

Efficacy of tilmicosin for on-arrival treatment of bovine respiratory disease in backgrounded winter-placed feedlot calves

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Abstract

A trial was conducted in a commercial feedlot in southern Alberta, Canada to evaluate the cost-effectiveness of metaphylactic treatment with tilmicosin for control of bovine respiratory disease. First-pull treatment rates for BRD ($P=0.006$) and arthritis ($P=0.02$) were significantly lower in calves administered tilmicosin on arrival compared to non-medicated controls. Calves treated with tilmicosin at arrival-processing had gained an additional 20 lb (9.1 kg) at terminal weight sort ($P=0.0002$), with higher average daily gain ($P=0.0001$) and lower dry matter conversion ($P=0.008$). The cost-benefit of tilmicosin metaphylaxis in these feedlot calves depended on the method of calculation. Based on reductions in BRD and arthritis treatment rates and reduced feed costs because of improved dry matter conversion, there was a net advantage of \$3.41CAN/head for those calves given tilmicosin on arrival compared to non-medicated controls. Based on improved treatment rates and additional weight gain, the net advantage was \$8.09CAN/head for those calves given tilmicosin compared to non-medicated controls. These economic calculations assumed performance benefits observed at terminal weight sort were retained until slaughter, approximately 30 to 40 days later.

Key words: bovine respiratory disease, tilmicosin, metaphylaxis, undifferentiated fever

Résumé

Un essai a été mené dans un parc d'élevage commercial du sud de l'Alberta, Canada, afin d'évaluer la rentabilité d'un traitement métaphylactique à la tilmicosine pour contrôler les maladies respiratoires bovines. Le taux de premier traitement pour maladies respiratoires bovines ($P = 0.006$) et pour l'arthrite ($P = 0.02$) était significativement moins élevé chez les veaux ayant reçu la tilmicosine à leur arrivé que chez

les veaux non-traités. Les veaux traités avec la tilmicosine à leur arrivé pesaient aussi 20 lb (9.1 kg) de plus au tri de poids final ($P = 0.0002$) en plus d'avoir un gain moyen quotidien plus élevé ($P = 0.0001$) et une conversion de matière sèche moindre ($P = 0.008$). La rentabilité de la métaphylaxie à la tilmicosine chez ces veaux d'élevage dépendait de la méthode de calcul. Tenant compte de la réduction du taux des maladies respiratoires bovines et de l'arthrite et de la baisse des coûts reliés à l'alimentation, qui résultait de la meilleure conversion de matière sèche, il y avait un avantage net de 3.14\$ CAN par tête pour les veaux qui recevaient la tilmicosine à leur arrivé par rapport aux veaux témoins. Tenant compte de l'amélioration du taux de traitement et du gain de poids additionnel, l'avantage net était de 8.09\$ CAN par tête pour ces mêmes veaux traités par rapport aux témoins. Ces calculs économiques assument que les bénéfices reliés à la performance qui s'observent au moment du tri de poids final se maintiennent jusqu'à l'abattage, approximativement 30-40 jours plus tard.

Introduction

Various metaphylactic antimicrobials, such as long-acting oxytetracycline, tilmicosin, tulathromycin, gamithromycin, and tildipirosin, are used in fall-placed feedlot calves to reduce morbidity and mortality from bovine respiratory disease (BRD) and to improve performance.^{1,4-9} In recent years, BRD morbidity and mortality rates in southern Alberta have increased in winter-placed calves that were previously backgrounded at the ranch or another feedlot. This observation may be due to several factors, including summer calvings on large ranches in western Canada, so that some January and February-placed calves are like fall-placed calves, about 5 to 6 months of age and recently weaned. Typically in southern Alberta feedlots, metaphylactic drugs are not used in backgrounded calves because disease rates have not been high enough to warrant the practice. Given recent increasing disease rates in backgrounded calves

and the economic value of feeder cattle, it is important to know if health and performance can be improved with metaphylactic treatment. There is little scientific data evaluating the efficacy and cost-effectiveness of metaphylactic antimicrobials for reducing BRD morbidity and mortality and improving performance in backgrounded winter-placed calves.

The purpose of this controlled field trial was to evaluate the effectiveness of tilmicosin administered on arrival to backgrounded winter-placed calves for reducing morbidity and mortality due to naturally occurring BRD in a commercial feedlot. The second objective was to measure performance (average daily gain and dry matter conversion) of calves administered tilmicosin on arrival and to calculate the cost-benefit of metaphylaxis.

