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R G. Main

Michael D. Tokach

Robert D. Goodband

See next page for additional authors

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Effects of ractopamine (paylean) dose and feeding duration on pig performance in a commercial finishing facility

Authors

R G. Main, Michael D. Tokach, Robert D. Goodband, Jim L. Nelssen, and Steven S. Dritz

EFFECTS OF RACTOPAMINE (PAYLEAN™) DOSE AND FEEDING DURATION ON PIG PERFORMANCE IN A COMMERCIAL FINISHING FACILITY¹

*R. G. Main², S. S. Dritz², M. D. Tokach,
R. D. Goodband, and J. L. Nelssen*

Summary

A total of 1,035 gilts were used in a 28-day trial conducted in a commercial research facility to determine the influence of ractopamine (Paylean™) dose (4.5 or 9.0 g/ton) and feeding duration (7, 14, 21, or 28 days prior to slaughter) on pig performance and carcass composition. Ractopamine supplementation at 4.5 g/ton for 14 to 28 days, and 9 g/ton for 7 to 28 days, improved ($P<0.05$) ADG by 26 to 35% (0.35 - 0.46 lb/d) and F/G by 16 to 20% (0.64 to 0.79) during the 28-days prior to slaughter. Due to these improvements in growth, carcass weights increased 8 to 10 pounds over controls. Fat depth and lean percentage improved (linear, $P<0.01$) with increased feeding duration. Ractopamine dose did not affect carcass lean parameters. However, carcass yield improved ($P<0.005$) when ractopamine was fed at 9.0 g/ton. Feed cost per pound of gain increased ($P<0.01$) with increasing feeding duration for Paylean and was greater ($P<0.05$) for pigs fed the 9.0 g/ton dose for 28 days as compared to the control. However, feeding ractopamine at 4.5 g/ton for 14 to 28 days and 9 g/ton for 7 to 28 days improved income over feed costs by \$3.53 to \$4.76 per head compared to pigs fed the control diet. Return over feed costs improved due to the increased carcass weights and improved feed efficiency with the greatest values

achieved with a 14 to 21 day feeding duration. These data indicate feeding ractopamine at either 4.5 or 9.0 g/ton for 14 to 21 days prior to slaughter is a cost-effective strategy to optimize return while minimizing increases in feed cost per pound of gain.

(Key Words: Ractopamine, Paylean, Economics.)

Introduction

Ractopamine is a feed additive that improves growth rate, feed conversion, and lean deposition. Due to the dietary costs associated with feeding ractopamine, determining a dose and feeding duration that provides optimum return and minimizes increases in feed cost per pound of gain is essential. The objective of this evaluation was to determine the effects of ractopamine dose (4.5 or 9.0 g/ton) and feeding duration (7, 14, 21, or 28 days prior to slaughter) on pig performance and the associated economic implications.

Procedures

This experiment was completed in a commercial finishing research facility. Forty-five pens of gilts (PIC 337 × C22, 227.5 ± 1.4 lb) were allotted to treatment 28 days prior to slaughter. Treatments included pigs fed 4.5 or

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²Food Animal Health and Management Center.

9.0 g/ton ractopamine for 7, 14, 21, or 28 days prior to slaughter, and a control treatment without ractopamine. Diets were corn-soybean meal-based, formulated to contain 0.75 and 1.00 % total dietary lysine for the control and ractopamine supplemented diets, respectively. Feed delivery was recorded daily, and feed remaining was determined weekly when pen weight gain was measured. Pens had totally slatted floors, were 10 × 18 ft, with 23 pigs per pen. Each pen was equipped with a 50-inch dry feeder (Staco) and cup waterer. The facility was a double curtain sided finishing barn with a deep pit.

At the conclusion of the feeding period, each pen was identified with a unique tattoo to obtain pen carcass composition and revenue information. At slaughter, fat and loin depth were measured with an optical probe and used to calculate lean percentage. Fat, loin depth, and lean percentage were adjusted to a common carcass weight for statistical evaluation. An economic evaluation was completed using actual feed costs and carcass revenue information attained from the pens in this evaluation. Data were analyzed using pair-wise orthogonal contrasts between each of the nine treatments, as well as for the main effects of ractopamine dose and duration. Pen was the experimental unit in all data analyses.

