	5.16 ± 2.16**	5.16 ± 2.16**	4.89 ± 2.66*	4.89 ± 2.66*	3.95 ± 0.49***	3.95 ± 0.49***	0.38 ± 3.79	0.38 ± 3.79

[a]SE = SE of difference between means.
[b]No mkt. Loss. full value was assigned to pigs that died in-transit; Mkt. loss, pigs that died in-transit were assigned value of zero.
[c]18 P = feeding 18% protein diet to all pigs throughout the trial; 18-16 P = feeding control pigs 18% protein diet until 28 days before slaughter and 16% protein thereafter.
[c]F_1 = Landrace x Index, 50% Line I genes; T = D-H sires x (L x I), 25% Line I genes.
* P < .10, ** P < .05, *** P < .01.

carcass premium for all combinations of economic scenarios are in Table 2.

Results

T-cross vs F_1 Pigs

Although not significant (P > 0.10), value of T-cross pigs with 25% Line I genes was greater than for F_1 pigs in all scenarios, ranging from $1.47±2.97 for all pigs with no market losses to $7.93± 5.41 for only those pigs marketed and with market losses. The difference is because 7 T-cross pigs were removed from the trial compared with only 3 F_1 pigs (Table 1). Increased value of T-cross pigs was due mostly to increased carcass weight due to more rapid growth and, in the scenario using only those pigs marketed, to greater premium above the base. Neither total production costs nor profit per pig differed significantly between T-cross and F1 pigs, but in all scenarios both were greatest for T-crosses. Increased profit per pig from

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pigs with 25% compared with 50% Line I genes ranged from $1.42± 2.21 to $5.83 ± 5.16 per pig.

Barrows vs Gilts

Gilts had greater value than barrows in all economic scenarios because they were leaner and received a greater premium, although none of the differences were significant. Differences in costs between barrows and gilts were small and not significant. Although differences were not significant, gilts were more profitable than barrows.

PAYLEAN®

Feeding PAYLEAN® significantly increased value of pigs in all scenarios except the ones based only on pigs that were marketed and with zero value for pigs that died in-transit. Pigs fed a diet with 18 g PAYLEAN® per ton were leaner and heavier when marketed and received greater carcass premium. They had increased value over control pigs that ranged from $11.05 ± 1.49 to $12.30± 2.97 per pig. In the scenarios in which only the pigs marketed were considered, pigs fed PAYLEAN® had greater value, but the difference between treated and non-treated pigs declined greatly and was not significant. The reduction in the difference was because the two pigs on the PAYLEAN® treatment that died in-transit were heavy, lean pigs with predicted average hot carcass weight of 190.5 lb, lean percentage of 54%, and carcass premium of 107%, whereas predicted averages for the two control pigs that died were 165 lb carcass weight, 51.9% lean, and premium of 100.5%. Although in this scenario differences in average value between treated and control pigs was $6.09 ± 4.46 it was not significant because including values of $0 for pigs that died in-transit greatly increased variation and increased standard errors of differences.

Total costs were significantly greater ($4.61± 0.70 to 5.42± 1.12 per pig) for pigs fed PAYLEAN® than for control pigs. Costs were reduced between $0.62 to $0.89 per pig for the scenario in which control pigs were fed a 16% protein diet the last 28 days before slaughter. Average daily feed intake for pigs fed PAYLEAN® was 6.42 lb per day. During the last 28 days they consumed 181.9 lb feed and 1.64 g PAYLEAN®. Feeding PAYLEAN® increased costs an average of $5.09 per pig.

Profit for pigs fed PAYLEAN® was significantly greater than for controls ($5.33± 1.56 to 7.41± 2.21 per pig) in all scenarios except the ones including only marketed pigs and with zero value for pigs lost in-transit. In this last scenario, increased profit from feeding PAYLEAN® was only $1.54± 4.83 when controls were fed a 16% protein diet during the last 28 days before slaughter. Because losses before the PAYLEAN® treatment period occurred randomly across lines, sexes, and treatments, including costs for these pigs did not affect differences among effects.

Discussion and Conclusions

Results for the scenario that included all pigs fed an 18% protein diet and zero market value for pigs lost in-transit compare lines, sexes, and PAYLEAN® treatment as the experiment was conducted. In this scenario, profit per pig was not significantly greater for pigs with 25% Line I genes than for those with 50% Line I genes ($2.05 ± 3.05), was not significantly greater for gilts than barrows ($4.32 ± 3.05), but was greater for pigs fed 18 g per ton PAYLEAN® than controls ($6.50± 3.05). A more realistic comparison is the one that included all pigs with control pigs being fed a 16%-protein diet the last 28 days. Then, differences between lines and sexes were similar to other scenarios, but increased profit from feeding PAYLEAN® decreased to $5.88 ± 3.05 per pig. In these analyses, deaths and conditions that led to removal of pigs were assumed to be due to the effects studied (line, sex, and treatment).

For the assumption that all losses were random and not related to line, sex, or diet, the appropriate scenarios are the ones including only the pigs marketed and with predicted market values for those pigs lost in-transit. In these cases, the added profits from feeding 18 g PAYLEAN® per ton were $5.97± 1.56 when all pigs were fed an 18%-protein diet, and $5.33± 1.56 when control pigs were fed a 16%-protein diet for 28 days. The last scenario including only the pigs marketed and assigning a value of $0 to those that died in-transit uses the assumption that losses up to 28 days before slaughter are completely random and not related to line and sex effects, but that in-transit deaths are related to treatments. Under these assumptions, feeding 18 g PAYLEAN® per ton increased profit by only $1.54± 4.83 and $2.19± 4.83 per pig for 18 and 18-16% protein regimens for control pigs.

The experiment was too small to determine whether deaths and conditions for removal of pigs were due to lines, sexes, or treatment. Causes of deaths and conditions causing pigs to be removed before the last 28 days before slaughter were not related to PAYLEAN® treatment. Ten pigs died or were removed before the last 28 days of the trial and seven of these were assigned to the control diet. Including them with value of $0 greatly affected estimates of profit from feeding PAYLEAN®. Therefore, the two best estimates of the increased profit from feeding PAYLEAN® are $5.33± 1.56 for the scenario with no in-transit losses and $1.54± 4.83 when in-transit losses were assumed to be related to treatment.

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