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Progress Report No. 112 (February, 2012)

Delayed Bovine Viral Diarrhea Vaccination and Growth Implant with Metaphylaxis[1]

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Introduction

The first month after arrival into a feedlot can bring numerous challenges to newly weaned calves. For this reason, proper management techniques which include cattle nutrition and health must be employed. Calves which have recently arrived into a feedlot most likely have been comingled with cattle of different origins, and as a result become exposed to disease.

Current industry practices are to vaccinate and implant newly received calves shortly after arrival to the feedlot. Vaccination programs are important to reduce the prevalence of disease by increasing calf immunity. However, efficacy of a vaccine may be affected by the health of cattle during or shortly after vaccination. If cattle are stressed, sick, or both, their ability to illicit an adequate immune response to the vaccine may be impaired. Similar to vaccination programs, use of a growth implant program by the beef industry is an important tool to improve cattle performance, and economic returns. However, efficacy of a growth implant may be affected by the animal's plane of nutrition. If cattle are stressed, sick, or both, growth responses to an implant may be limited by low dietary intake and subsequent nutrition restriction. Once newly received calves adapt to the feedlot environment, recover from disease, and attain an adequate nutrient intake, they should be more prepared to meet the growth demands of implants, as well as the immune responses to vaccination. To promote recovery from disease, antibiotic therapy of calves before they receive their vaccine and initial implant may improve the efficacy of the vaccination and implant program.

Our hypothesis is that delaying the vaccine and growth implant in stressed calves receiving antibiotic therapy will improve the efficacy of the vaccination and implant programs. The objectives of the current study are to evaluate cattle health and performance in response to delaying the bovine viral diarrhea (BVD) vaccination and initial implant with or without multiple pulse doses of Aureomycin in combination with a metaphylaxic treatment with Draxxin.

Experimental Procedures

Cattle. All procedures were approved by the New Mexico State University Animal Care and Use Committee. In July 2011, 312 crossbred heifer calves (405 ± 2.1 lb) purchased from sale barns in Southeast Texas were shipped to the Clayton Livestock Research Center. At initial processing, cattle were weighed individually using a single animal squeeze chute (Silencer, Moly Manufacturing, Inc.), uniquely identified with individual ear tags, given antiparacitics (Dectomax and Valbazen; Pfizer Animal Health, Exton, PA), given metaphylaxis with tulathromycin (Draxxin, Pfizer Animal Health), and their horns were tipped as needed. Approximately 24 hours after initial processing (day 1), cattle were re-weighed individually, and vaccinated against viral diseases using Inforce 3 (Pfizer Animal Health).

Experimental Design. Heifers were randomly assigned to one of 24 soil-surfaced pens (40 ft by 115 ft) equipped with fenceline bunks (36 ft bunk line) and continuous flow water tanks. There were 13 heifers per pen, and pens were randomly assigned to one of four treatments. The four treatments (Table 1), in a 2 by 2 factorial arrangement, were vaccination against bovine viral diarrhea (Bovi-Shield Gold BVD; Pfizer Animal Health) and a growth implant (Synovex-C; 100 mg of progesterone and 10 mg estradiol benzoate; Fort Dodge Animal Health, Fort Dodge, IA) on day 1 (**INITIAL**) or day 28 (**DELAYED**) after initial processing in combination with (**+AUR**) or without (**-AUR**) three 5-day pulse-doses of Aureomycin (Alpharma Animal Health, Bridgewater, NJ). Aureomycin was included in the +AUR rations (formulated to provide 1 gram of chlortetraclyine per 100 lb of body weight) on days 7 to 11, 13 to 17, and 19 to 23. All heifers received an additional colored tag on day 1 based on treatment assignment.

Management, Feeding, and Weighing Procedures. Cattle were fed a diet based on a commercially available complete feed (RAMP; Cargill, Inc., Wayzata, MN) with a 20% inclusion of ground corn for the first 28 days, and then RAMP with a 30% inclusion of ground corn from day 29 to 56 of the receiving period (Table 1). A coccidiostat (Deccox; Alpharma Animal Health, Bridgewater, NJ) was used during the first 28 days on feed, and an ionophore (Bovatec; Alpharma Animal Health) was fed from day 29 to 56. During the receiving period, feed intake of pens of cattle was managed to minimize build-up of orts in feed bunks. Feed was delivered two times a day, and bunks were evaluated visually twice each day (morning and evening) to determine the quantity of feed to offer each pen. Diet samples were obtained weekly from randomly selected feed bunks to calculate dietary dry matter and for nutrient analyses. Nutrient analyses of feed samples were conducted by a commercial laboratory (SDK Labs, Hutchinson, KS).

