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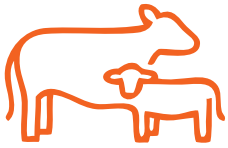

Evaluation of CATTLYST®+AUREOMYCIN® or Rumensin®+Tylan® With and Without ACTOGAIN™ as Feeding Strategies in Finishing Steers

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Summary

- A university study examined the performance of finishing feedlot steers fed CATTLYST® (laidlomycin) ionophore in combination with AUREOMYCIN® (chlortetracycline; 350 mg/hd/day) compared to animals fed Rumensin® (monensin) and Tylan® (tylosin).[1] Feed supplementation with ACTOGAIN™ (ractopamine) beta-agonist during the last 32 days of the finishing period was also evaluated.
  - Four treatment groups each comprised of 48 newly arrived heavy steers (780 lb) were evaluated during a 151-day finishing period at a Texas feedlot.
  - CATTLYST/AUREOMYCIN was fed without ACTOGAIN or followed by ACTOGAIN, Rumensin/Tylan was fed with ACTOGAIN, and a control group was not medicated.
- The CATTLYST/AUREOMYCIN program alone, without beta-agonist (ACTOGAIN), helped improve ($P < 0.05$) final live and hot carcass weights compared to controls and sustained greater feed intake when other groups were fed beta-agonist.
- Performance and carcass outcomes were similar for both ionophores (CATTLYST or Rumensin) when fed with a beta-agonist (ACTOGAIN).
- Feeding CATTLYST/AUREOMYCIN throughout the feeding period without a beta-agonist may yield responses similar to Rumensin/Tylan fed with a beta-agonist.

Feeding CATTLYST® and AUREOMYCIN® in finisher rations without a beta-agonist yielded responses similar to Rumensin®+ Tylan® with a beta-agonist.

Supplementation of feedlot cattle rations with ionophores has long been a standard industry-wide practice for enhancing growth performance. Rumensin® (monensin, an ionophore; Elanco) and Tylan® (tylosin, an antibacterial; Elanco) represent the traditional feeding program intended to improve feed efficiency and control liver abscesses in feedlot cattle. The availability of alternative feed additive programs, however, may allow feedyard nutritionists, veterinarians, and managers greater flexibility for improving health, elevating performance, and overcoming economic challenges. CATTLYST® (laidlomycin, for performance) and AUREOMYCIN® (chlortetracycline, for pneumonia control) represent alternative ionophore and antimicrobial feed additives from Zoetis that should be considered.

In addition, the inclusion of a beta-agonist 'repartitioning' agent in the final finish feed for feedlot cattle has also become standard industry practice. A beta-agonist feed supplement can help cattle convert feed to high-quality meat instead of fat (or excreting excess nutrients) during this expensive closing phase of the feeding period, thus boosting efficiency, conserving

resources, and reducing input costs, all without adverse impacts on animal nutrition or health. Ractopamine hydrochloride is the original beta-1 agonist that has been safely and reliably used for more than 10 years to help finishing cattle efficiently generate more pounds of lean beef with little adverse impact on quality/tenderness.

Though beta-agonists have achieved significant improvements in carcass yield, their implementation has not been without scrutiny.

Though significant improvements in carcass yield have been achieved with the use of beta-agonists, their implementation has not been without scrutiny. Some countries have banned imports of US beef due to the use of beta-agonists, and some domestic processors banned use of the beta-agonist zilpaterol, citing animal welfare concerns.

With such increased oversight of feed technologies in the beef industry, the opportunity to further explore the full potential of currently available approved compounds is of interest to many industry influencers and producers. A recent study[1] investigated the effects of different ionophore/antimicrobial combinations (CATTLYST/AUREOMYCIN vs Rumensin/Tylan) and beta-agonist inclusion on finishing performance and carcass characteristics of feedlot steers (effects on respiratory health not assessed).

CATTLYST®

CATTLYST® is a potent second-generation ionophore developed specifically for use in high-energy rations with no step-up requirement.