Materials and Methods

Study Facility

This trial was conducted at a commercial feedlot in southern Alberta, Canada with a one-time feeding capacity of 15,000 head. The animals were housed in open dirt-floor pens with a heated automatic waterer and a concrete feed bunk within the fence line facing a common feed alley; each pen held approximately 225 animals. The hospital and treatment areas of these feedlots were used to care for sick animals. The hospital has a roof and concrete floor, and is equipped with a hydraulically operated squeeze chute with weigh scale, a chute-side computer and a health data management system.^a Body temperatures were taken with an electronic thermometer.^b

Cattle were fed rations consisting of barley grain, barley or corn silage, corn dried distiller grains with solubles, and supplement formulated to meet standard nutritional requirements of feedlot cattle. Monensin sodium^c was included in the ration throughout the feeding period to control bloat and coccidiosis and to improve performance. Tylosin phosphate^d was included in the starter ration to reduce liver abscesses. All pens of cattle were fed 3 times daily on an *ad libitum* basis using truck-mounted mixers on load cells. Feed intake was recorded by pen, with feed from sick and chronic pens prorated back to the original lot of cattle.

Study Animals

A total of 4,314 crossbred steer calves, approximately 6 to 10 months of age with an average induction weight of 765 lb (348 kg), were used in this study. All backgrounded calves had been recently purchased either through the auction market system or directly from a ranch or another feedlot, and then shipped to the feedlot. The history of the calves was not known since that information is not typically provided to finishing feedlots in Alberta that purchase this type of cattle. In

Alberta, backgrounded calves are typically weaned 3 to 4 months prior to entering a finishing feedlot. During the backgrounding period, these calves will have either been placed on grass or confined in a feeding pen and fed a roughage diet, with or without varying amounts of grain and/or dried distillers grains to limit growth between 1.5 to 2 lb (0.68 to 0.91 kg)/day. Usually these calves have been vaccinated at weaning for respiratory viruses and clostridial diseases, and some may have been implanted.

Upon arrival at the finishing feedlot, animals were given a modified-live infectious bovine rhinotracheitis and bovine viral diarrhoea virus (types 1 and 2) vaccine, 8-way clostridial bacterin, *Histophilus somni* bacterin, *Mannheimia haemolytica* leukotoxin vaccine, ivermectin pour-on or injectable, and an anabolic implant. If it was raining or wet snow was falling, animals within a processing group were treated with an injectable ivermectin rather than the pour-on product. All animals were uniquely identified with a numbered feedlot eartag and CCIA (Canadian Cattle Identification Agency) tag. Animals were placed into the study within 48 hours after arrival at the feedlot.

Experimental Design

A randomized block design was used; each block consisted of 2 pens as they were filled. A total of 20 pens or 10 blocks were created. The sample size used was typical of commercial feedlot trials when assessing metaphylactic drugs or feed additives where the pen is the unit of analysis.^{1,8,9}

The two treatments were: 1) tilmicosin^e SC at 4.54 mg/lb (10 mg/kg) of body weight and 2) non-medicated control, i.e., no metaphylactic antimicrobial was administered. Tilmicosin was administered at arrival regardless of rectal temperature, and no other metaphylactic antimicrobials were given. On-arrival treatment was dosed according to the average weight of animals in that processing group.

Animals administered tilmicosin were not eligible for additional therapy until 5 days following on-arrival treatment (i.e. 5-day post-metaphylactic interval (PMI)). This was the standard PMI used for tilmicosin at this feedlot. Non-medicated control animals were eligible for treatment for BRD at any time post-arrival. Moribund animals were euthanized for humane reasons, regardless of days-on-feed.

Animals from both treatment groups pulled for BRD were treated according to the feedlot's standard treatment protocol for BRD. Animals relapsing a third time with BRD were considered chronics; thus, no further treatment was given and they were placed in a chronic pen. Therapeutic drugs were used at label dose with label withdrawals adhered to. Treatment dosages were based on the individual body weight of the sick animal.

