THE EFFECT OF OPTAFLEXX® ON GROWTH, PERFORMANCE AND CARCASS TRAITS OF CALF-FED HOLSTEIN STEERS FED TO HARVEST
A SUMMARY OF FOUR POST-APPROVED STUDIES

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Introduction

As the beef industry continues to advance, Elanco Animal Health is committed to develop and market research-based products that not only improve cattle performance, but also help beef producers meet consumer needs and expectations.

Optaflexx is Elanco's trademark name for ractopamine hydrochloride, the first beta-agonist to be approved by the United States Food and Drug Administration (FDA) for increased rate of weight gain, improved feed efficiency and increased carcass leanness when fed to steers and heifers during the final 28 to 42 days of the finishing period. The effects of Optaflexx fed to beef steers during the FDA registration studies are presented in Optaflexx Exchange #1 (Elanco Animal Health, AI9251) while the effects of Optaflexx fed to beef steers in large pen conditions and under current management practices during post-approval studies are presented in Optaflexx Exchange #4 (Elanco Animal Health, AI9725). This publication presents data relative to four post-approval studies conducted with calf-fed Holstein steers.

Objective

The objective of these studies was to evaluate the effects of Optaflexx fed for the final 28 to 35 days of the finishing period on the growth performance and carcass traits of calf-fed Holstein steers.

Materials and Methods

Study Location and Seasons. The studies were conducted at various commercial and university feedlot research facilities across the United States during the spring and summer of 2004. Cattle used in these studies were calf-fed Holstein steers obtained from commercial feed yards.

Animal Numbers and Treatments. One thousand nine hundred fourteen (1,914) calf-fed Holstein steers were used in four studies to evaluate the effects of Optaflexx when fed for the last 28 to 38 days of the finishing period. Each study consisted of four to eight blocks (replicates) of steers per treatment fed in 13- to 72-head pens (Table 1). At each study site, Optaflexx was incorporated into the ration between 9.8 and 24.6 g/ton (90 percent DM) to achieve intakes of approximately 0, 200 and 300 mg/hd/d, respectively, based on estimated feed intake at the start of each study. Actual Optaflexx consumption for the 200 and 300 mg/hd/d treatments averaged 212 and 286 mg/hd/d, respectively.

Ration. Rations were typical for the geographical region where the studies were conducted and met or exceeded National Research Council (NRC) nutrient requirements for finishing steers. Nutrient profile of the diets fed at each location is provided in Table 2. Rumensin® and Tylan® were included in all diets at approved levels.

Cattle Management, Implant Programs, Pre-treatment Phase and Study Duration. Steers used in these studies were placed on feed in commercial feedyards at approximately 300 lbs. As cattle approached the end of the feeding period, they were transported to the research site. Cattle at each study site were fed and managed in two phases: 1) pre-treatment phase, and 2) Optaflexx-feeding phase. During the pre-treatment phase, cattle were processed according to each research site's standard receiving procedures. The length of the pre-treatment phase varied both within and across study sites. Cattle for the California 1, Arizona and California 2 studies were placed in pens at the research location within 33 days of study initiation, while cattle in the Kansas study were placed in research pens from 92 to 185 days prior to study initiation.

Terminal implants were administered at least 90 days pre-harvest. Details of initial and re-implant programs are provided in Table 3. The feeding of Optaflexx started when blocks of cattle were judged to be between 28 to 35 days from harvest based on marketing projection programs, visual evaluation and live weight. Live animal weights were obtained at the beginning and end of the Optaflexx-feeding phase. Live weights were pencil shrunk by 4 percent for calculating animal performance and dressing percent.

Harvest and Carcass Data Collection. Shipping distances from the feedyard to harvest plant ranged from 140 to 310 miles. With the exception of the California 1 study, cattle at each study site were commingled and randomly presented for harvest. In the California 1 study, entire pens of cattle within a block were presented for harvest. Identification of cattle and carcasses was maintained by correlating ear tag identification with plant carcass identification number.

