Comparative Efficacy of Tilmicosin versus Tulathromycin as a Metaphylactic Antimicrobial in Feedlot Calves at Moderate Risk for Respiratory Disease*

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The purpose of this study was to compare the efficacy and cost-effectiveness of tilmicosin (MIC) versus tulathromycin (DRAX) as a metaphylactic antimicrobial in feedlot calves at moderate risk for bovine respiratory disease (BRD). Calves that received DRAX had significantly (P ≤ .05) lower initial BRD treatment rates compared with calves that received MIC. However, there were no significant differences in the BRD relapse rate, raider rate, total mortality rate, BRD mortality rate, average daily gain, and dry matter conversion between the two groups. The economic advantage of the MIC group was Can$8.29/animal. Based on these results, while DRAX was more efficacious in reducing initial treatments for BRD in feedlot calves at moderate risk for disease, MIC was more cost-effective. The lower initial BRD treatment costs in the DRAX group did not offset the higher metaphylactic cost of DRAX.

INTRODUCTION

Tilmicosin (Micotil [MIC], Elanco Animal Health) received a metaphylaxis label claim in 1994. Since that time, it has become a standard metaphylactic treatment for calves at medium to high risk of developing respiratory disease. Research with MIC versus negative controls has demonstrated efficacy in reducing morbidity and mortality.† With the arrival of tulathromycin (Draxxin Injectable Solution

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[DRAZ], Pfizer Animal Health), a new long-lasting antimicrobial labeled for metaphylactic use to control bovine respiratory disease (BRD) in calves, some feedlots in Canada have started using DRAZ instead of tilmicosin (MIC) or long-acting oxytetracycline for on-arrival processing.2 The reason some feedlots have switched to DRAZ is that it appears to be more effective in reducing BRD morbidity and mortality rates.2–5 With the shortage of skilled pen riders in feedlots, a highly efficacious drug to control BRD in fall-placed calves is beneficial.

Very few studies have compared the cost effectiveness of DRAZ versus MIC as a metaphylactic drug in feedlot calves.2 The one published study that determined the cost-effectiveness of DRAZ versus MIC was performed in calves at ultra-high risk of developing BRD.2 The question arises as to whether DRAZ is still more cost-effective than MIC in calves at moderate risk for developing BRD. Moderate-risk calves are those that, based on past experience and such various factors as source (ranch versus auction), commingling, distance traveled, arrival weight, age, immune status, previous vaccination and feeding history, weather conditions, and time to fill a pen, will have a BRD morbidity rate of 10% to 20% and an overall mortality rate of 1% to 2%.

In Canada, DRAZ (Can$22.61) is approximately Can$11/head more expensive than MIC (Can$12.00) when used for metaphylaxis in a 600-lb calf. Feedlot veterinarians have a responsibility to help producers minimize disease while recommending the most cost-effective preventive procedures in their cattle, based on anticipated disease risks and taking into account other factors, such as labor issues.

The purpose of this clinical trial was to determine the efficacy and cost-effectiveness of using DRAZ versus MIC as a metaphylactic antimicrobial in terms of animal health and feedlot performance in calves at moderate risk of developing BRD.

**MATERIALS AND METHODS**

**Study Facility**

The study was conducted at a commercial feedlot in southern Alberta, Canada, with a capacity of 25,000 animals. Animals were housed in open-air, dirt-floor pens arranged side by side in alleys of approximately 14 pens, with each pen surrounded on three sides with a 10-foot, 20% porosity windbreak fence. The fourth side contained the feed bunk with a cement apron. Water bowls were not shared between adjacent pens. Each pen held 225 animals on average.

One hospital facility was located at the feedlot and contained a hydraulic chute and weigh scale. A chute-side computer with an animal health software program (DG Pro Animal Health, Computer Aid, Okotoks, Alberta, Canada) was used to record all processing and treatment data.

