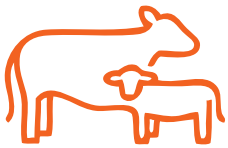
zoetis

TECHNICAL BULLETIN

July 2016



Meta-Analysis of 17 Studies Comparing the Effects of CATTLYST® vs Rumensin® for Finishing Cattle

Zoetis
Florham Park, NJ 07932

Summary

- A recent meta-analysis study published in the *Journal of Animal Science* investigated the effects of CATTLYST® (laidlomycin) compared with Rumensin® (monensin) on performance, carcass, and health-related outcomes for finishing feedlot cattle.[1]
  - The meta-analysis used data representing 135 pens/treatment group (total of 13,603 beef steers) compiled from 17 studies/data sets employing randomized control trial designs and sourced in the scientific literature or industry reports.
  - In each source study, CATTLYST was fed with or without AUREOMYCIN® (chlortetracycline) and Rumensin was fed with or without Tylan® (tylosin).
- Steers fed CATTLYST generated significant ($P < 0.01$) improvements in ADG (0.11 lb), feed intake (0.64 lb/day), and hot carcass weight (11.82 lb), with equivalent feed/gain ($P \geq 0.31$), compared to cattle fed Rumensin.
- No differences ($P \geq 0.09$) were observed between treatments in the incidence of respiratory, digestive, or overall mortality.
- Results of the meta-analysis study support the use of CATTLYST in finishing rations for feedlot cattle as an alternative to Rumensin.

Meta-analysis of 17 studies shows CATTLYST® in feedlot rations helped improve steer finishing performance compared to Rumensin,® with no adverse impacts on digestive mortality.

For decades feedyard managers have included ionophores in feedlot cattle rations as a standard performance-enhancing management strategy. 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 veterinarians, nutritionists, and managers greater flexibility for improving health, elevating performance, and overcoming economic challenges.

CATTLYST® (laidlomycin) and AUREOMYCIN® (chlortetracycline; CTC) represent alternative medicated feed additives from Zoetis that should be considered.

CATTLYST is a potent second-generation ionophore developed specifically for use in high-energy rations with *no step-up* requirement (excellent palatability and full dose from day one). 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

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

in feedlot cattle when fed at 5 to 10 g/ton (30 to 150 mg/head/day). CATTLYST is also 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 CTC/head/day for the control of bacterial pneumonia (*Pasteurella* spp). AUREOMYCIN may also be fed at a therapeutic dose of 10 mg CTC/lb of body weight/day for up to 5 consecutive days for treatment of bacterial pneumonia caused by *P. multocida* and bacterial enteritis caused by *Escherichia coli.* Like Rumensin, CATTLYST requires no pre-slaughter withdrawal.

While many feedyard veterinarians and nutritionists have expressed interest in evaluating comparative data that contrasts CATTLYST and Rumensin, they typically require such information to be sourced in the scientific literature. A recent publication in the *Journal of Animal Science* offered just the type of information sought, reporting a meta-analysis of comparative outcomes provided by these ionophores.[1]

Experiment Design

A meta-analysis study published in the Journal of Animal Science provides a unique evaluation of CATTLYST® vs Rumensin® sourced in the scientific literature.

A systematic review of peer-reviewed literature and industry reports was conducted to identify studies that included direct comparisons of CATTLYST vs Rumensin in finishing steers in North America.[1] The intent of the review was to determine the effects of CATTLYST (fed with or without AUREOMYCIN) compared with Rumensin (fed with or without Tylan) on performance, carcass, and health-related outcomes in studies that had a randomized control trial design and used all products at commercially approved dosages.

Multiple electronic databases were accessed through a university library in 2015 to identify studies matching various search criteria. Nearly 2300 potential citations were initially identified from 7 electronic databases, plus 38 additional publications acquired from industry reports or by hand-search (studies initiated by industry researchers and pharmaceutical companies, performed in feedlots in multiple states). Specific parameters of interest used to screen publications for relevance included the reporting of average daily gain (ADG), feed efficiency (FE), dry matter (DM) intake, mortality (cause-specific and overall), hot carcass weight (HCW), and liver abscesses. Other factors assessed included study design (randomized controlled trial), study implementation (randomization and blinding), study analysis (clustering and outcome assessment), production setting (commercial or research feedlot), and study population (finishing steers).

This relevance-screening process identified 17 relevant data sets contained in 14 reports that were deemed eligible for data extraction and meta-analysis (Table 1), representing a research period exceeding 20 years. Six data sets were extracted from 5 peer-reviewed publications and hand-search reports, and 11 data sets were derived from 9 industry reports. The 17 data sets comprised a total of 270 pens (135 pens/treatment) holding 13,603 steers.