Carcass chill time ranged from approximately 24 to 96 hours. Carcasses that were severely trimmed (estimated trim >50 lbs) were not used to calculate mean carcass weight, dressing percentage or United States Department of Agriculture (USDA) yield grade. Each study utilized an experienced group of carcass evaluators to collect standard carcass data. Percent kidney, pelvic and heart fat (KPH) and 12th rib fat thickness were recorded for use in calculating USDA yield grade. Carcass rib eye area was measured using video image technology (Computer Vision System; RMS-Research Management Systems USA, Inc., Ft Collins, CO), or by tracing the outline of the rib eye and measuring with a plainmeter or grid. A grading supervisor from the USDA Grading

Service determined marbling score and lean maturity for each study. Marbling score and overall carcass maturity were used to determine USDA quality grade.

In the California 1 study, carcass measurements from approximately 83 cattle within one block were not obtained due to a miscommunication with plant personnel. Consequently, carcass data for the entire block were deleted in the pooled analysis.

Statistics. Pooled analyses of growth performance and carcass data were conducted using the least squares, mixed model procedure of SAS (SAS Inst. Inc., Cary, NC). Frequency distributions of USDA quality grades, USDA yield grades, rib eye area, and the incidence of dark cutting carcasses among treatment groups were compared using the GLIMMIX macro of SAS, utilizing the logit link function (SAS Inst. Inc., Cary, NC). In all analyses, pen was used as the experimental unit. Statistical models included treatment as the independent fixed effect, average initial live weight as a covariate, and study and block within study as random effects. Study heterogeneity was tested using a residual and random component. Depending on the results of these tests, either a weighted mixed model analysis was conducted showing study heterogeneity or an unweighted mixed model analysis was conducted for all traits without study heterogeneity.

Results and Discussion

Growth Performance. Results of growth performance characteristics in calf-fed Holstein steers fed Optaflexx for the last 28 to 38 days of the finishing period are presented in Table 4. Final live weights were heavier ($P<0.05$) for Optaflexx-fed steers than for control steers. Average daily gain in the treatment period was higher ($P<0.05$) for steers fed Optaflexx. Average daily gain was increased 17.9 percent and 15.0 percent over control steers for the 200 and 300 mg/hd/d treatment groups, respectively. Additional weight gain over control steers was 17.6 lbs for steers fed Optaflexx at 200/mg/hd/d and 14.9 lbs for steers fed Optaflexx at 300 mg/hd/d.

Feed intake for steers fed either level of Optaflexx was not different when compared to feed intake of control steers. Feed efficiency and gain efficiency were improved ($P<0.05$) by Optaflexx feeding at both the 200 mg/hd/d and 300 mg/hd/d treatment levels. Compared to steers in the control group, feed efficiency was improved 14.4 percent and 14.3 percent while gain efficiency was improved 15.9 percent and 16.6 percent at the 200 and 300 mg/hd/d treatment levels, respectively

During the feeding period, four animals died in three of the studies. Causes of mortalities were determined to be: digestive (one at 200 mg), peritonitis (one at 300 mg), suspected acidosis (one at 300 mg) and bloat (one at 200 mg.) Animal mortalities occurred in a random manner, in different pens at the various sites, at days 5, 15, 17 and 21. Eighteen animals were removed during the feeding period in the four studies when it was determined that an animal needed a treatment intervention and could not return to the same pen within 24 hours. Reasons for animal removals were listed as: leg abscess (one at 0 mg); dehydration (one at 300 mg); chronic bloat (one at 300 mg); foot rot and lameness (total of 15, 2 at 0 mg, 6 at 200 mg, 7 at 300 mg). The majority of the removed animals (14) were from the Kansas study and were removed for either foot rot or lameness at various times during the study.