CATTLYST is a potent second-generation ionophore developed specifically for use in high-energy rations with *no step-up* requirement (full dose from day one, eliminating the need for multiple starter rations). CATTLYST is available as a granular Type A Medicated Article (CATTLYST 50G) containing 50 g laidlomycin/lb, approved for improved feed efficiency and increased rate of weight gain in feedlot cattle when fed at 5 to 10 g/ton (30 to 150 mg/hd/d). Like Rumensin, CATTLYST requires no pre-slaughter withdrawal.

AUREOMYCIN®

CATTLYST is approved for feeding in combination with AUREOMYCIN, the reliable broad-spectrum antibacterial approved for feeding to beef cattle at a dose rate of 350 mg chlortetracycline/head/day for the control of bacterial pneumonia (*Pasteurella* spp). AUREOMYCIN may also be fed at a therapeutic dose of 10 mg chlortetracycline/lb of body weight (BW)/day for up to 5 consecutive days for treatment of bacterial pneumonia caused by *P. multocida* and bacterial enteritis caused by *Escherichia coli.*

ACTOGAIN™

ACTOGAIN is the ractopamine hydrochloride feed additive product from Zoetis that offers producers a choice for which beta-agonist ractopamine hydrochloride product they want to incorporate in their finishing rations. ACTOGAIN contains 45.4 g/lb ractopamine hydrochloride and is FDA-approved to increase the rate of weight gain, improve feed efficiency, and increase carcass leanness in feedlot cattle during the last 28 to 42 days on feed. The approved ractopamine hydrochloride dosage for these indications in complete Type C feeds is 9.8 to 24.6 g/ton (11 ppm to 27 ppm, 90% DM basis) to provide 90 to 430 mg/head/day.

ACTOGAIN can be fed immediately prior to harvest due to a zero-day preslaughter withdrawal, and cattle fed ACTOGAIN are accepted by all major US packers. ACTOGAIN is approved to be fed in combination with Rumensin and Tylan, Rumensin and MGA® (melengestrol acetate), or Rumensin, Tylan and MGA. ACTOGAIN is a distinctly different beta-agonist than Zilmax® (zilpaterol) which requires a 3-day withdrawal.

Experiment Design

The study involved 192 cross-bred beef steers (average 780 lb) received in August at a university research feedlot in Texas after transport. Three days after arrival, steers were weighed and processed according to normal feedlot procedures that included administration of vaccines (BOVI-SHIELD GOLD® 5, ONE SHOT ULTRA® 7, Myco-Bac® B), parasite control agent (DECTOMAX® Pour-On), and terminal implant (SYNOVEX® CHOICE). Arriving cattle were transitioned to a final finishing ration for 17 days before study initiation on day 0.

The study was conducted as a randomized complete block design with 'pen' as the experimental unit (4 treatments × 12 replications/blocks = 48 pens; 4 hd/pen). Pen

assignments were based on individual BW using a method that reduced average pen variability. Once the 48 concrete pens were filled, 12 pens were randomly assigned to each of 4 treatment groups which received the following feeding regimens beginning on study day 0 (Figure 1).

- **Treatment 1: Control**
  - Baseline ration with no ionophore, antimicrobial, or beta-agonist.
- **Treatment 2: CATTLYST/AUREOMYCIN (CA)**
  - CATTLYST (10.7 g/ton);
  - AUREOMYCIN (350 mg/hd/d).
- **Treatment 3: CATTLYST/AUREOMYCIN + ACTOGAIN (CA+Ac)**
  - CATTLYST (10.7 g/ton);
  - AUREOMYCIN (350 mg/hd/d);
  - At 32 days (day 119) before expected harvest, single-day transition adding ACTOGAIN (255 mg/hd/d) and removal of CATTLYST/AUREOMYCIN (no cross-clearance with ACTOGAIN).
- **Treatment 4: Rumensin/Tylan + ACTOGAIN (RT+Ac)**
  - Rumensin (32 g/ton);
  - Tylan (10.7 g/ton);
  - At 32 days (day 119) before expected harvest, single-day transition adding ACTOGAIN (255 mg/hd/d).

The respective treatment rations were fed to provide ad libitum access to feed once daily in the morning for the duration of the 151-day experiment. Composition of the finishing diet is detailed in Appendix 1. Weekly ration samples were obtained directly from the feed bunk immediately following feed delivery and subsequently analyzed to confirm medication levels and dry matter (DM) content.