Data extraction was independently performed by 2 reviewers. Extracted data included the author; title; year of study; month of study; study location (country, state, city); sex; days on feed; pen size; number of pens/treatment; number of animals/treatment; breed; treatment; treatment dose; use of antimicrobials and dosage; use of implants; day of implant; other preventative measures (e.g., coccidiostats, vaccines, beta-agonists); mean, standard error of the mean (SEM), or standard deviation (SD) of ADG; initial body weight (BW); final weight; DM intake; FE; HCW; number of morbid animals and deaths (digestive, respiratory, and any cause); and liver abscesses (number, percent, total, A+, A, and no abscesses). Feed efficiency was computed as feed/gain. Outcome measures pertaining to performance characteristics (ADG, DM intake, FE, HCW) were computed on a live weight and/or carcass-adjusted basis, after excluding cattle that died or did not finish. Health outcomes were extracted as proportions or percentages, or percentage of the events of interest. For performance outcomes measured on a continuous scale, the mean of each treatment group was recorded, along with the SEM, SD, variance, or *P*-value.

Extensive statistical analyses of the 17 data sets were performed. Extracted data were

Table 1 – Description of 17 comparative finishing studies/data sets used for meta-analysis.

Study, year	Location	Source[a]	Production setting	Pens/ treatment	Steers/ pen	Steers/ treatment
Domby E, 2010-2011[2]	Colorado	J	Research	24	9	216
Bryant T, 2010	Oklahoma	IR	Commercial	15	135	2025
Cooper R, 2010	Nebraska	IR	Commercial	6	73	438
Hunsaker B, 2010	Colorado	IR	Research	6	10	60
Swingle S, 2010a[b]	Texas	IR	Commercial	6	81-132	589-614
Swingle S, 2010b[c]	Texas	IR	Commercial	6	81-132	573-593
Johnson E, 2009-2010	Idaho	IR	Commercial	8	100	800
Gibb D, 2008[d 3]	Alberta, Canada	J	Research	4	15	60
Gibb D, 2008[e 3]	Alberta, Canada	J	Research	4	15	60
Hunsaker B, 2008[f]	Colorado	IR	Research	16	10	160
Hunsaker B, 2008[g]	Colorado	IR	Research	6	100	600
Swingle S, 1998	Texas	IR	Commercial	10	80-107	942
Kreikemeier K, 1995 [4]	Kansas	CP	Research	5	9	45
Galyean M, 1992 [5]	New Mexico	J	Research	6	12	72
Freeman A, 1989 [6]	Kansas	CP	Research	4	10	40
Hale R, 1989	Colorado	IR	Research	5	8	39
Lofgreen G, 1989	New Mexico	IR	Research	4	15	60
Total				135		6779-6824

[a] J = peer-reviewed journal publications; CP = conference proceedings (reports available online); IR = industry reports [b] No beta-agonist [c] Zilpaterol hydrochloride [d] Steam-rolled corn [e] Ground corn [f] Progesterone and estradiol benzoate [g] Trenbolone acetate and estradiol

incorporated (pooled) into meta-analysis models to compute summary estimates for the different outcomes of interest: 1) a fixed-effect meta-analysis, where each study was weighted using an inverse variance method; and 2) a random-effects meta-analysis model to account for the heterogeneity between studies (the reader is referred to the source paper, Cernicchiaro et al. 2016, for detailed description of the statistical models). For this discussion, outcomes are reported as 'mean differences' for performance parameters (continuous variables), and 'odds ratio' for mortality and liver abscesses (dichotomous variables) (both reflect relative differences between treatments, not measures of efficacy as compared with a negative control). Mean difference estimates the amount by which CATTLYST changes the outcome on average compared with Rumensin. For analyses of liver abscess outcomes, only 12 data sets explicitly reporting the use of ionophores concurrently with antimicrobials (AUREOMYCIN or Tylan) were included in meta-analysis models since these specific antimicrobial drugs are fed in combination with ionophores for the purpose of disease prevention. For all analyses, probabilities (P) ≤ 0.05 were considered significant. The reader is again referred to the source paper for detailed description of between-study heterogeneity analyses that were also performed.

The meta-analysis used 17 data sets from 14 reports, representing 270 pens containing 13,603 finishing steers.

Results

Analysis of extracted data from the 17 studies involving 13,603 steers indicated a mean initial weight of 750 lb (SD 62; range 624-853 lb). The average days on feed for each study ranged from 112 to 187. CATTLYST was fed at dietary concentrations of 11 to 11.1 g/ton of feed (DM basis) while Rumensin was fed at 27.8 to 33.3 g/ton. After excluding deaths and removals, carcass-adjusted final weight averaged 1371 lb (SD 68; range 1237-1451 lb).