Animal Allotment

Experimental animals were selected from large groups of animals arriving at the feedlot from February 08 to March 08, 2012. As new cattle were presented for processing, calves within each arrival processing group were randomly assigned to 1 of 2 treatment groups using systematic randomization. A coin was flipped to determine which of the feeding pens would house tilmicosin-treated or non-medicated control cattle. Then a coin was flipped to determine if the first calf through the chute for a new block of pens went into the tilmicosin or non-medicated control group. Every other animal through the chute went into the same treatment group. For example, if the coin flip was heads and heads was set for tilmicosin, then the first calf through the chute received tilmicosin, the second calf through the chute received nothing, the third calf through the chute received tilmicosin, and so on until the 2 pens were filled. Calves were processed and individually weighed in the processing chute. The scale in the processing chute was verified with a standard weight and calibrated as necessary prior to processing. After every 20 head, the scale was tared to zero. Calves from the 2 treatment groups were penned separately. Once 2 pens were full (approximately 225 animals in each pen), 2 new pens were filled until 20 pens of cattle were placed on trial. Each pen was an experimental unit, and each group of 2 pens represented a block. Animals were moved to their home pen and maintained as a unit for the duration of the trial, which was from induction processing until terminal weight sorting, approximately 30-40 days before slaughter. Feedlot personnel who processed the cattle were different from feedlot personnel who checked the cattle for illness. The trial could not be blinded because the health crew (i.e. pen riders) needed to know the PMI of the cattle so they knew when sick animals could be pulled and treated for BRD.

Observations

Any animals appearing "sick" based on subjective parameters, such as general appearance and attitude, gauntness, reluctance to move, separation from the group, and signs of respiratory disease, such as nasal discharge, ocular discharge, abnormal respiration, and coughing, were moved to the hospital area of the feedlot for closer observation. Upon presentation at the hospital facility, the rectal temperature of each sick calf was taken with an electronic thermometer, and its identification was entered into the chute-side computer.^a

A diagnosis of the initial case of BRD was made on an animal if the following criteria were satisfied: 1) the case abstract, which appeared on the computer screen, indicated no previous treatment history for BRD; 2) there was an absence of clinical signs attributable to organ systems other than the respiratory tract; and

3) animals met the temperature criteria ($\geq 104.0^{\circ}\text{F}$ or 40°C). If all these criteria were met, the animal was treated and designated as UF (undifferentiated fever). The same protocol was used to treat morbid animals in both study groups. Animals not meeting the temperature criteria were treated and designated as NF (no-fever). All treated animals (UF and NF) were returned to their home pen the same day of treatment unless they were severely compromised. Severely compromised cattle were housed in the hospital pen until they could be returned home.

A diagnosis of a relapse case of BRD was made if the following criteria were satisfied: 1) the case abstract indicated previous treatment for BRD (UF or NF) and 2) there was an absence of clinical signs attributable to organ systems other than the respiratory tract. If treatment for BRD was necessary, then animals were treated according to the feedlot's standard treatment protocol.

A calf was defined as a chronic if pulled as a third relapse; these animals were sent to the chronic pen. Calves that were moribund at any time were humanely euthanized. Calves gaining weight that could not be returned to their home pen because they could not compete for feed or water with their peers were sent to a railer pen for fattening prior to slaughter.

Animals that died during the trial period were necropsied by feedlot veterinarians to determine the cause of death.

Statistical Analysis

The following data were analyzed on a pen basis from arrival to terminal weight sort: a) BRD initial treatment rate (UF0 and NF0), b) BRD first relapse rate (UF1 and NF1), c) BRD second relapse rate (UF2 and NF2), d) BRD chronicity rate (UF3 and NF3), e) arthritis treatment rate, f) railers, g) crude mortality rate, h) mortality rate for BRD and histophilosis, i) weight gain, j) average daily gain (ADG), k) daily dry matter intake (DDMI); l) dry matter conversion (DMC), and m) days-on-feed (DOF).

Individual body weights at processing and terminal weight sort were imported into a spreadsheet program (Microsoft Office Excel), and an average weight was calculated for each pen. From the computerized animal health data, proportional rates for BRD treatment, arthritis treatment, railers, overall mortality, and BRD/histophilus mortality were calculated for each pen. Histophilus mortality included death from myocarditis, pericarditis, pleuritis, and arthritis.

Body weights, DOF, DDMI, ADG, and DMC were calculated for each pen at terminal weight sort. Terminal weight sort body weights were shrunk 4% (i.e. the standard industry practice of reducing chute weights by 4% to account for animal weight attributed to gut fill). Weight gain per pen was the change in average weight

from induction to terminal weight sort. Average DOF per pen was calculated as the total head days divided by the number of head inducted, ADG per pen was calculated as the terminal sort weight minus the total weight inducted divided by the total head days. DDMI per pen was calculated as the total pounds of feed fed divided by total head days. DMC per pen was calculated as the total pounds of feed fed divided by total weight gain.