Cattle were fed rations consisting of barley or corn grain, barley or corn silage, dried distiller grains with solubles, and supplement formulated to meet standard nutritional requirements of feedlot cattle. Monensin sodium (Rumensin Premix, Elanco Animal Health) was included in the ration throughout the feeding period to improve performance and control bloat and coccidiosis. Chlortetracycline was fed for the first 56 days on feed (DOF) to control histophilosis. Calves were stepped up to the finishing ration over 30 to 35 days, and calves in matched pens were fed the same rations three 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**

Calves enrolled in this study were British–Exotic crossbred heifer calves, weighing between 570 and 640 lb, purchased from auction markets or ranches throughout western Canada.
Calves arrived between November 24 and December 16, 2007.

Calves were processed within 24 hours after arriving at the feedlot. All animals were identified with a uniquely numbered feedlot ear tag and a Canadian Cattle Identification Agency ear tag; implanted with a growth implant (Synovex C, Wyeth Animal Health); vaccinated with a multivalent clostridial bacterin (Vision 7 with Spur, Wyeth Animal Health, Canada), Mannheimia haemolytica and Histophilus somnus bacterin (Somnu-StarPh, Novartis Animal Health), and a modified-live bovine rhinotracheitis virus and bovine viral diarrhea virus vaccine (Vista 3 SQ, Intervet); and treated with topical ivermectin (Ivermax Pour-On, RXV Veterinary Products). All processing treatments were administered at labeled doses. Calves were individually weighed in the processing chute to determine their arrival weight. The chute scale was verified with a standard weight and calibrated as necessary before processing. After every 20 head through the chute, the scale was tared to zero.

At approximately 60 DOF for each pen, calves were reimplemented with a growth implant (Synovex H, Wyeth Animal Health) and revaccinated with a modified-live bovine rhinotra-
cheitis vaccine (Vista IBR, Intervet). At 137
DOF on average, cattle received their terminal
implant (Synovex Choice, Wyeth Animal
Health) and individual body weights in the
chute weigh scale were recorded. The scale was
verified as described earlier. Matched pens were
reimplanted either on the same day or within
24 hours of each other.

Experimental Design

A randomized block design was used with
the pen as the unit of analysis. Each block con-
sisted of two pens, one from each experimental
group, which were filled simultaneously.
Matched pens were randomly allocated to one
of two experimental groups. Individual ani-
mals from each processing group were system-
atically randomized to one of two matched
pens, where they remained until harvest. Ani-
mals in each experimental group were housed in
separate pens, with 10 pens/experimental group
for a total of 20 pens.

Animals received a single dose of antimicro-
bial drug as follows:

- **MIC:** Tilmicosin (Micotil) at 10.0 mg/kg
  SC in the neck

- **DRAX:** Tulathromycin (Draxxin Injectable
  Solution) at 2.5 mg/kg SC in the neck

Animal Health

Animals treated with DRAX were not eligi-
ble for additional treatments until 10 days af-
after on-arrival treatment (postmetaphylaxis in-
terval [PMI]). Animals treated with MIC were
not eligible for additional treatments for a 5-
day PMI. PMIs were based on manufacturers’
recommendations.

Experienced pen riders checked the cattle
once daily for signs of disease following feedlot
induction and allocation to the study. During
the PMI, cattle exhibiting a disease other than
BRD were pulled and treated for that disease.

After the PMI, animals that appeared sick were
pulled from their home pen and moved to the
hospital facility, where they were diagnosed
and treated according to the feedlot’s standard-
ized treatment protocol provided by the feed-
lot veterinarian. The same treatment protocol
was used for both experimental groups.