Table 2 – Effects/benefits of CATTLYST (vs Rumensin) on performance outcomes.[a]

Item	No. of data sets	CATTLYST impact (mean difference)	*P* value
ADG, live (lb)	16	+0.11	<0.01
ADG, carcass-adj. (lb)	8	+0.13	<0.01
DM intake (lb/d)	17	+0.64	<0.01
Feed efficiency, live	16	+0.02	0.65
Feed efficiency, carcass-adj.	9	-0.03	0.31
Hot carcass weight (lb)	17	+11.82	<0.01

[a] CATTLYST fed with or without AUREOMYCIN; Rumensin fed with or without Tylan

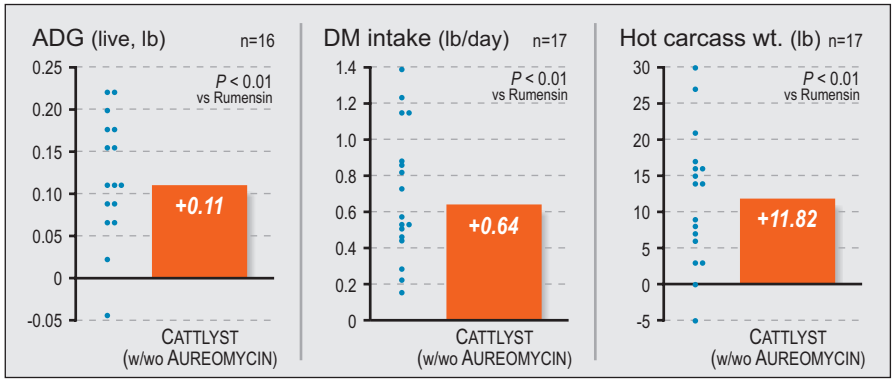


Figure 1 – Overall live performance benefits (mean difference, deads-out basis) of CATTLYST vs Rumensin from meta-analysis of 17 data sets (individual non-weighted means indicated by blue marks).

Table 3 – Effects of CATTLYST (vs Rumensin) on health-related outcomes and liver abscesses.[a]

Item	No. of data sets	Odds ratio	*P* value
Respiratory mortality	9	1.34	0.67
Digestive mortality	8	1.77	0.09
Overall mortality	9	1.27	0.28
Total mortality and removals	10	1.01	0.96
Proportion of A livers	8	1.29	0.10
Proportion of A+ livers	10	1.60	<0.01
Total livers with abscesses	12	1.40	0.01
Total livers with no abscesses	9	0.78	0.07

[a] CATTLYST fed with or without AUREOMYCIN; Rumensin fed with or without Tylan; liver abscess results from 12 data sets where antimicrobials were concurrently fed.

Performance / Carcass

Results of the meta-analyses (Table 2, Figure 1) indicated that steers fed CATTLYST experienced significantly greater ADG (mean 0.11 lb, $P < 0.01$) than steers fed Rumensin, based on both live and carcass-adjusted measurements. Similarly, finishing steers fed CATTLYST demonstrated increased DM intake (mean 0.64 lb/day, $P < 0.01$) compared with animals fed Rumensin. Feed efficiency outcomes based on live weight and carcass-adjusted measurements did not significantly differ between treatments ($P \geq 0.31$). Notably, the superior rate of ADG and DM intake in CATTLYST-fed cattle helped these animals generate significantly ($P < 0.01$) heavier hot carcass weights that averaged 11.82 lb greater than animals finished on Rumensin.

Mortality / Abscesses

Results from the meta-analysis models for health-related parameters (Table 3) demonstrated no statistically significant differences ($P \geq 0.09$) between CATTLYST- and Rumensin-fed cattle for respiratory mortality, digestive mortality, overall mortality, and total mortality and removals. In regard to liver abscesses (Table 3), the analyses included only 12 of the 17 data sets, those that explicitly reported concurrent feeding of antimicrobials (AUREOMYCIN or Tylan). Results indicated that steers fed CATTLYST+AUREOMYCIN had significantly greater odds of having liver abscesses ($P = 0.01$) and A+ livers ($P < 0.01$) than steers fed Rumensin+Tylan.

Implications

The results of this extensive meta-analysis provide a sound scientific basis for feedyard veterinarians and nutritionists to consider using CATTLYST as an alternative to Rumensin for inclusion in finishing rations for feedlot cattle. Steers fed CATTLYST generated greater ADG, consumed more feed, and produced heavier hot carcass weights, all with equivalent feed/gain as cattle fed Rumensin. The increased feed intake observed for the CATTLYST group apparently helped cattle achieve greater carcass weight accumulation during the finishing period. Furthermore, the greater

feed intake by CATTLYST steers did not significantly increase the incidence of digestive mortality. Thus, only positive performance consequences resulted from the increased feed intake demonstrated by CATTLYST steers across the 17 studies.