All steers were individually weighed before morning feed delivery on days 0, 35, 70, 119, and 151. Average daily gain (ADG), dry matter intake (DMI), and feed efficiency (feed/gain, F/G) were calculated excluding animals that were removed during the course of the study. Cattle were observed daily for signs of illness and 7 animals were removed (control: 1 coccidiosis, 1 lameness, 2 *Mycoplasma* symptoms; CA: 1 lameness; RT+Ac: 1 respiratory failure, 1 *Mycoplasma* symptoms). One control pen was removed entirely from the statistical analysis since 2 removed animals came from that individual pen.

When approximately 60% of the steer population was estimated to possess external fat cover sufficient to grade USDA Choice, all animals were transported about 50 miles to a commercial processor. Individual carcass measurements (n = 181) collected by university-trained personnel included hot carcass weight (HCW), 12th-rib fat depth, ribeye (longissimus muscle) area, kidney/pelvic/heart (KPH) fat percent, marbling score, USDA quality grades, calculated yield grade, and evaluation for liver abscesses. A 3% shrink was applied to all final live BW for calculation of dressing percentage.

In the CA+Ac group, CATTLYST® was removed from the ration when ACTOGAIN® was fed, due to the current lack of a cross clearance.

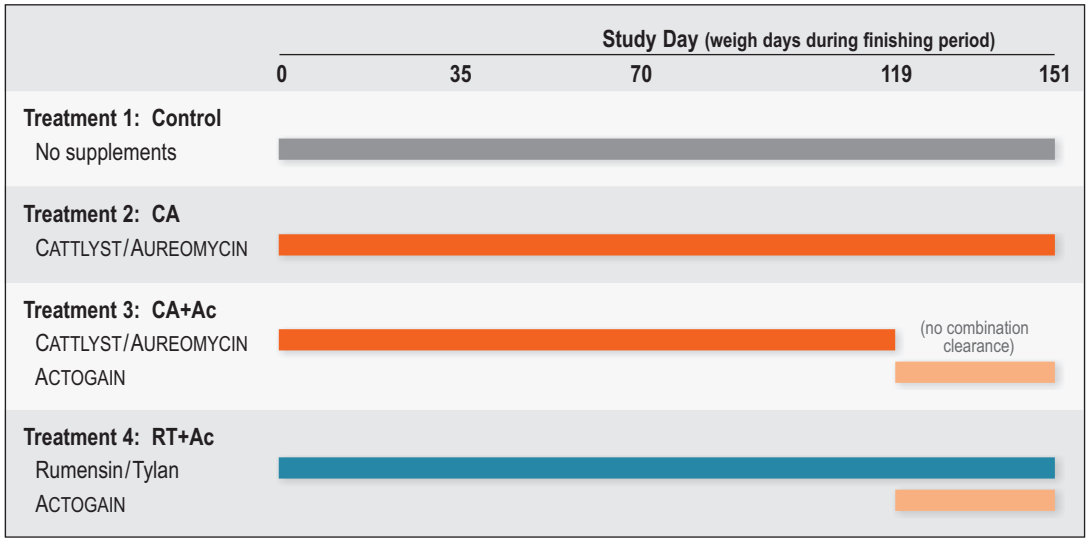

Figure 1 – Summary of treatment groups and study timeline.

Subsequent analysis of the longissimus muscle was conducted to estimate tenderness using Warner-Bratzler shear force (WBSF). Strip loins were obtained from 2 carcasses/pen (the 2 intermediate animals in each pen based on day-35 BW); loins were fabricated on day 4 postmortem. Four inch-thick steaks were cut from the anterior end and each was assigned to either of 4 aging periods (7, 14, 21, or 28 days) in rotating order to ensure each aging period was equally represented among anatomical position within the loin. Shear force values were recorded (kg) and the values from 6 cores of each steak were averaged for statistical analysis.

Performance and carcass data were statistically evaluated by appropriate standard methods. 'Pen' was the experimental unit for all analyses of live performance and carcass characteristics, but each strip loin was the experimental unit for WBSF analyses. Probabilities < 0.05 were considered significant, and values between 0.05 and 0.10 were considered as trending toward significance. The study was conducted in accordance with the Zoetis Institutional Animal Care and Use Committee.