Carcass Traits. The effects of Optaflexx in four post-approval studies when fed for 28 to 38 days on carcass traits are shown in Table 5. Carcass weights of steers fed Optaflexx were heavier (P<0.0001) than control steers. Carcass weights were increased by 10.3 and 11.1 lbs for the 200 and 300 mg/hd/d Optaflexx treatments, respectively. Fat thickness was reduced (P<0.05) in steers fed Optaflexx at 300 mg/hd/d. Percent KPH was not affected by Optaflexx treatment. Rib eye area was increased (P<0.05) by 0.27 and 0.43 square inches for steers fed 200 and 300 mg/hd/d, respectively, compared to steers in the control group. Calculated yield grade was decreased (P<0.05) by 0.14 units in steers fed 300 mg/hd/d Optaflexx. Feeding Optaflexx also improved (P<0.05) carcass conformation score (a visual assessment of muscling in the sirloin and round) at both the 200 and 300 mg/hd/d level compared to steers in the control group.

Feeding Optaflexx at 200 mg/hd/d resulted in a reduction (P<0.05) in marbling score of carcasses when compared to carcasses of control steers. Mean marbling scores were not different for carcasses of steers in the control and 300 mg/hd/d treatment groups. The reduction in marbling score observed in these studies at 200 mg/hd/d was inconsistent with that reported previously in beef steers by Schroeder et al. (2003) or Laudert et al. (2004). Optaflexx treatment did not influence overall maturity of carcasses.

Frequency distributions of USDA quality grades, USDA yield grades, and rib eye size in the four calf-fed Holstein studies are presented in Tables 6 to 8, respectively. When compared to controls, feeding Optaflexx at 200 mg/hd/d resulted in a reduction (P<0.05) in the percentage of Choice and Prime carcasses and an increase in the percentage of Select carcasses. No differences (P>0.05), however, were observed in percentage Choice and Prime or percentage Select between the control and 300 mg/hd/d treatments. No differences (P>0.30) were noted in the percentage of Prime and Premium Choice for steers fed Optaflexx. The reduction in quality grade observed in these studies at 200 mg/hd/d is inconsistent with that reported previously by Laudert et al. (2004).

Feeding Optaflexx resulted in a shift in the distribution of USDA yield grades among the treatment groups (Table 7). The percentage of USDA yield grade 3 carcasses was reduced (P<0.05) in both Optaflexx treatments compared to the control group. The percentage of USDA yield grade 1 carcasses was higher (P<0.05) for the 300 mg/hd/d group compared to the control group.

Feeding Optaflexx to Holstein steers resulted in a shift in the distribution of rib eye size. Feeding Optaflexx resulted in an increase (P<0.05) in the percentage of rib eyes that measured between 12.0 to 12.99, and 13.0 to 13.99 in2 and a reduction (P<0.05) in the percentage of rib eyes that measured between 10.0 to 10.99 and 11.0 and 11.99 in2. Optaflexx feeding did not affect the incidence of dark cutting beef (Table 9).

Conclusions

Optaflexx, when fed to calf-fed Holstein steers during the final stage of the finishing period, increased average daily gain and improved feed efficiency. Optaflexx also increased hot carcass weight, rib eye area and carcass conformation score. Feeding Optaflexx resulted in a greater percentage of yield grade 1 carcasses and a smaller percentage of yield grade 3 carcasses. Although marbling scores and percentage Choice and Prime were reduced for steers for 200 mg/hd/d of Optaflexx, these results were inconsistent with previously reported data.

These data demonstrate that Optaflexx is an effective tool that can be used to help restore production efficiency lost during the final portion of the finishing period in calf-fed Holsteins.

References

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Schroeder, A.L., D.M. Polser, S.B. Laudert, and G.J. Vogel. 2003. The Effect of Optaflexx on Growth Performance and Carcass Traits of Steers, Five-Trial Registration Summary, Optaflexx Exchange #1. Elanco Animal Health. AI9251

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AI9724 (2/05)

Table 1. Study Location, Number of Head and Treatments

Study Number	Location	Blocks per Treatment	No. of Head per Pen	Control 0 mg Optaflexx/hd/d	Treatment 1 200 mg Optaflexx/hd/d	Treatment 2 300 mg Optaflexx/hd/d
T4V060405	California 1	4	70-72	284	284	284
T4V060406	California 2	5	13	65	65	65
T4V040334	Arizona	4	23-27	99	98	96
T4V200332	Kansas	8	22-25	193	190	191
Totals		21		641	637	636