Animal Health. Clinical monitoring was performed by trained personnel at the same time every day of the 56-day study. Animals were scored (0 to 3 scale, with 0 = normal) based on visual appraisal. Animals were observed as feed was delivered to the pen for signs of inappetence, anorexia, decreased activity, abnormal posture, abnormal gait, respiratory status, and depression. Calves with a combined score greater than 1 were removed from the pen and taken to the processing facility for further evaluation. At the processing facility, the pulled calves were weighed, and a rectal temperature was obtained. If the rectal temperature was greater or equal to 104.5°F and clinical assessment (combined score greater than 1) warranted treatment, then the calf was treated according to the Clayton Livestock Research Center's standard protocol.

Collections. Performance and health measurements that were taken throughout the course of the study included dry matter intake, average daily gain, feed-to-gain ratio, morbidity, and mortality. Initial body weights were the average of weights which were taken on an individual basis using a single animal squeeze chute at initial processing and approximately 24 hours later. On days 28 and 56, animals were weighed using a pen scale.

Statistical Analysis. Performance data were analyzed as a completely randomized design using the MIXED procedure of SAS (SAS Inst. Inc., Cary, NC) with pen as the experimental unit. Mortality and morbidity data were analyzed as binomial proportions using the GLIMMIX procedure of SAS.

Results and Discussion

Effects of Treatment Interactions. In the current study, a significant treatment interaction indicated that the effect of delaying the BVD vaccine and growth implant on animal performance and health was influenced by the use of Aureomycin, or the effects of Aureomycin on performance and health was influenced by delaying the BVD vaccine and growth implant. Treatment interactions occurred for dry matter intake (Table 2). From day 0 to 56, dry matter intake tended to be lower for DELAYED than INITIAL when heifers received -AUR, but dry matter intake was not different between DELAYED and INITIAL when heifers received +AUR (treatment interaction, $P = 0.06$). Therefore, the effects of delaying the BVD vaccine and implant on intake may depend upon the choice to feed or not to feed Aureomycin. Because the use of growth implants can have an impact on feed intake (Anderson and Botts, 1995), it is likely that the observed differences in dry matter intake were driven by the growth implant, and not the vaccine. From day 0 to 28, average daily gain tended to be less for DELAYED than INITIAL when heifers received -AUR, but average daily gain was not different between DELAYED than INITIAL when heifers received +AUR (treatment interaction, $P = 0.09$). This treatment interaction for average daily gain from day 0 to 28 reflects the treatment interaction observed for dry matter intake. Treatment interactions were not significant ($P \geq 0.17$) for heifer body weight on days 28 and 56, nor for overall (day 0 to 56) average daily gain or feed-to-gain ratio (Table 2). Similarly, no treatment interaction ($P \geq 0.39$) occurred for morbidity or mortality.

Effect of Delaying the BVD Vaccine and Growth Implant. Newly arrived calves in the feedlot are often naïve and do not necessarily know how to eat from a bunk. The objective of delaying the BVD vaccination and growth implant for 28 days was to allow calves to recover from stress and disease, and to establish adequate feed intake so that they are more prepared to meet the growth demands of implants, as well as the immune responses to vaccination. In the current study, body weights on days 28 and 56, average daily gain from day 0 to 56, and dry matter intake from day 0 to 56, were lower ($P \leq 0.04$) for heifers when the BVD vaccine and growth implant was delayed until day 28 (DELAYED versus INITIAL; Table 2). Lower overall (day 0 to 56) performance in DELAYED versus INITIAL heifers was due to lower ($P = 0.03$) average daily gain from day 0 to 28, whereas average daily gain from day 29 to 56 was not different ($P = 0.29$) between DELAYED and INITIAL heifers. Therefore, heifers receiving a delayed BVD vaccination and implant were unable to compensate from days 29 to 56 for loss of performance during days 0 to 28. The fact that average daily gain from day 0 to 28 was greater for INITIAL versus DELAYED heifers indicated that greater dry matter intake during the first 28 days was sufficient to meet the nutrient demands of an implant. Therefore, delaying the BVD vaccine and growth implant to allow the cattle to recover from stress and disease, and to establish adequate feed intake was not beneficial. Because both average daily gain and dry matter intake were decreased by delaying the BVD vaccination and growth implant, the feed-to-gain ratio was not different ($P \geq 0.32$) between INITIAL and DELAYED heifers.