Cattle fed CATTLYST®/ AUREOMYCIN® with no beta-agonist (CA group) demonstrated 3.5% greater final BW than controls.

Results

Performance

Performance results for the finishing period are summarized in Table 1. Cattle fed CATTLYST alone with no beta-agonist supplementation (CA group) demonstrated significantly greater ($P < 0.05$) final BW than controls at both day 119 (+2.8%) and at study conclusion (+3.5%), while both ACTOGAIN-supplemented treatments were intermediate (CA+Ac $P = 0.08$ days 0-118). Prior to initiation of ACTOGAIN

Table 1 – Finishing performance of study cattle, 151 days on feed.

Item[2]	Treatment				SEM[1]
	Control	Cattlyst/Aureo.	Cattlyst/Aureo. +Actogain	Rumensin/Tyl. +Actogain	
Pens (n)	12	12	12	12	
Initial head count (n)	48	48	48	48	
Removals (n)	4	1	0	2	
Day 151 head (pen) count (n)	44 (11)	47(12)	48(12)	46(12)	
Initial body weight (lb)	782	780	780	781	13.9
Day 119 body weight (lb)	1260[a]	1295[b]	1288[ab]	1279[ab]	17.2
Final body weight (lb)	1363[a]	1411[b]	1396[ab]	1398[ab]	19.1
Day 0 to 118					
ADG (lb)	4.02[a]	4.33[b]	4.27[b]	4.19[ab]	0.074
DMI (lb/day)	21.95	22.27	22.21	22.26	0.301
Feed/Gain	5.46[a]	5.15[c]	5.21[bc]	5.33[ab]	0.061
Day 119 to 151[3]					
ADG (lb)	3.23	3.62	3.37	3.73	0.180
DMI (lb/day)	21.80[ab]	23.10[b]	21.07[a]	20.71[a]	0.623
Feed/Gain	6.85[a]	6.48[a]	6.45[a]	5.62[b]	0.254
Day 0 to 151					
ADG (lb)	3.85[a]	4.18[b]	4.08[b]	4.09[b]	0.072
DMI (lb/day)	21.92	22.44	21.96	21.95	0.324
Feed/Gain	5.71[a]	5.38[b]	5.39[b]	5.37[b]	0.065

[abc] Means in rows with different superscripts are significantly different ($P < 0.05$)
[1] Standard error of mean, n = 12 [2] 3% shrink applied to all live BW measurements [3] Day 119 to 151 represents the 32-day ACTOGAIN supplementation period

administration on day 119, both CATTLYST treatment groups performed similarly by achieving significantly ($P < 0.05$) improved ADG and F/G compared to controls during the first 4 months of the finishing period, but cattle fed Rumensin/Tylan failed to outperform controls. No significant differences ($P > 0.05$) between treatment groups were observed for DMI prior to beta-agonist supplementation.

During the final 32 days (period of beta-agonist inclusion), cattle supplemented with CATTLYST alone (CA) demonstrated greater ($P < 0.05$) DMI than both ACTOGAIN-supplemented groups (Table 1), but ADG did not differ. The RT+Ac group produced the best F/G during this last month compared to all other groups ($P < 0.05$). DMI at each weigh date during the study course (Figure 2) further illustrates that a high level of DMI was maintained in the CA group during the last month, but both beta-agonist groups experienced significantly lower DMI.

Results for the entire feeding period (day 0-151; Figure 3) indicate that all 3 medicated groups produced significant ($P < 0.05$) improvements in ADG (6.0-8.6%) and F/G (5.6-6.0%) vs controls. The improved F/G for the RT+Ac group during the final 32 days apparently compensated for the earlier depressed efficiency during the first 119 days, resulting in equivalent F/G for all ionophore-supplemented cattle over the entire feeding period. No significant DMI differences ($P > 0.05$) were detected between treatment groups over the entire 5-month feeding period, though the CA group consumed 2% more feed than the other groups.

Cattle fed CATTLYST®/ AUREOMYCIN® with no beta-agonist (CA group) maintained high feed intake during the last month on feed.