Results and Discussion

Sale weight, gain and feed efficiency improved ($P<0.04$) for pigs fed 4.5 g/ton ractopamine for 14, 21, or 28 days and for pigs fed 9.0 g/ton for all durations compared to the control treatment. The 4.5 g/ton, 7-day treatment was intermediate in sale weight, daily gain and feed efficiency. Increasing ractopamine dose from 4.5 to 9.0 g/ton tended to improve ($P<0.10$) gain (1.63 vs. $1.75 \pm .05$ lb) and sale weight (273.0 vs. 276.7 ± 1.4 lb). Feeding duration had no significant effects ($P>0.17$) on sale weight, gain, or feed effi-

ciency. Pigs fed ractopamine at 4.5 g/ton for 21 or 28 days and 9.0 g/ton for 7, 14, 21, or 28 days had increased feed intake ($P<0.05$) compared to negative controls, with the 4.5 g/ton 7- and 14-day treatments being intermediate. Feed intake tended to increase (linear, $P<0.09$) with feeding duration (5.46, 5.50, 5.53, 5.65 ± 0.08 lb/d), and intake was not affected ($P>0.16$) by dose. Ractopamine dose (4.5 vs. 9.0 g/ton) did not affect ($P>0.37$) carcass lean parameters. However, pigs fed 9.0 g/ton had improved ($P<0.05$) carcass yield compared to pigs fed 4.5 g/ton and the negative controls. Feeding duration did not affect ($P>0.37$) carcass yield. Fat depth (0.64, 0.62, 0.60, $0.58 \pm .01$ in) decreased and lean percentage (56.0, 56.6, 56.8, $57.0 \pm 0.14\%$) increased linearly ($P<0.01$) as ractopamine feeding duration increased from 7 to 28 days. However, the control (0.62 in. backfat, 56.6% lean) treatment was intermediate to all other treatments. Ractopamine feeding duration did not affect ($P>0.78$) loin depth.

Carcass weight and revenue increased ($P<0.05$) for pigs fed 4.5 g/ton ractopamine for 14, 21, or 28 days and for pigs fed 9.0 g/ton for all durations compared to the control treatment. The treatment of 4.5 g/ton of ractopamine for 7 d was intermediate in carcass weight and revenue. Increasing ractopamine dose (4.5 vs. 9.0 g/ton) and feeding duration (7, 14, 21, or 28 days) improved carcass weight (dose effect of 4.5 vs. 9.0 g/ton, respectively; 207.2 vs. $210.2 \pm .95$ lb, $P<0.03$, and duration effect from 7 to 28 d before market; 205.7, 209.6, 209.9, 209.8 ± 1.4 lb, linear, $P<0.05$) and revenue (dose; 129.41 vs. $131.38 \pm \$0.62$ /hd, $P<0.03$, and duration effect; 128.14, 130.90, 131.30, $131.24 \pm \$0.89$ /hd, linear, $P<0.02$). Only pigs fed 9.0 g/ton for 21 and 28 days had improved grade premium as compared to controls. However, grade premium improved (linear, $P<0.03$) with feeding duration (6.26, 6.42, 6.52, $6.53 \pm \$0.07$ / CWT). Ractopamine dose (4.5 vs. 9.0 g/ton)

did not affect grade premium. Feed costs per head increased ($P < .05$) in pigs fed 4.5 g/ton ractopamine for 14, 21, or 28 days as well as pigs fed 9.0 g/ton for all durations compared to the control treatment. Ractopamine dose (4.5 vs. 9.0 g/ton) and feeding duration (7, 14, 21, and 28 days) increased ($P < 0.0001$) feed cost per head (dose effect; 8.12 vs. $8.92 \pm \$0.12/\text{hd}$, $P < 0.0001$, and duration effect; 7.69, 8.28, 8.77, $9.33 \pm \$0.17/\text{hd}$). Only pigs fed 9.0 g/ton for 28 days prior to slaughter had an increased ($P < 0.05$) feed cost per pound of gain over negative controls. However, feed cost per pound of gain increased (linear, $P < 0.03$) with increasing feeding duration (0.175, 0.174, 0.185, $0.193 \pm \$0.006/\text{lb}$). Pigs fed 4.5 g/ton ractopamine for 14, 21, or 28 days as well as pigs fed 9.0 g/ton for all durations had improved (3.50 to $4.83 \pm \$1.35/\text{hd}$) income over marginal feed costs (IOMFC) compared to the controls. Income over marginal feed costs (IOMFC) is defined as value of the pigs at slaughter minus the feed costs incurred during the trial period. The pigs fed 4.5 g/ton ractopamine for 7 days had intermediate improvement in IOMFC ($0.93 \pm \$1.35/\text{hd}$ IOMFC) over controls. However, pigs fed 4.5 g/ton ractopamine for 28 days and 9.0 g/ton for 7 days only tended ($P = 0.08$) to have an increased IOMFC compared to controls. Neither ractopamine dose (4.5 or 9.0 g/ton) nor feeding duration (7, 14, 21, or 28 d) statistically improved ($P > 0.19$) IOMFC.