The results of the current study are different to the results of our previous study (McDaniel et al., 2011), which evaluated the effects of delaying a growth implant from day 0 to day 21 on performance of feedlot heifers. McDaniel et al. (2011) reported that delaying an implant did not affect dry matter intake, but decreased calf body weight, average daily gain and feed efficiency during the first 21 days of the study. However, by day 42 of the study, body weight, average daily gain, and feed efficiency were not different between calves receiving the implant on day 21 versus day 0. Therefore, calves were able to compensate from days 21 to 42 for loss of performance during days 0 to 21 in the study by McDaniel et al. (2011). Different results between the current study and the study of McDaniel et al. (2011) could be due to differences in implant strength and chemistry (estrogenic versus androgenic), as well as differences in length (28 days versus 21 days) of the delay in implant. In the current study, performance was not monitored beyond day 56, and therefore it could not be determined whether the compromised performance of the DELAYED heifers could recover later during the feeding period. Delaying the BVD vaccine and growth implant did not affect ($P \geq 0.17$) the percentage of calves treated for sickness or the percentage of death loss (Table 3). Although differences between DELAYED and INITIAL were not statistically significant ($P = 0.17$), it is interesting that none of the DELAYED heifers received 3 treatments.

Effects of Feeding Aureomycin. In theory, healthier cattle have improved performance because of increased feed intake, and less demand for nutrient allocation to support immune function. Aureomycin is used to reduce the incidence of subclinical disease, and potentially the negative impact of disease on performance. The idea behind the concurrent use of Aureomycin with Draxxin was that cattle which were fed +AUR would have effective blood concentrations of chlortetracycline prior to the loss of efficacy of Draxxin. In this case, the additional protection provided by the use of Aureomycin could reduce losses of performance associated with health issues. However, the use of Aureomycin did not affect ($P \geq 0.39$) body weight, dry matter intake, average daily gain, or feed-to-gain ratio during this experiment (Table 2). Auroemycin is used to reduce the number of cattle which are pulled for treatment in a feedlot. A reduction in pulls represents a significant improvement in the profitability of feeding cattle. However, the addition of Aureomycin also did not affect ($P \geq 0.56$) morbidity or mortality in this study (Table 3). Feedlot morbidity and mortality of heifers were low, and it is possible that Aureomycin could be more effective when fed to cattle with greater stress and sickness.

Conclusion

Delaying a BVD vaccination and initial growth implant for 28 days decreased heifer performance during the first 56 days on feed in the feedlot. Therefore, delaying a BVD vaccination and initial growth implant did not improve efficacy of the vaccination and implant program in stressed heifers receiving antibiotic therapy. Feeding multiple pulse doses of Aureomycin to heifers during the first 28 days did not improve animal performance and health. Therefore, use of Aureomycin did not improve the efficacy of a delayed vaccination and implant program. The managerial decision to delay the initial growth implant may be dependent upon the strength and chemistry of the implant intended for use at initial processing, and managerial decisions to feed multiple pulse doses of Aureomycin may be dependent upon the health risk of the newly received calves.

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Acknowledgements

Authors thank Cargill, Pfizer Animal Health, and Lextron for their support for this project.

Table 1.Composition of receiving diets

	Day 0 to 28[1]				Day 29 to 56
	INITIAL		DELAYED		
Item	-AUR	+AUR	-AUR	+AUR	All pens
Ingredient, % dry basis					
RAMP	79.1	79.1	79.1	79.1	69.1
Ground corn	20.0	20.0	20.0	20.0	30.0
Supplement A[2]	0.53	-	0.53	-	-
Supplement B[3]	-	0.53	-	0.53	-
Supplement C[4]	-	-	-	-	0.53
Mineral supplement[5]	0.35	0.35	0.35	0.35	0.35
Nutrient[6], % dry basis					
Crude protein	17.46	17.56	17.46	17.56	16.49
Neutral detergent fiber	27.42	26.75	27.42	26.75	25.85
Acid detergent fiber	13.51	14.03	13.51	14.03	13.18
Potassium	1.36	1.30	1.36	1.30	1.07
Calcium	1.39	1.37	1.39	1.37	1.12
Phosphorus	0.84	0.81	0.84	0.81	0.72
Sulfur	0.36	0.33	0.36	0.33	0.33

[1]Heifers were fed diets with treatments from day 0 to 28. Treatments, in a 2 by 2 factorial arrangement, were BVD vaccination and a growth implant on day 1 (INITIAL) or day 28 (DELAYED) after initial processing in combination with (+AUR) or without (-AUR) three 5-day pulse-doses of Aureomycin. Aureomycin was included in the +AUR rations on days 7 to 11, 13 to 17, and 19 to 23. From day 29 to day 56, all heifers were fed a common diet.
[2]Contained Deccox to supply 22.7 mg decoquinate per 100 lb of body weight.
[3]Contained Deccox and Aureomycin to supply 22.7 mg decoquinate and 1 g chlortetracycline per 100 lb of body weight, respectively.
[4]Contained Bovatec at 38.93 g/ton.
[5]Mineral supplement composition: 90.36% limestone, 5.12% salt, and 4.52% trace mineral and vitamin premix (supplied 9% zinc, 5.75% manganese, 1.8% copper, 1600 mg/kg iodine, 500 mg/kg cobalt, and 360 mg/kg selenium, 2500 IU/lb vitamin A, 300 IU/lb vitamin D, and 40 IU/lb vitamin E).
[6]Nutrient composition analyzed by SDK Laboratories, Hutchinson, KS.