Table 2. Nutrient Profile of Rations (100% DM)[a]

Location	Crude Protein %	DM %	Fat %	NPN %	Ca %	P %	Nem[b] (Mcal/cwt)	NEg[b] (Mcal/cwt)
California 1	13.35	80.9	9.3	2.9	0.91	0.34	98.5	67.3
California 2	12.98	86.4	7.6	3.7	0.74	0.36	94.4	61.0
Arizona	13.48	86.8	7.8	4.3	0.70	0.24	100.4	68.9
Kansas	15.01	82.2	3.5	2.9	0.71	0.36	97.0	66.5

[a]Based on assay results of weekly feed samples

[b]Calculated using standard NRC nutrient values for ingredients

Table 3. Implant Program and Study Duration.

Location	Initial Implant	Reimplant	Days from Reimplant to Harvest	Study Site Pre-treatment Period, d	Days on Optaflexx
California 1	Encore®	Revalor® S	113-121	21-22	28
California 2	Ralgro®	None	N/A	10-18	28
Arizona	Synovex®S	Synovex S	104-116	31-33	34
Kansas	Estrogen[a]	Revalor S	120-148	92-185	35-38[b]

[a]Cattle received either a Ralgro, Ralgro Magnum™ or Encore at initial processing

[b]Blocks 1, 2 and 3, blocks 4, 5 and 6, and blocks 7 and 8 were on study for 38, 36 and 35 days, respectively

Table 4. Growth Performance of Calf-fed Holstein Steers Fed Optaflexx in Four Post-approval Studies When Fed for 28 to 38 Days[a]

	Optaflexx, mg/hd/d				
Variable	0	200	300	SE	OSL[b]
No. pens	21	21	21	-	-
No. animals[c]	638	628	626	-	-
Initial weight, lb (4% shrink)	1194.9	1198.1	1191.7	11.2	-
Adjusted initial weight for covariant, lb		1194.7			
Final weight, lb (4% shrink)	1288.8^{x}	1306.4^{y}	1303.7^{y}	6.38	0.0001
ADG, lb	3.01^{x}	3.55^{y}	3.46^{y}	0.14	0.0002
ADG improvement, %		17.9	15.0	-	-
Total weight gain, lb	94.1	111.7	109	-	-
Optaflexx response, lb		17.6	14.9	-	-
DM intake, lb	20.6	21.1	20.2	0.42	0.08
Feed efficiency	7.08^{x}	6.06^{y}	6.07^{y}	0.25	0.0001
Feed efficiency improvement, %		14.4	14.3	-	-
Gain efficiency	0.145^{x}	0.168^{y}	0.169^{y}	0.01	<0.0001
Gain efficiency improvement, %		15.9	16.6	-	-

[a]Least squares means with initial weight used as a covariate. Deads and removals out basis

[b]Observed significance level for Optaflexx treatment

[c]Animals were removed for nontreatment-related causes

[xy]Values with different superscripts within a row are different ($P<0.05$)

Table 5. Carcass Traits of Calf-fed Holstein Steers Fed Optaflexx in Four Post-approval Studies When Fed for 28 to 38 Days[a]

Variable	Optaflexx, mg/hd/d 0	200	300	SE	OSL[b]
No. pens	20	20	20	-	-
No. carcasses	568	558	556	-	-
Hot carcass weight, lb	786.6[x]	796.9[y]	797.7[y]	3.15	<0.0001
Optaflexx response, lb	-	10.3	11.1	-	-
Dressing percent[c], %	61.2	61.2	61.4	0.49	0.51
12^{th} rib fat thickness, in	0.26[x]	0.25[x]	0.23[y]	0.01	0.003
KPH, %	2.30	2.33	2.32	0.08	0.69
Rib eye area, in^2	11.94[x]	12.21[y]	12.37[y]	0.25	0.0002
Yield grade[d]	2.77[x]	2.71[x]	2.63[y]	0.08	0.002
Carcass conformation[e]	17.72[x]	17.94[y]	17.99[y]	0.21	0.01
Marbling[f]	514.8[x]	497.7[y]	507.0[xy]	20.7	0.01
Skeletal maturity[g]	169.5	170.1	168.3	7.1	0.12
Lean maturity[g]	151.3	149.4	151.8	6.3	0.05
Overall carcass maturity[g]	160.6	159.9	160.1	1.8	0.64

