



Effects of an Aureomycin® program on cattle health and performance during a 30 day receiving period.

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Introduction

Despite the advent of new and more effective antimicrobial therapeutics a problem that continues to confront the cattle feeding industry has been bovine respiratory disease (BRD) in newly received cattle. The economic consequences attributable to BRD are a major factor affecting both production costs and profitability in feedlots. The costs related to BRD result not only from animals dying from BRD, but more significantly the costs associated with the medicine and labor required to treat morbid animals. Likewise, individual animals that have experienced either clinical or sub-clinical BRD can have a diminished value due to decreased growth performance throughout the feeding period. During the receiving period, decreased feed consumption has also been hypothesized to contribute to poor cattle health by limiting intake of energy, protein and other essential nutrients required for maintenance, growth and an optimum immune responses to stress and disease challenges. Therefore, improving nutrient intake during the receiving period should be beneficial as long as greater starch intakes do not result in ruminal acidosis.

The metaphylactic administration of injectable antibiotics at initial processing has been a commonly used management practice to decrease the incidence and severity of BRD in receiving cattle. While many of the newer injectable antimicrobials have a greater persistence in the blood and lung tissue and thus a longer therapeutic window, their cost may be prohibitive for general use in metaphylactic programs for all but those cattle thought to be at the greatest risk for experiencing BRD. The use of Aureomycin, brand of chlortetracycline (CTC), provided in the feed for five consecutive days to supply 10 mg CTC /lb of body weight is effective for helping assist the immune system of stressed, receiving cattle by inhibiting the growth and establishment of bacterial pathogens that contribute to the development of BRD. However, the time frame during which a single 5 -day treatment of Aureomycin is

most effective can be problematic for various types of cattle, when administration potentially takes place either before or after peak challenge periods. Therefore, the use of multiple 5-day treatments or pulses of Aureomycin throughout the receiving period may have the potential to reduce the uncertainty of determining the optimum timing of Aureomycin administration and thereby improve opportunities for treatment success.

The primary objective of the current study was to evaluate the impact of five consecutive five -day pulses of Aureomycin on cattle health and performance during a 30 -day receiving period as compared with a non-medicated control or cattle fed Rumensin / Tylan.

Materials and Methods

The research study was conducted at a commercial research facility located in southern Ontario, Canada. Research pens were located in barns that were open to the south with steel fencing separating each pen. The pens measured approximately 16.5 (5.1 m) feet wide and 33.2 (10.2 m) feet in depth and contained 10 animals at a density of 55 square feet per animal. Pens had concrete floors with bedding placed in the back of the pen under the roof. Feed bunks were located along the open southern side of the pens.

A total of 350 continental cross yearling steers were purchased in sale barns within approximately 80 miles of the research location over a two week period. Upon arrival cattle were vaccinated for IBR, PI3 and BVD, treated for internal and external parasites and implanted with Synovex C(r) (Fort Dodge Animal Health). When an adequate number of cattle had been received at the study site (approximately 60 head), they were allotted to treatment pens within each block. There were six pens in each of the five blocks. Three hundred steers were allotted to thirty, 10 head pens that were randomly assigned to dietary treatments resulting in 5 pens / treatment group. Medicated feed additive

(MFA) treatments consisted of:

- Non-medicated control diet
- Rumensin supplied at 33 g/ton (DM basis) combined with Tylan supplied at 10 g/ton. A Rumensin step-up program was not used in this study.
- Aureomycin supplemented to supply 10 mg/lb of body weight on study days 1-5, 7-11, 13-17, 19-23, and 25-29. For the Aureomycin treatment group cattle received the non-medicated diet on study days 6, 12, 18, 24, and 30.

The study investigators also imposed an additional treatment on each of the above treatment groups that consisted of feeding either none or a natural feed ingredient. This was included in the diet at 1.2% of diet dry matter replacing an equivalent amount of corn. Treatments were arranged in a 3 x 2 factorial arrangement such that each medicated feed additive treatment was fed with and without the natural feed ingredient.

Cattle were fed once daily in the morning. The amount of feed provided each day was adjusted as required to allow each pen of steers to express their potential for full intake. Unconsumed feed (i.e., orts) were removed from the pen and weighed. The amount of feed offered was increased until the average amount fed per head was equal to 3% of the pen's initial body weight. After this point, the amount of daily feed was "capped" at this level until the completion of the study. The number of days required to achieve the 3% level was recorded for each pen. A single receiving diet was fed during the 30 day study (Table 1).