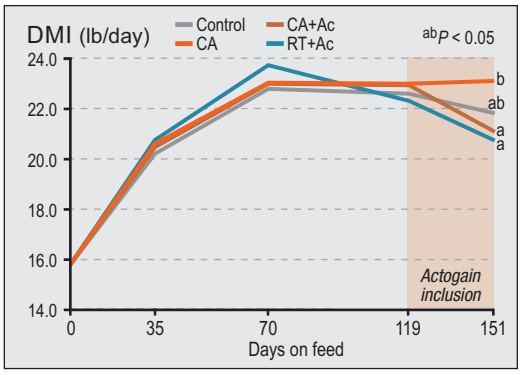

Figure 2 – Mean dry matter intake measured at 5 timepoints during the study.

Over the entire finishing period, all 3 medicated groups significantly improved ADG (6.0-8.6%) and F/G (5.6-6.0%) vs controls.

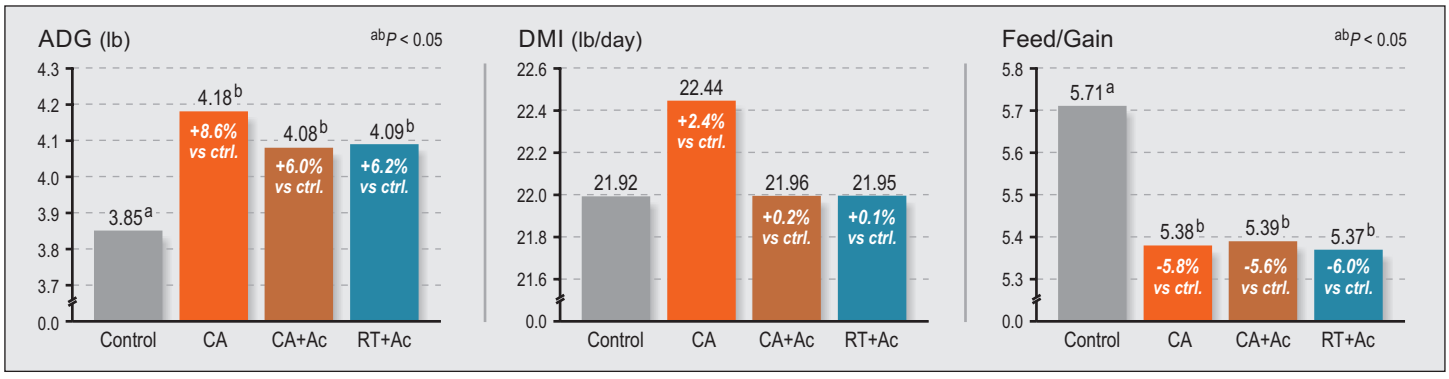

Figure 3 – Mean performance outcomes during the entire study, 151 days on feed.

Cattle fed CATTLYST®/ AUREOMYCIN® with no beta-agonist (CA group) demonstrated 25 lb (2.9%) greater hot carcass weight than controls.

Carcass characteristics

Table 2 and Figure 4 report results of carcass evaluations at processing. The CA group (CATTLYST-supplemented without beta-agonist) yielded significantly greater HCW (25 lb, 2.9%; *P* = 0.04) than controls, while CA+Ac trended toward greater HCW (22 lb; *P* = 0.07) and RT+Ac was not significantly improved (*P* = 0.12). Both ACTOGAIN-supplemented groups generated the greatest ribeye area outcomes. Ribeye area was significantly improved in the RT+Ac group compared to controls (*P* = 0.03) and trended toward improvement the CA+Ac group (*P* = 0.07); however, no significant differences in ribeye area were observed between medicated groups. Although percent KPH was significantly greater in CA cattle than RT+Ac (*P* = 0.03), this outcome was likely due to the low variability for this parameter (SEM = 0.039). No other carcass differences (*P* > 0.05) were detected between treatment groups, including calculated yield grade or liver abscesses.

Results of the Warner-Bratzler shear force measurements summarized in Table 3 show that steaks from the RT+Ac group were significantly (*P* = 0.04) less tender than controls after 7 days of aging, and significantly (*P* = 0.03) less tender than the CA+Ac group after 28 days of aging. These observations were likely due to the larger ribeye size of cattle fed RT+Ac. No differences in estimation of tenderness from WBSF were detected at 14 or 21 days of aging. Notably, all analyzed steaks derived from longissimus muscle exhibited low shear force values, suggesting the cattle population exhibited very high estimations of consumer-perceived tenderness and that differences may have been more easily distinguished in a less tender set of cattle.