Animals that had a rectal temperature of
≥104°F, an absence of clinical signs referable to
organ systems other than the respiratory sys-
tem, and no previous treatment history for NF
(no fever) or UF (undifferentiated fever) were
designated as first UF treatments. Animals not
meeting the rectal temperature criterion above
but having signs of BRD (e.g., depression, in-
appetence, nasal discharge, cough, abnormal
respiration) and no previous treatment history
of UF or NF were designated as first NF treat-
mements. First BRD treatments included first UF
treatments and first NF treatments. Animals
not having signs of BRD at chute side and no
fever were designated as NT (no treatment) and
returned to their home pen. After receiving ini-
tial therapy, animals were returned to their
home pens unless they were unable to walk
home. In that case, the calves were housed in a
hospital pen until they could walk home. Ani-
mals treated and subsequently showing clinical
signs of BRD as described above were again
pulled by the pen checkers and diagnosed as
UF or NF relapses based on their original diag-
nosis (i.e., all animals relapsing subsequent to
initial UF therapy were defined as UF relapses,
and all animals relapsing subsequent to initial
NF therapy were defined as NF relapses).

First UF and NF cases were treated with flor-
fencicol (Nuflor, Schering-Plough Animal
Health, Division of Schering Canada Inc.), with
a 5-day posttreatment interval; first UF and NF
relapses were treated with enrofloxacin (Baytril
100, Bayer Healthcare, Animal Health Divi-
sion), with a 3-day posttreatment interval; and
second UF and NF relapses were treated with
trimethoprim–sulfadoxine (Borgal, Intervet Canada, Inc.) daily for 3 to 5 days. All treatments were administered according to label doses.

Animals relapsing more than two times were considered chronics. They were no longer treated and were moved to a chronic pen where they were handled according to the feedlot’s chronic pen management protocol. Chronics that did not die and animals requiring emergency slaughter before normal harvest were defined as railers. All animals that died were necropsied by the feedlot veterinarian, and the cause of death was determined based on gross postmortem examination findings.

The feedlot manager determined when cattle were ready for sale based on visual appraisal and/or body weight, ensuring cattle had passed all drug withdrawal periods before harvest. The same numbers of animals within each experimental group from the same block were sold on the same day to the same processing plant. Final body weights were based on ship weight measured via a government-certified truck scale.

### Statistical Analysis

Equations used to calculate morbidity and mortality rates have been previously defined.² BRD cases included both UF and NF.

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<table>
<thead>
<tr>
<th>Performance Variable</th>
<th>Experimental Group</th>
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<tbody>
<tr>
<td></td>
<td>MIC</td>
<td>DRA</td>
<td>SEM</td>
<td>P Value</td>
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<tr>
<td>No. of pens</td>
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<td>10</td>
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<td>No. of heifers</td>
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<td>2,244</td>
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<td>603</td>
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<td>DOF at terminal implant</td>
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<td>137</td>
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<td>Terminal implant weight (lb)</td>
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<td>1,024</td>
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<td>3.09</td>
<td>0.02</td>
<td>.05*</td>
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<td>DMC at implant (lb/lb)</td>
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<td>DOF at harvest</td>
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<td>Final weight + (lb)</td>
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<td>1,244</td>
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<td>.32</td>
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<tr>
<td>Final DMC – (lb/lb)</td>
<td>6.97</td>
<td>7.02</td>
<td>0.05</td>
<td>.49</td>
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</tbody>
</table>

*Statistically significant differences (P ≤ .05).

+ = weight of dead animals added; – = weight of dead animals removed; ADG = average daily gain; DDMI = daily dry matter intake; DMC = dry matter conversion; DOF = days on feed.
ual body weights at processing and terminal implant were imported into a spreadsheet program (Microsoft Office Excel 2007), and an average weight was calculated for each pen. From the computerized animal health data, rates for UF, NF, BRD, railers, and total and BRD mortality were calculated for each pen.

Final ship weights, DOF, daily dry matter intake (DDMI), average daily gain (ADG), and dry matter conversion (DMC) were calculated for each pen. Terminal implant weights and final ship 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). Average DOF/pen was calculated as the total head days divided by the number of head inducted. ADG/pen was calculated as the total final ship weight minus the total weight inducted divided by the total head days. DDMI/pen was calculated as the total pounds of feed fed divided by the total head days. DMC/pen was calculated as the total pounds of feed fed divided by total weight gain. Feedlot performance was calculated by two methods, one including and one excluding the weight of dead animals in the total final ship weight.

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 $P \leq .05$.