For the 12 data sets where antimicrobials were fed, liver abscesses were significantly more common in cattle fed CATTLYST+AUREOMYCIN than those fed Rumensin+Tylan (presumably reflecting differences in the concurrently fed antimicrobials, though study authors emphasize that the effects of ionophores and the effects of antimicrobials could not be separated in this study). However, these outcomes notably differed from another recent pooled analysis of 7 feedlot studies where no differences between CATTLYST+AUREOMYCIN and Rumensin+Tylan groups were detected in either the total percent of animals with liver abscesses (P = 0.17) or cattle with severe liver abscesses (P = 0.84).[7]

In regard to the statistical models used for this meta-analysis, study authors point out that performance and carcass outcomes had substantial variability (heterogeneity) in the effects of CATTLYST compared with Rumensin between data sets. The significant heterogeneity among studies was expected given the diversity of studies included in the analysis. Anticipating such responses, statistical measures of heterogeneity were performed in regard to pen size and type of production setting. While substantial degrees of heterogeneity could be attributed to these factors, they failed to completely explain the heterogeneity between data sets and caution should thus be exercised when interpreting results. Still, this study was deemed to provide unique and comprehensive information on the comparative effects of different ionophores across multiple studies and in multiple years, states, and production settings.

Conclusions

This meta-analysis comparing CATTLYST (with or without AUREOMYCIN) to Rumensin (with or without Tylan) included 17 data sets utilizing 135 pens/treatment and 13,603 finishing steers. Study results indicated beneficial effects of feeding CATTLYST as compared with Rumensin for most feedlot performance and carcass parameters. Across this diverse group of studies, steers fed CATTLYST demonstrated increased feed intake, ADG, and hot carcass weight compared with those fed Rumensin, with no mortality differences between treatment groups.

Results of this unique meta-analysis can help enable quantitative and informed decisions by veterinarians, nutritionists, and managers when selecting an ionophore program. Feeding protocols that include CATTLYST and AUREOMYCIN represent a sound strategy for helping reduce the costs of beef production by optimizing performance, and study results support use of CATTLYST in finishing rations for feedlot cattle as an alternative to Rumensin.

Steers fed CATTLYST® generated greater ADG, consumed more feed, and produced heavier hot carcass weights, all with equivalent FE as cattle fed Rumensin®.

Study results support the use of CATTLYST® in finishing rations for feedlot cattle as an alternative to Rumensin®.

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.

References

1. Cernicchiaro N, Corbin M, Quinn M, Prouty F, Branine M, Renter DG. Meta-analysis of the effects of laidlomycin propionate, fed alone or in combination with chlortetracycline, compared with monensin sodium, fed alone or in combination with tylosin, on growth performance, health, and carcass outcomes in finishing steers in North America. *J Anim Sci* 2016; 94:1662-1676.
2. Domby E, Schutz JS, Wagner JJ, et al. The effect of medicinal feed additive programs and dietary sulfur concentrations in steam-flaked corn diets containing wet distillers grains on performance and carcass merit in yearling feedlot steers. *Prof Anim Sci* 2013; 29:566-574.
3. Gibb DJ, Streeter M, Schwartzkopf-Gensweing KS, et al. Performance and bunk attendance of cattle fed steam-rolled or ground corn supplemented with laidlomycin and chlortetracycline or monensin and tylosin. *Can J Anim Sci* 2008; 88:499-506.
4. Kreikemeier KK. Comparison of laidlomycin propionate and monensin at equal feed intakes. *Cattle Feeders' Day. Report of Progress 794.* Kansas State University, Agricultural Experiment Station and Cooperative Extension Service. Southwest Research-Extension Center. 1997; p 7-11. http://www.asi.k-state.edu/species/beef/research-and-extension/1997CFD.pdf (accessed May 2016)
5. Galyean ML, Malcolm KJ, Duff GC. Performance of feedlot steers fed diets containing laidlomycin propionate or monensin plus tylosin, and effects of laidlomycin propionate concentration on intake patterns and ruminal fermentation in beef steers during adaptation to a high-concentrate diet. *J Anim Sci* 1992; 70:2950-2958.
6. Freeman AS, Spires HR, Botts RL. 1991. Performance of feedlot steers fed high energy diets containing laidlomycin propionate with and without antibiotics. *Cattle Feeders' Day. Report of Progress 632.* Kansas State University, Agricultural Experiment Station and Cooperative Extension Service. Southwest Research-Extension Center. 1991; p 2-6. http://www.ksre.k-state.edu/historicpublications/pubs/SRP632.pdf (accessed May 2016)
7. Technical Bulletin AUR-00032. Pooled statistical analysis of 7 feedlot studies comparing the performance of steers fed Cattlyst®+Aureomycin® vs Rumensin®+Tylan®. 2016, Zoetis Inc.

TAKE TIME
OBSERVE LABEL DIRECTIONS

zoetis™