Income over marginal feed costs increased due to improved carcass weights and feed efficiency. Feed costs per pound of gain were only increased ($P > 0.05$) over controls in pigs fed 9.0g/ton ractopamine for 28 days prior to slaughter. However, feed cost per pound of gain increased (linear, $P < 0.03$) with feeding duration. These data indicate that feeding ractopamine at either 4.5 or 9.0 g/ton for 14 to 21 days prior to slaughter is a cost-effective strategy to optimize return while minimizing increases in feed cost per pound of gain. It should be understood that feeding ractopamine offers the most economic opportunity for producers who are limited in grow-finish space and are having difficulty in optimizing carcass weights. However, the shorter feeding durations fed in this study indicate feed cost per pound of gain is not affected by ractopamine supplementation due to the improvements in feed efficiency. Therefore, the shorter feeding durations are a more conservative economic approach for operations not constrained in finishing capacity. Operations with excess finishing capacity typically have a more conservative value for improvements in ADG, as finishing spaces are available to otherwise attain desired market weights. Understanding the biologic and economic dynamics of feeding ractopamine helps producers develop operationally dependant strategies concerning the cost-effective use of ractopamine.

Table 1. Effects of Ractopamine Dose (4.5, 9.0 g/ton) and Feeding Duration (7, 14, 21, or 28 days) on Pig Performance^a

| Item | Dose, g/ton | | | | | | | | | | Probability (<i>P</i> <) | | | | |
|-----------------------------------|------------------------|-------------------------|-----------------------|-----------------------|-------------------------|------------------------|-----------------------|---------------------|-------------------------|------|---------------------------|------|--------------------|--------------------|-----------------------|
| | 4.5 g/ton | | | | | 9.0 g/ton | | | | | SE | Dose | Dose × Duration | Linear Duration | Quadratic Duration |
| | Feeding Duration, days | | | | | | | | | | | | | | |
| | Control | 7 | 14 | 21 | 28 | 7 | 14 | 21 | 28 | | | | | | |
| Start weight, lb | 227.4 | 227.6 | 228.1 | 227.5 | 227.2 | 227.7 | 227.4 | 227.9 | 227.7 | 1.37 | 0.97 | 0.97 | 0.87 | 0.86 | |
| Sale weight, lb | 264.8 ^b | 268.8 ^{b,c} | 274.4 ^{c,d} | 274.9 ^{c,d} | 274 ^{c,d} | 275.6 ^{c,d} | 277.7 ^d | 276.1 ^d | 277.6 ^d | 2.86 | 0.07 | 0.8 | 0.26 | 0.38 | |
| ADG, lb | 1.32 ^b | 1.47 ^{b,c} | 1.67 ^{c,d} | 1.69 ^{c,d} | 1.70 ^{c,d} | 1.71 ^{c,d} | 1.78 ^d | 1.73 ^{c,d} | 1.77 ^d | 0.09 | 0.1 | 0.72 | 0.17 | 0.43 | |
| ADFI, lb | 5.18 ^b | 5.34 ^{b,c} | 5.46 ^{b,c} | 5.52 ^c | 5.60 ^c | 5.57 ^c | 5.55 ^c | 5.54 ^c | 5.70 ^c | 0.11 | 0.16 | 0.83 | 0.09 | 0.63 | |
| Feed Conversion | 3.97 ^b | 3.7 ^{b,c} | 3.33 ^{c,d} | 3.3 ^{c,d} | 3.31 ^{c,d} | 3.27 ^{c,d} | 3.18 ^d | 3.23 ^{c,d} | 3.22 ^{c,d} | 0.17 | 0.13 | 0.71 | 0.23 | 0.35 | |
| Yield, % ^f | 76.3 ^b | 76.7 ^{b,c,d,e} | 76.5 ^{b,c} | 76.6 ^{b,c,d} | 76.6 ^{b,c,d,e} | 77.05 ^{c,d,e} | 77.24 ^{d,e} | 77.38 ^e | 76.7 ^{b,c,d,e} | 0.25 | 0.004 | 0.26 | 0.37 | 0.39 | |
| 10th rib backfat, in ^g | 0.62 ^{b,c,d} | 0.65 ^d | 0.61 ^{b,c,d} | 0.60 ^{b,c} | 0.59 ^{b,c} | 0.64 ^{c,d} | 0.62 ^{b,c,d} | 0.59 ^{b,c} | 0.57 ^b | 0.02 | 0.7 | 0.77 | 0.005 | 0.7 | |
| Loin depth, in ^g | 2.68 ^{c,d,e} | 2.61 ^{b,c} | 2.64 ^{c,d} | 2.64 ^{c,d,e} | 2.67 ^{c,d,e} | 2.57 ^b | 2.67 ^{c,d,e} | 2.70 ^e | 2.69 ^{d,e} | 0.03 | 0.46 | 0.96 | 0.96 | 0.78 | |
| Lean, % ^g | 56.6 ^{c,d,e} | 56.2 ^{b,c} | 56.6 ^{c,d,e} | 56.6 ^{c,d,e} | 56.8 ^{d,e} | 55.9 ^b | 56.5 ^c | 57.01 ^e | 57.06 ^e | 0.21 | 0.37 | 0.38 | 0.0001 | 0.14 | |

^aA total of 45 pens (23 pigs/pen, 5 pens/treatment) of gilts were fed 4.5 or 9.0 g/ton ractopamine (PayleanTM) for 7, 14, 21, or 28 days prior to slaughter, along with a control treatment without ractopamine.