The relative cost-effectiveness of the metaphylactic drugs was calculated based only on health and performance variables that were statistically different between the two experimental groups. Variables included the metaphylactic antimicrobial therapy costs of Can$12.00/animal for MIC, Can$22.61/animal for DRAX, and an initial BRD therapy cost of Can$20.88/animal for florfenicol, plus a $1/animal labor charge for pulling and treating BRD cases.

### RESULTS

Pen-based summary statistics for morbidity and mortality data are presented in Table 1. Initial UF, NF, and BRD treatment rates were significantly lower over the entire feeding period in the DRAX group compared with the MIC group. There were no significant differences in BRD relapse rates, total mortality, BRD mortality, or railers between the DRAX and MIC groups.

Terminal implant weights, terminal implant DMI, and terminal implant ADG were significantly higher in the DRAX group compared with the MIC group (Table 2). Over the entire feeding period, there were no significant differences in final weights, DOF, ADG, DMI, or DMC between the DRAX and MIC groups.

The net advantage, based on statistically significant variables (i.e., first BRD treatments and the cost of metaphylaxis) was Can$8.29/head for the MIC group compared with the DRAX group. This value was calculated as follows (all values are in Can$): DRAX [$22.61 + ($20.88 \times 0.035) + ($1 \times 0.035)] – MIC [$12.00 + ($20.88 \times 0.14) + ($1 \times 0.14)] = $8.29

### DISCUSSION

The results of this study are consistent with studies conducted previously in very high risk feedlot and stocker calves, in which DRAX significantly reduced BRD initial treatments. In this study, there were no significant differences in relapse rates, total mortality, BRD mortality, or feedlot performance as reported in earlier studies conducted in very high risk calves. Failure to show statistically significant differences most likely reflects the lower disease rates and potentially lesser effects of disease on feedlot performance in these feedlot calves. When evaluating performance at terminal implant, the DRAX cattle did consume more feed and gained more weight, similar to findings reported in a 43-day stocker study; however, these
performance differences did not persist to harvest. The cattle appeared to compensate for disease that occurred early in the feeding period.

When calculating the cost-effectiveness of DRAX versus MIC, a simple mathematical calculation was used to compare treatment cost differences. With medium disease risks overall, the high metaphylaxis costs of DRAX compared with MIC were not offset by lower subsequent BRD treatment costs. These results emphasize the importance of not only reviewing significant differences in health and performance rates but also reviewing differences in therapeutic costs and benefits. Otherwise, feedlot veterinarians may advise clients inappropriately as to what is in their best economic interests. With the large shortage in competent feedlot pen riders, it is important for feedlot veterinarians to discuss preventive treatment protocols with their clients to determine their needs. The feedlot client may be willing to pay more for a preventive regimen simply because of the lack of labor to manage the calves properly, resulting in more chronic and higher mortality as a result of missed or late treatments. Feedlot clients with sufficient trained health staff will most likely choose the most cost-effective program. Thus, it is important that feedlot veterinarians include economic assessments in their decision-making process and discussions with clients when determining which antimicrobials to use when and under various disease risk conditions.

A factor not addressed in this study is improved animal welfare due to lower BRD morbidity risks. It is unknown what animal welfare value to place on the reduced number of sick animals in the DRAX versus MIC group. Another factor not addressed in the study is prudent drug use, in which it could be argued that one should not use a drug of longer duration needlessly when a drug of shorter duration will work almost as well in many cases, or the issue of mass treatment of all cattle when only a proportion, albeit often unknown, are sick on arrival or will develop disease shortly thereafter. Mass medication of high- or moderate-risk calves when they arrive at the feedlot has been shown to significantly reduce disease, suggesting an animal welfare benefit of metaphylactic medication, which is consistent with an economic benefit.

CONCLUSION

The results of this study demonstrate that MIC is more cost-effective than DRAX when used as a metaphylactic on arrival at the feedlot in calves at moderate risk of developing BRD.

ACKNOWLEDGMENTS

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REFERENCES