[a] Least squares means with initial weight used as a covariate

[b]Observed significance level for Optaflexx treatment

[c] 4% pencil shrink applied to final full weight

[d] Calculated utilizing USDA yield grade equation method

[e] Carcass conformation, 18=high Good, 19=low Choice

[f] Marbling score of 500=$Small^0$=low Choice

[g] Skeletal, lean and overall maturity, A^0=100, B^0=200

[xy]Values with different superscripts within a row are different ($P<0.05$)

Table 6. Frequency Distribution of USDA Quality Grades in Calf-fed Holstein Steers Fed Optaflexx in Four Post-approval Studies When Fed for 28 to 38 Days

Quality Grade	Optaflexx, mg/hd/d 0	200	300	OSL[a]
Choice and Prime, %	47.7[x]	40.7[y]	45.3[x]	0.02
Prime, %	1.4	0.6	0.9	0.30
Premium Choice, % (Average / High Choice)	11.4	10.5	10.8	0.85
Low Choice, %	34.9	29.6	33.6	0.09
Select, %	46.2[y]	52.6[x]	45.7[y]	0.04
Standard / sub-standard, %	6.1[y]	6.7[y]	9.0[x]	0.03

[a]Observed significance level for Optaflexx treatment

[xy]Percentages with different superscripts within a row are different ($P < 0.05$)

Table 7. Frequency Distribution of USDA Yield Grades in Calf-fed Holstein Steers Fed Optaflexx in Four Post-approval Studies When Fed for 28 to 38 Days[a]

Yield Grade[a]	Optaflexx, mg/hd/d 0	200	300	OSL[b]
Yield grade 1, %	4.0[y]	5.5[xy]	8.5[x]	<0.01
Yield grade 2, %	60.4	66.0	64.6	0.13
Yield grade 3, %	34.2[x]	27.6[y]	26.0[y]	0.01
Yield grade 4, %	1.4	0.9	0.9	0.54
Yield grade 5, %	-	-	-	-

[a]Calculated utilizing USDA yield grade equation

[b]Observed significance level for Optaflexx treatment

[xy]Percentages with different superscripts within a row are different ($P < 0.05$)

Table 8. Frequency Distribution of Rib Eye Size in Calf-fed Holstein Steers Fed Optaflexx in Four Post-approval Studies When Fed for 28 to 38 Days

Rib eye Size	Optaflexx, mg/hd/d 0	200	300	OSL[a]
Less than 10.0 in^2	7.5	5.3	4.8	0.08
10.00 to 10.99 in^2	17.5^{x}	11.7^{y}	12.1^{y}	<0.01
11.00 to 11.99 in^2	31.0^{x}	25.4^{y}	24.9^{y}	0.03
12.00 to 12.99 in^2	25.7^{y}	32.3^{x}	32.4^{x}	0.02
13.00 to 13.99 in^2	13.0^{y}	18.1^{x}	17.0^{x}	0.05
14.00 in^2 or greater	5.4^{y}	7.3^{xy}	9.0^{x}	0.04

[a]Observed significance level for Optaflexx treatment

[xy]Percentages with different superscripts within a row are different ($P < 0.05$)

Table 9. Incidence of Dark Cutters in Calf-fed Holstein Steers Fed Optaflexx in Four Post-approval Studies When Fed for 28 to 38 Days

Dark Cutter	Optaflexx, mg/hd/d 0	200	300	OSL[a]
Total of all studies	6/568	7/558	5/556	0.71
California 1	0	2	0	-
Arizona	0	0	1	-
California 2	0	0	0	-
Kansas	6	5	4	-

[a]Observed significance level for Optaflexx treatment