^{b,c,d,e}Means in the same row without a common superscript differ ($P<0.05$).

^fYield was calculated using live carcass pen-weights attained at the slaughter plant.

^gBackfat, loin depth, and percent lean were adjusted to a common carcass weight.

Table 2. Economic Effects of Ractopamine Dose (4.5, 9.0 g/ton) and Feeding Duration (7, 14, 21, or 28 days)

| Item | Dose, g/ton | | | | | | | | | | Probability (<i>P</i> <) | | | | |
|-----------------------------------|------------------------|-----------------------|-----------------------|-----------------------|-------------------------|-------------------------|----------------------|-----------------------|-----------------------|------|---------------------------|------|--------------------|--------------------|-----------------------|
| | 4.5 g/ton | | | | | 9.0 g/ton | | | | | SE | Dose | Dose × Duration | Linear Duration | Quadratic Duration |
| | Feeding Duration, days | | | | | | | | | | | | | | |
| | Control | 7 | 14 | 21 | 28 | 7 | 14 | 21 | 28 | | | | | | |
| Carcass weight, lb | 200.7 ^a | 202.9 ^{a,b} | 208.6 ^{b,c} | 208.9 ^c | 208.5 ^{b,c} | 208.4 ^{b,c} | 210.5 ^c | 210.9 ^c | 211 ^c | 2.04 | 0.04 | 0.77 | 0.05 | 0.14 | |
| Grade Premium, \$/CWT | 6.32 ^{a,b} | 6.31 ^{a,b} | 6.33 ^{a,b} | 6.44 ^{a,b} | 6.50 ^{a,b} | 6.22 ^a | 6.52 ^{a,b} | 6.59 ^b | 6.56 ^b | 0.11 | 0.71 | 0.39 | 0.03 | 0.51 | |
| Revenue/hd ^f , \$ | 125.13 ^a | 126.55 ^{a,b} | 130.13 ^{b,c} | 130.52 ^c | 130.43 ^{b,c} | 129.73 ^{b,c} | 131.68 ^c | 132.08 ^c | 132.05 ^c | 1.36 | 0.03 | 0.89 | 0.02 | 0.12 | |
| Feed cost/hd, \$ | 6.93 ^a | 7.42 ^{a,b} | 7.91 ^{b,c} | 8.42 ^{c,d} | 8.73 ^d | 7.95 ^{b,c} | 8.65 ^d | 9.13 ^d | 9.93 ^e | 0.23 | 0.01 | 0.56 | 0.01 | 0.93 | |
| Feed cost/hd over controls, \$ | - | 0.49 | 0.99 | 1.49 | 1.81 | 1.03 | 1.72 | 2.20 | 3.01 | . | . | . | . | . | |
| Feed cost/lb of gain | 0.187 ^a | 0.182 ^{a,b} | 0.173 ^a | 0.18 ^{a,b} | 0.186 ^{a,b} | 0.167 ^a | 0.175 ^{a,b} | 0.19 ^{a,b} | 0.20 ^b | 0.01 | 0.71 | 0.39 | 0.03 | 0.51 | |
| IOMFC/hd ^h , \$ | 118.20 ^a | 119.13 ^{a,b} | 122.21 ^{b,c} | 122.10 ^{b,c} | 121.71 ^{a,b,c} | 121.78 ^{a,b,c} | 123.03 ^c | 122.95 ^{b,c} | 122.11 ^{b,c} | 1.35 | 0.19 | 0.81 | 0.29 | 0.12 | |
| IOMFC/hd over controls, \$ | - | 0.93 | 4.01 | 3.90 | 3.50 | 3.58 | 4.83 | 4.75 | 3.92 | . | . | . | . | . | |

^{a,b,c,d,e}Means in the same row without a common superscript differ ($P < 0.05$).

^fRevenue = Average pig revenue for each pen on test; with a \$56.00 CWT base meat price on day of sale.

^gDiet Cost: Control = \$94/ton, 4.5 g/ton = \$113/ton, 9.0 g/ton = \$123/ton.

^hIOMFC (Income Over Marginal Feed Costs) = Carcass value - feed costs incurred during trial.