Cattle were observed daily for signs of sickness, primarily respiratory disease by research personnel who were blinded to treatment identity. Animals thought to be suffering from BRD were removed from their home pen, rectal temperature taken and treated as required. Animals with a rectal temperature greater than 104.0_F were treated with Micotil (tilmicosin; Elanco Animal Health) at 1.5 cc / 100 lbs BW. Following treatment, animals were returned to their home pen. If an animal continued to exhibit clinical signs of BRD, it was re-pulled from its home pen. If the rectal temperature was 104.0_F or above, Nuflor (florfenicol; Schering Plough Animal Health) was administered at 3.0 cc / 100 lbs BW and the animal returned to its home pen. Steers that remained unresponsive after a third medical treatment were treated as chronic respiratory cases and these animals removed from study. Animals that died during the study were necropsied by a veterinarian.

The study began on April 29, 2005 when the first block was processed and feeding of treatment diets commenced. The study was completed on June 5, 2005,

when the last block completed the thirty day receiving period. Individual animal body weights were taken at study initiation and at the end of the thirty day receiving period. Individual body weights for each pen were summed and a pen average body weight computed. Initial pen weights were calculated without a pencil shrink with a 3% shrink adjustment factor imposed on the thirty day body weight. Pen performance values were calculated on the basis of both including and excluding the animals dying or removed from study based on the calculations provided in Appendix 1.

Primary data were reviewed for completeness and accuracy. For all statistical analyses, probabilities less than 10% ($P < 0.10$) were considered significant. Pen-based performance parameters were evaluated by standard General Linear Model (GLM) procedures of Statistix 7.0 (Analytical Software Inc.) for a complete block design using pen as the experimental unit. The model included main effect factors (MFA and natural feed ingredient) and block as sources of variation. The MFA x natural feed ingredient x Block interaction was used as the experimental error term. A main effect interaction was considered significant at $P \leq 0.10$, in which case the simple effect means were analyzed as the individual treatment groups. Tukey's procedure was used to compare treatment means when the overall F test was significant. General contrast statements were used to evaluate treatment response according to the following criteria:

Contrast 1: Effect of control vs. Aureomycin and Rumensin / Tylan

Contrast 2: Effect of Aureomycin vs. Rumensin / Tylan

Discrete variables were analyzed using Chi-square procedures (Statistix 7.0, Analytical Software Inc.).

Results and Discussion

For MFA effects, initial weight was not different among treatments, either on a dead and removals included or excluded basis. There was a significant MFA x natural feed ingredient interaction for initial weight that resulted from a statistical difference in initial weight between natural feed ingredient treatments. Because this interaction was present for initial weight, it was considered an artifact of the randomization process and was not a significant factor in the interpretation of the main effects. Therefore, only the main effects for MFA are reported.

On a dead and removals included basis (Table 2), final weight, daily gain, days to 3% intake and DM intake were affected ($P \leq 0.05$) by MFA treatment. Steers in the Aureomycin group had greater final weight and

daily gain compared to steers fed R / T. Dry matter in the R/T group was decreased ($P \leq 0.01$) compared to controls and Aureomycin fed steers, with no difference between the latter two groups. In the control group, final weight and daily gain were not statistically different from either the Aureomycin or R / T groups. Contrasts between the Aureomycin and R/T treatments were significant for daily gain, DM intake and DM feed:gain ratio. Expressing pen performance variables on the basis of "deads and removals excluded" (Table 3) indicated a similar statistical difference for daily gain as was observed with data shown in Table 2; however, final weight was not affected by MFA treatment. Dry matter intake was similar between controls and Aureomycin-fed steers and was decreased ($P < 0.01$) in steers fed R/T. Feed efficiency was not affected by MFA treatment.

Dry matter intake during the 30 day receiving period was restricted once pen intake reached an average of 3% of initial body weight. Days to reach 3% body weight intake can be roughly equated to the time required to reach a final finishing diet with cattle similar to those used in the current study. Steers fed Aureomycin achieved the 3% of BW level of DM intake faster than R/T steers ($P = 0.01$).