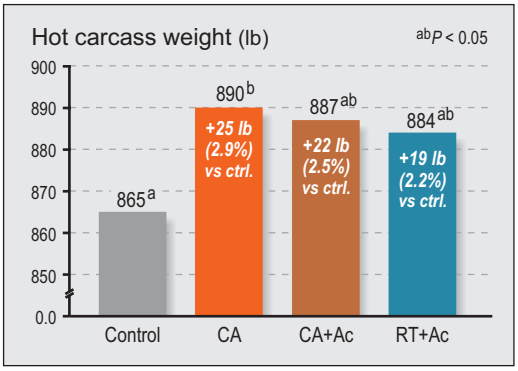

Figure 4 – Mean hot carcass weight at market after 151 days on feed.

No significant differences in ribeye area were observed between medicated groups.

Table 2 – Carcass characteristics of study steers after 151 days on feed.

Item[2]	Treatment				SEM
	Control	Cattlyst/Aureo.	Cattlyst/Aureo. +Actogain	Rumensin/Tyl. +Actogain	
Hot carcass weight (lb)	865[a]	890[b]	887[ab]	884[ab]	13.6
Dressing percent (%)	63.38	63.09	63.54	63.18	0.265
Ribeye area (sq. in)	13.58[a]	13.71[ab]	14.16[ab]	14.28[b]	0.215
12th-rib fat (in)	0.63	0.65	0.60	0.68	0.032
KPH (%)	1.97[ab]	2.03[a]	2.00[ab]	1.92[b]	0.039
Marbling score[1]	412	430	435	409	10.2
Yield grade, calculated	3.40	3.52	3.24	3.36	0.115
Liver abscess (%)[2]	6.71	4.17	2.08	6.92	3.066

[ab] Means in rows with different superscripts are significantly different (*P* < 0.05)
[1] As determined by trained personnel, 300 = Slight00; 400 = Small00
[2] A+ = 1 or more large, or multiple small active abscesses, with or without adhesions; A = 2-4 small well-organized abscesses; A- = 1-2 small abscesses/scars.

Table 3 – Warner-Bratzler shear force (kg) of the longissimus muscle.

Days of postmortem aging	Treatment				SEM
	Control	Cattlyst/Aureo.	Cattlyst/Aureo. +Actogain	Rumensin/Tyl. +Actogain	
7 days	3.07[a]	3.20[ab]	3.26[ab]	3.49[b]	0.144
14 days	2.79	2.76	2.90	3.02	0.114
21 days	2.66	2.55	2.51	2.72	0.093
28 days	2.52[ab]	2.52[ab]	2.40[a]	2.66[b]	0.082

[ab] Means in rows with different superscripts are significantly different ($P < 0.05$)

For the 2 groups fed beta-agonist, Rumensin®/Tylan® cattle yielded steaks significantly less tender than CATTLYST®/AUREOMYCIN® cattle after 28 days of aging.

Implications

While improved feed efficiency is a traditional hallmark of Rumensin supplementation, reduced DMI often suppresses any benefit for live and carcass weights. Thus, beta-agonists are often fed to positively influence lean tissue accretion and carcass yield. As mentioned earlier, however, beta-agonist usage has not been without scrutiny. This study provided further insight into feeding options regarding the use of beta-agonists.

Study outcomes suggest that CATTLYST and AUREOMYCIN should be considered for inclusion in finisher rations for feedlot cattle, perhaps without the use of a beta-agonist. Steers fed CATTLYST/AUREOMYCIN generated heavier final live weights, greater ADG, better feed efficiency, and heavier HCW than controls (effects of AUREOMYCIN on respiratory health were not assessed in this study). In addition, performance and carcass characteristics were similar with those generated by Rumensin/Tylan+ACTOGAIN, even when a beta-agonist was not used (CA group) or when CATTLYST was withdrawn for ACTOGAIN feeding (CA+Ac group).

Only the CA group (no beta-agonist) maintained a high rate of feed intake during the last month when other groups received ACTOGAIN. The lower DMI for the RT/Ac group, even with better F/G, resulted in similar final live weights and HCW between medicated groups.