Data were analyzed using an analytical software program (Statistix 8 Analytical Software, Tallahassee, FL). A randomized complete block analysis of variance was used to compare outcomes between experimental groups. Statistical significance was set at $P \leq 0.05$.

The relative cost-effectiveness of tilmicosin as a metaphylactic drug was calculated based on health and performance variables that were statistically different between the 2 experimental groups. Variables included the feedlot's metaphylactic antimicrobial therapy cost of \$15.94CAN for tilmicosin, an initial BRD therapy cost of \$29.80CAN/animal, an arthritis therapy cost of \$10CAN/animal, a sale price of \$111/cwt, and a feed cost of \$0.15CAN/lb of feed dry matter (\$300CAN/ton dry matter).

Results and Discussion

First-pull treatment rates for BRD ($P=0.006$) and arthritis ($P=0.02$) were significantly lower in the tilmicosin group than in the non-medicated control group (Table 1). Differences in total mortality and BRD/histophilus mortality between the 2 treatment groups approached statistical significance at $P=0.09$ (Table 1). Steers treated with tilmicosin on arrival gained an additional 20 lb (9.1 kg) at terminal weight sort, and had higher ADG and lower DMC than non-medicated controls (Table 2). These improvements in health and performance following metaphylaxis treatment with tilmicosin are similar to those observed in trials conducted previously in fall-placed feedlot calves.^{4,7}

Dosing the metaphylactic drug based on the average induction weight of each incoming processing group may have reduced treatment response rates in the tilmicosin group. At the study feedlot, calves were bought in 100-lb (45.4 kg) weight groups; therefore, the variability in incoming weight within a processing group of calves was not very large (data not shown), suggesting that averaging the dose of the metaphylactic drug

Table 1. Effect of on-arrival treatment with tilmicosin on morbidity and mortality of backgrounded feedlot steer calves at moderate risk for BRD.

Variable	Experimental group		SEM	P-value
	Control	Tilmicosin ^a		
No. pens	10	10		
No. animals	2157	2157		
First BRD (UF ^b +NF ^c) treatment (%)	18	12	0.01	0.006
First UF treatment (%)	12	8	0.008	0.005
First NF treatment (%)	6	4	0.007	0.07
First BRD relapse (%)	21	20	0.02	0.77
First UF relapse (%)	20	19	0.02	0.70
First NF relapse (%)	23	20	0.04	0.63
Second BRD relapse (%)	28	23	0.07	0.67
Second UF relapse (%)	24	21	0.05	0.62
Second NF relapse (%)	16	9	0.07	0.47
Third BRD relapse (%)	15	8	0.06	0.39
Third UF relapse (%)	10	3	0.03	0.08
Third NF relapse (%)	5	5	0.05	1.0
Arthritis (%)	0.9	0.5	0.01	0.02
Railers (%)	1.6	1.2	0.002	0.21
Total mortality (%)	0.84	0.44	0.001	0.09
BRD/histophilus mortality (%)	0.41	0.10	0.001	0.09

^aMicotil®, Elanco Animal Health, Guelph, Ontario, Canada

^bUF = undifferentiated fever

^cNF = no fever

within each processing group most likely had a small effect, if any, on reducing potential treatment responses in the tilmicosin group.

A 5-day PMI following metaphylactic treatment with tilmicosin was used in this study, which was the standard PMI used after administration of tilmicosin at this feedlot. Previous work suggested that the PMI for tilmicosin can be extended from 3 to 7 days with improved treatment success rates.²

The health crew was not blind to the treatment groups because they needed to know when calves could be pulled for BRD. It is not known if the lack of blinding created any directional bias in the results.

The unit of analysis in this study, the pen, could not be maintained as a unit from arrival until slaughter. This study was discontinued at terminal weight sort due to mixing of cattle into different pens prior to sale to reduce carcass discounts; typically this was done 30 to 40 days prior to harvest. It is unlikely that following cattle through to harvest would have changed the health results observed here, given that most BRD occurred early in the feeding period. It is not known, or previously reported elsewhere, if performance differences observed between the 2 treatment groups at terminal weight sort would have been smaller or larger with another 30 to 40 days-on-feed. It is unlikely that reduced weight gain in the non-medicated control group could have been compensated for within that short feeding period. It is also unknown whether there would have been any differences in carcass data between the 2 experimental groups. Given observed

differences between the 2 treatment groups in health and performance outcomes, it is likely there would have been some differences in carcass weight and grades,³ which would have increased the net economic advantage of metaphylactic treatment with tilmicosin. Additional studies are warranted in different disease-risk backgrounded calves with follow-up through to slaughter in order to accurately determine the overall benefit of using tilmicosin metaphylactically at induction processing.