Response on health-related parameters to main effects of MFA treatments are shown in Table 4. Because of the type of cattle used in this study, mortality from BRD was minimal (2 steers) with an overall case fatality rate of 1.7%. Likewise, the number of cattle removed from study due to chronic respiratory disease was low. The number of cattle pulled for BRD while low was significantly ($P = 0.05$) associated with MFA treatment. The number of cattle pulled and treated for BRD was decreased ($P = 0.02$) in the Aureomycin groups compared to the R/T group. While not significantly associated with MFA treatment, the number of cattle requiring re-treatment for BRD again was lowest in the Aureomycin group and tended ($P = 0.15$) to be greater in the R/T group. The mean number of days on feed to the first pull and treatment for BRD was affected by MFA ($P = 0.03$) with the R/T group having the least number of days and no difference between the control or Aureomycin groups. Likewise, the mean maximum days to first pull and treatment was affected ($P = 0.01$) by MFA, being greatest for the control group, with no difference between the Aureomycin and R/T treatment groups. The overall mean rectal temperature at first BRD treatment did not differ among MFA treatments.

Implications

The results of this receiving study would suggest that starting cattle using 5 consecutive 5-day pulses of Aureomycin may be an effective method of decreasing

morbidity while improving nutrient intake needed for immune function and performance. Medicated feed additives that limit feed intake or increase time to reach maximum intake may be counter productive with general feedyard objectives of decreasing morbidity and improving performance. Evidence for the independent effects of nutrient supply on health and performance is provided by reduced morbidity and improved performance with cattle fed the non-medicated control diet compared with the Rumensin/Tylan diet. The addition of Aureomycin further reduced the disease challenges compared with non-medicated control fed cattle allowing a greater amount of nutrient intake to be used to support growth. While the type of cattle used in this study may be considered to have a low to moderate risk for experiencing BRD, multiple administrations of Aureomycin, to provide 10 mg /lb of body weight, appeared to reduce concerns created by the timing of Aureomycin administration and prediction of disease onset. These results also appear to support the concept that extending the duration of exposure to an antimicrobial product, such as Aureomycin may be an important factor in controlling the incidence and severity of BRD in newly received cattle. Additional studies are planned to further evaluate the merits of this program.

Table 1. Experimental ingredient formulation and estimated nutrient analysis.

Ingredients	100% Dry matter basis
Steam-flaked corn, % ^a	40.0
Wet distillers grain, %	14.0
Corn silage, %	40.0
Premix, %	6.0
Estimated Nutrient Analysis	
Crude protein, %	13.50
Non Protein Nitrogen, % of CP	2.80
Crude Fat, %	3.80
Crude Fiber, %	5.00
Calcium, %	0.60
Phosphorus, %	0.33

^a Natural Feed Ingredient replaced 1.2 percentage units of corn in the Natural Feed Ingredient treatments.

Table 2. Effects of a non-medicated receiving diet or receiving diets providing Aureomycin or Rumensin/Tylan on growth performance and DM intake during the first thirty days in the feedyard (dead and removed steers included).

Item	Main Effects - MFA Treatments			SEM ^b	Probability ^a		
	Non-medicated	Aureomycin Program	Rumensin / Tylan		Overall Significance	Contrast ^c	
						1	2
Pens, n	10	10	10				
Head counts, n							
Initial	100	100	100				
Final	98	100	93				
Net live weight ^d , lb							
Initial ^d	711	707	714	4.9	0.62	0.95	0.34
Final, actual	818 ^{e,f}	825 ^e	795 ^e	9.6	0.10	0.59	0.04
Daily gain, lb	3.88 ^{e,f}	4.25 ^e	3.10 ^f	0.26	0.02	0.53	<0.01
Daily DM intake, lb	18.56 ^e	18.69 ^e	16.86 ^f	0.32	<0.01	0.06	<0.01
Days to 3% BW intake	22.4 ^{e,f}	18.6 ^e	25.8 ^f	1.5	0.01	0.92	<0.01
Gain:DM Feed	0.21	0.23	0.18	0.02	0.17	0.83	0.06

^a Probability based on F-statistic

^b Standard error of mean, n = 10.

^c Contrasts: 1 = Comparison of non-medicated diet to mean response of medicated diets

2 = Comparison of Rumensin / Tylan response to Aureomycin response

^d MFA x Natural Feed Ingredient interaction.

^{e,f} Means with different superscripts differ.

Table 3. Effects of a non-medicated receiving diet or receiving diets providing Aureomycin or Rumensin/Tylan on growth performance and DM intake during the first thirty days in the feedyard (dead and removed steers excluded).