The common use of beta-agonists has also been associated with increased shear force and decreased consumer acceptance due to the production of tougher beef. In this study, results indicated that the cattle population had very tender longissimus muscle, thus the low WBSF values likely limited the ability to detect differences between treatments. Still, CATTLYST-supplemented cattle averaged WBSF values 7.1% lower than cattle fed Rumensin when averaged across all aging periods, perhaps suggesting some moderation of the adverse impact of beta-agonists on meat tenderness.

Conclusions

CATTLYST® and AUREOMYCIN® fed with or without beta-agonist yielded performance and carcass responses similar to Rumensin® and Tylan® with beta-agonist.

Increased scrutiny of feed supplements commonly used in the beef industry (like beta-agonists) implores further exploration of existing alternatives. Results of this study support combination feeding of CATTLYST (for performance) and AUREOMYCIN (for pneumonia control) in finisher rations for feedlot cattle, with or without a beta-agonist like ACTOGAIN. CATTLYST/AUREOMYCIN supplementation *without* a beta-agonist yielded performance and carcass responses similar to those observed using Rumensin/Tylan with a beta-agonist, but absent the negative impacts on meat quality. Furthermore, performance and carcass characteristics for cattle fed CATTLYST/AUREOMYCIN followed by ACTOGAIN were similar to those of cattle fed Rumensin/Tylan plus ACTOGAIN.

Feeding protocols that include CATTLYST and AUREOMYCIN offer fresh options for helping feedlot nutritionists and managers optimize finishing performance and carcass quality with or without use of a beta-agonist.

Appendix 1 – Ingredient and analyzed chemical composition (DM basis) of diet.

Ingredient	%, DM	SD
Steam-flaked corn [1]	64.11	0.306
Wet corn gluten feed	19.71	0.273
Cottonseed hulls	4.10	0.038
Alfalfa hay	3.97	0.033
Fat (yellow grease)	3.13	0.004
Supplement [2]	1.94	0.010
Limestone	1.89	0.002
Treatment premix [3]	0.65	0.003
Urea	0.52	0.002
Analyzed composition [4]		
DM (%)	78.39	1.036
Crude protein (%)	13.48	0.345
Crude fiber (%)	7.66	0.361
Ether extract (%)	5.76	0.397
TDN (%)	87.18	0.485
NE_m (Mcal/kg)	2.16	0.016
NE_g (Mcal/kg)	1.48	0.012

[1] During final 32 days, 0.50% of the diet as steam flaked corn was replaced with a ractopamine hydrochloride supplement (95.74% ground corn, 4.26% ACTOGAIN 45) for CA+Ac and RT+Ac treatments. An equal amount of untreated ground corn was supplied to control and CA treatments.

[2] Supplement composition (DM basis): 67.789% cottonseed meal; 15.000% NaCl; 10.000% KCl; 4.167% ammonium sulfate; 0.986% zinc sulfate; 0.648% dicalcium phosphate; 0.500% Endox (Kemin Industries); 0.333% manganese oxide; 0.196% copper sulfate; 0.158% vitamin E (500 IU/g); 0.125% selenium premix (0.2% Se); 0.083% iron sulfate; 0.010% vitamin A (1,000,000 IU/g); 0.003% ethylenediamine dihydroiodide; 0.002% cobalt carbonate.

[3] Premix composition: control = 100.00% ground corn; CA/CA+Ac = 96.319% ground corn, 1.501% CATTLYST 50, 2.180% AUREOMYCIN 100; RT+Ac = 95.604% ground corn, 2.512% Rumensin 90, 1.884% Tylan 40 (Elanco).

[4] Composition from 13 composite samples analyzed at a commercial laboratory. DM calculated weekly (forced air oven for 24 h at 100°C).

Do not allow horses or other equines access to feeds containing CATTLYST. Do not use in animals intended for breeding.

Do not use AUREOMYCIN in calves to be processed for veal.

Do not use ACTOGAIN in animals intended for breeding.

References

1. Data on file, Study Report No. 15CARGFA01, Zoetis Inc.

TAKE TIME
OBSERVE LABEL DIRECTIONS

zoetis™