The economic advantage of using tilmicosin at arrival processing varied depending on which cost-benefit analysis was used. Based on additional weight gain, the net benefit was \$8.09CAN/head; using improved feed conversion, the net benefit was \$3.41CAN/head. Changes in disease risks, drug pricing, live cattle prices, and feed costs will affect the net economic value of using tilmicosin as a metaphylactic treatment in backgrounded feedlot calves.

Conclusion

Metaphylactic treatment with tilmicosin in backgrounded steer calves reduced first-pull treatments by 6 percentage points, arthritis treatments by 0.4 percentage points, improved weight gain by 20 lb (9.1 kg), improved ADG by 0.14 lb (0.064 kg)/day, and reduced DMC by 0.22 lb (0.10 kg) of feed/lb of gain. The net economic advantage of tilmicosin metaphylaxis ranged from \$3.41CAN/head to \$8.09CAN/head, depending on the cost-benefit method of analysis.

Table 2. Effect of on-arrival treatment with tilmicosin on performance of backgrounded feedlot steer calves at moderate risk for BRD.

Variable	Experimental group		SEM	P-value
	Control	Tilmicosin ^a		
No. pens	10	10		
No. animals	2157	2157		
Induction weight (lb)	763.8	765.8	1.11	0.23
DOF ^b at terminal sort	133	133		
Terminal sort weight (lb)	1274.3	1296.9	2.60	0.0002
Weight gain (lb)	510.6	531.1	2.18	0.0001
Terminal wt sort DDMI ^c (lb)	23.5	23.3	0.18	0.44
Terminal wt sort ADG ^d (lb)	4.00	4.14	0.01	0.0001
Terminal wt sort DMC ^e (lb/lb)	5.84	5.62	0.05	0.008

^aMicotil[®], Elanco Animal Health, Guelph, Ontario, Canada

^bDOF = days-on-feed

^cDDMI = daily dry matter intake

^dADG = average daily gain

^eDMC = dry matter conversion

Endnotes

- ^aDG Pro, ITS Global, Okotoks, Alberta, Canada
^bM750 thermometer, GLA Agricultural Electronics, San Luis, Obispo, CA
^cRumensin[®], a Division of Eli Lilly Canada, Inc.
^dTylan[®], Elanco, a Division of Eli Lilly Canada, Inc.
^eMicotil[®], Elanco, a Division Eli Lilly Canada, Inc.

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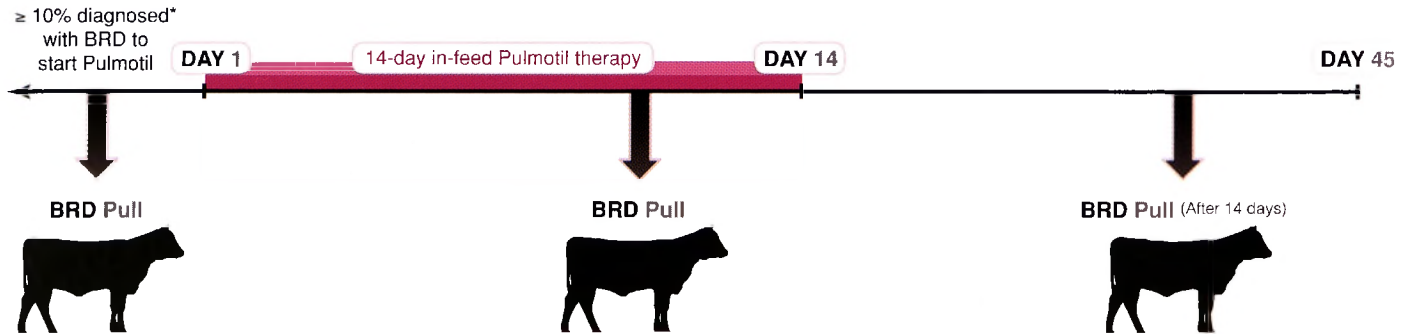


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¹Pulmotil 90 Freedom of Information Summary (NADA 141-064).

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