Item	Main Effects - MFA Treatments			SEM ^a	Probability ^b		
	Non-medicated	Aureomycin Program	Rumensin / Tylan		Overall Significance	Contrast ^c	
Pens, n	10	10	10				
Head counts, n							
Initial	100	100	100				
Final	98	100	93				
Net live weight ^d , lb							
Initial ^d	710	706	716	5.1	0.35	0.90	0.15
Final, actual	829	833	829	5.9	0.83	0.72	0.63
Daily gain, lb	3.95 ^{e,f}	4.25 ^e	3.76 ^f	0.12	0.03	0.73	0.01
Daily DM intake, lb	18.60 ^e	18.69 ^e	17.00 ^f	0.33	<0.01	0.08	<0.01
Days to 3% BW intake	22.4 ^{e,f}	18.6 ^e	25.8 ^f	1.5	0.01	0.92	<0.01
Gain:DM Feed	0.21	0.23	0.22	0.006	0.26	0.11	0.73

^a Probability based on F-statistic

^b Standard error of mean, n = 10.

^c Contrasts: 1 = Comparison of non-medicated diet to mean response of medicated diets

2 = Comparison of Rumensin / Tylan response to Aureomycin response

^d MFA x Natural Feed Ingredient interaction

^{e,f} Means with different superscripts differ

Table 4. Effects of control, Rumensin/Tylan or Aureomycin on animal health during a 30 day receiving period.

Item	MFA Treatments			Overall Significance	Probability ^b	
	Non-medicated	Aureomycin Program	Rumensin / Tylan		Contrast ^c	
Initial head count, n	100	100	100			
Respiratory morbidity						
Unique cases, n	21	14	28	0.05	1.00	0.02
% of initial head	21.0	14.0	28.0			
Cases treated >once, n ^d	4	2	10	0.23	0.41	0.15
% of unique cases	19.0	14.3	35.7			
Respiratory removals ^e						
Total removed, n	2	0	5			
% of initial head	2.0	0.0	5.0			
Respiratory mortality ^a						
Total dead, n	0	0	2			
% of initial head	0.0	0.0	2.0			
Case fatality rate ^e , %	0.0	0.0	7.1			
Total dead + removed, n ^a	2	0	7			
% of initial head	2.0	0.0	7.0			
Days to first pull						
Minimum ^g	7.8	8.1	6.2	0.34	0.61	0.17
Maximum ^g	13.4 ^e	9.6 ^f	9.0 ^f	0.01	≤ 0.01	0.65
Mean ^g	10.7 ^e	9.1 ^{e,f}	7.9 ^f	0.03	0.02	0.32
Body temperature, °F						
Mean at first pull ^h	105.5	105.8	105.8	0.55	0.25	0.90
Maximum at first pull ^h	106.0	106.3	106.4	0.63	0.36	0.82

^a Too few cases to analyze

^b Based on Chi-square statistic for number of animals pulled and repulled for BRD treatment. Based on F statistic for days to first pull and rectal temperature.

^c Contrasts: 1 = Comparison of non-medicated diet to mean response of medicated diets

2 = Comparison of Rumensin / Tylan response to Aureomycin response

^d Caution: 1 cell(s) have expected values less than 5.0

^{e,f} Means with different superscripts differ at the observed significance level.

^g The sums of squares, mean squares, and F-tests are approximate for analyses with missing values.

Appendix 1. Pen data calculations:

Deads and removals included:

- Total head days = (No. head completing study*days on feed) + (Sum of days on feed for animals removed from study and dying)
- Initial weight = Sum of individual initial weights ÷ initial number of animals.
- Final weight = (Sum of individual final weights*0.97) + sum of weight from animals removed) ÷ Initial pen head count
- Total weight gained = (Sum of individual final weights + sum of weight from animals removed) - (Sum of individual initial weights)
- Mean daily weight gain = Total weight gained ÷ Total head days
- Mean daily DM intake = Total feed (including live, dead and removal feed less orts) ÷ Total head days
- DM conversion = Mean daily DM intake ÷ Mean daily gain

Deads and removals excluded:

- Total head days = (No. head completing study*days on feed)
- Initial weight = Sum of individual initial weights - sum of initial weights of animals dying and removed ÷ (Initial number of animals - number animals dying and removed).
- Final weight = Sum of individual final weights*0.97 ÷ Number of head completing study
- Total weight gained = Sum of individual final weights - sum of individual initial weights- sum of weights of animals dying and removed
- Mean daily weight gain = Total weight gained ÷ Total head days
- Mean daily DM intake = Total feed (excluding dead and removal feed less orts) ÷ Total head days
- DM conversion = Mean daily DM intake ÷ Mean daily gain



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