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Table 2. The effects of a delayed BVD vaccination and growth implant with or without Aureomycin on intake and performance of newly received feedlot heifers

	Treatment[1]					*P*-value		
	INITIAL		DELAYED					TIME by
Item	-AUR	+AUR	-AUR	+AUR	SEM	TIME[2]	AUR[3]	AUR[4]
Body weight, lb								
Day-0	407	406	407	405	0.98	0.64	0.39	0.61
Day-28	484	478	475	476	2.73	0.04	0.39	0.19
Day-56	592	587	577	581	4.97	0.04	0.98	0.33
Dry matter intake, lb/d								
Day-0 to 28	10.54	10.30	9.67	10.05	0.164	<0.01	0.69	0.07
Day-29 to 56	16.13	15.36	14.95	15.21	0.289	0.03	0.39	0.09
Day-0 to 56	13.33	12.81	12.29	12.62	0.213	0.01	0.67	0.06
Average daily gain, lb/d								
Day-0 to 28	2.80	2.55	2.39	2.49	0.099	0.03	0.47	0.09
Day-29 to 56	3.89	3.89	3.64	3.77	0.172	0.29	0.72	0.70
Day-0 to 56	3.34	3.21	3.01	3.13	0.087	0.02	0.97	0.17
Feed-to-gain ratio								
Day-0 to 28	3.77	4.07	4.11	4.04	0.151	0.34	0.46	0.23
Day-29 to 56	4.17	3.97	4.16	4.10	0.168	0.72	0.45	0.68
Day-0 to 56	3.99	3.99	4.10	4.05	0.083	0.32	0.73	0.74

[1]Treatments, in a 2 by 2 factorial arrangement, were BVD vaccination and a growth implant on day 1 (INITIAL) or day 28 (DELAYED) after initial processing in combination with (+AUR) or without (-AUR) pulse-doses of Aureomycin on days 7 to 11, 13 to 17, and 19 to 23. Dead heifers were not included in statistical analyses for performance.
[2]TIME = *P*-value for the difference between a BVD vaccination and growth implant on day 1 (INITIAL) versus day 28 (DELAYED).
[3]AUR = *P*-value for the difference between feeding (+AUR) versus not feeding (-AUR) pulse-doses of Aureomycin.
[4]TIME by AUR = *P*-value for the effects of an interaction between delaying BVD vaccination and growth implant and feeding pulse-doses of Aureomycin.

Table 3. The effects of a delayed BVD vaccination and growth implant with or without Aureomycin on health of newly received feedlot heifers

	Treatment[1]					*P*-value		
	INITIAL		DELAYED					TIME by
Item	-AUR	+AUR	-AUR	+AUR	SEM	TIME[2]	AUR[3]	AUR[4]
Morbidity[5], %								
1 treatment	16.67	12.82	15.38	16.66	3.64	0.72	0.72	0.49
2 treatments	3.84	2.56	5.12	3.84	2.18	0.56	0.56	0.99
3 treatments	1.28	1.28	0	0	0.90	0.17	0.99	0.99
Mortality, %	1.28	2.56	2.56	1.28	1.46	0.99	0.99	0.39

[1]Treatments, in a 2 by 2 factorial arrangement, were BVD vaccination and a growth implant on day 1 (INITIAL) or day 28 (DELAYED) after initial processing in combination with (+AUR) or without (-AUR) pulse-doses of Aureomycin on days 7 to 11, 13 to 17, and 19 to 23.
[2]TIME = *P*-value for the difference between a BVD vaccination and growth implant on day 1 (INITIAL) versus day 28 (DELAYED).
[3]AUR = *P*-value for the difference between feeding (+AUR) versus not feeding (-AUR) pulse-doses of Aureomycin.
[4]TIME by AUR = *P*-value for the effects of an interaction between delaying BVD vaccination and growth implant and feeding pulse-doses of Aureomycin.
[5]Number of times treated during the experiment (1, 2, or 3 treatments).