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The Effect of Arrival Vaccine Combination on Performance and Efficiency During the Receiving and Backgrounding Phase

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Abstract

A 56-day backgrounding trial was conducted to assess the effects of three arrival vaccine combinations on growth performance and efficiency during the receiving and backgrounding periods. Crossbred high-risk heifer calves (n = 393; initial body weight [BW] = 499 ± 38 lb) were blocked by truckload (4) and stratified by initial BW within block and allocated into one of nine pens. Pens were randomly assigned to one of three treatments to provide a total of 12 replicates per treatment for a total of 36 pens. All calves were fed a common diet composed of 40.00% Sweet Bran (Cargill Animal Nutrition, Blair, NE), 30.01% warm-season grass hay, 24.37% dry-rolled corn, and 5.63% pellet supplement. This ration was formulated to provide 53 Mcal net energy for gain and offered at *ad libitum* intake. Feed bunks were read at 7:00 a.m. each day and were targeted to be empty when feed was delivered at 8:00 a.m. Vaccine treatment combinations were designed to include a 5-way modified live virus vaccine, a 7-way clostridial, and respiratory and somnus bacterins. Treatments were: Pyramid (Pyramid 5 + Presponse SQ [Boehringer Ingelheim, Ridgefield, CT] and Bovilis Vision 7 Somnus with Spur [Merck Animal Health, Rahway, NJ]); Stimulator (Stimulator 5 [Bimeda, Schaumburg, IL], Pro-Bac 4 [Bimeda, Schaumburg, IL], and Bovilis Vision 7 with Spur [Merck Animal Health, Rahway, NJ]); and Bovi-Shield Gold (Bovi-Shield Gold One Shot [Zoetis Inc., Parsippany, NJ] and Bovilis Vision 7 Somnus with Spur). All employees responsible for the care and feeding of the animals, as well as the data analyses, were blinded to treatments until all analyses were complete. At the conclusion of the 56-day study, final BW, average daily gains, feed efficiency, and water usage did not differ ($P \geq 0.35$) between treatments. No differences ($P \geq 0.10$) in morbidity or mortality across treatments were detected. Arrival vaccine combinations did not affect cattle's ability to perform or interfere with their health outcomes during the early feeding period.

Introduction

Newly received cattle face many challenges upon arrival at feedyards or backgrounding facilities. Stressors such as weaning, transportation, diet change, and pathogen exposure are just a few of the changes that may occur during the transition period from dam to a confined setting. The purpose of a vaccine is to provide future protection from pathogens to which an animal may be subject. Oftentimes, cattle are in a high-stress state prior to or during administration of vaccines, which can affect the animal's ability to mount a strong immune response to those antigens. Other factors, such as adjuvant

type or number of injections, specifically related to endotoxin staking (the administration of multiple gram-negative bacteria containing vaccine at one time), can also play a role in the animal's ability to mount a response, as well as the animal's propensity to get up on feed during the receiving period. Aluminum salts, oil-based emulsions, saponins, or monophosphoryl lipid A would be considered some of the most common adjuvant types used, and although they differ in terms of modes of action, they all work to help stimulate an immune response to the antigens present in the vaccine. The number of injections during a processing event can vary depending on the operation, veterinary recommendation, and potential for disease exposure. Oftentimes, two or more gram-negative vaccines are given in a production setting on top of other injections such as modified live virus vaccines, antibiotics, and injectable dewormers (Richeson et al., 2019). Endotoxins are produced from gram-negative bacteria that die and break down in the system, and excessive amounts of endotoxin in the body can be fatal. Higher endotoxin levels have been known to cause "vaccine sweat" post-vaccination. This can also lead to cattle taking longer to get up on feed and appear to show more clinical signs of illness postvaccination. Given the vast array of options for vaccination protocol combinations, the objective of this study was to evaluate a direct comparison of various product lines on their impact on feed intake early in the feeding period.

Experimental Procedures

A total of 393 crossbred heifer calves (body weight [BW] = 499 ± 38 lb) were purchased at auction markets in Tennessee, assembled at an order buyer's facility in Dickson, TN, and then shipped 674 miles to the Kansas State University Beef Stocker Unit over a 9-day period from October 9 to October 17, 2024. The heifers were used in a randomized complete block design to analyze the effect of arrival vaccine combination on performance and efficiency during a 56-day receiving trial. Heifer calves were labeled high-risk due to the long transportation time and comingling at the order buyer's facility. Heifers were blocked by truckload (4), stratified by individual arrival (day -1) weight within load, and assigned to pens containing 10 or 11 head. Pens within each block were randomly assigned to one of three treatments, which equaled 12 pens/treatment for a total of 36 pens. Cattle were weighed immediately on arrival (day -1) and individually identified using both visual and electronic identification tags. Heifers were then offered warm-season grass hay at 1% of BW (dry matter [DM] basis), had *ad libitum* access to water, and were allowed to rest for 24 hours.

The following day (day 0), all heifers were individually weighed again and received antibiotic metaphylaxis with Tulathromycin (Macrosyn; Bimeda, Schaumburg, IL). Heifers were treated for internal and external parasites with a combination deworming strategy using levamisole oral suspension (Levamed; Bimeda, Schaumburg, IL) and ivermectin pour-on (Bimectin; Bimeda, Schaumburg, IL) and assigned a tag with a pen number. Farm staff was blinded to vaccine treatments during the entire 56-day receiving period. Prior to the trial start date, vaccine protocols were relabeled with a color and letter (White A, Red B, and Blue C) for the purpose of animal allocation and vaccine administration during processing and data analysis. Vaccination treatments were: White A = Pyramid (Pyramid 5 + Presponse SQ [Boehringer Ingelheim, Ridgefield, CT] and Bovilis Vision 7 Somnus with Spur [Merck Animal Health, Rahway, NJ]); Red B = Stimulator (Stimulator 5 [Bimeda, Schaumburg, IL], Pro-Bac 4 [Bimeda, Schaumburg, IL], and Bovilis Vision 7 with Spur [Merck Animal Health, Rahway, NJ]) and Blue C = Bovi-Shield Gold (Bovi-Shield Gold One Shot [Zoetis Inc., Parsippany, NJ] and Bovilis Vision 7 Somnus with Spur). Throughout the trial, heifers were observed twice daily for

clinical signs of respiratory illness during the first 21 days and then once daily for the remainder of the study. Clinical illness scores (CIS) and rectal body temperatures were used to identify and confirm illness. The CIS system was assessed as 1- normal, 2- mild depression, 3- severe depression, and 4- moribund. Respiratory illness was treated with a first treatment of florfenicol (Norfenicol; Norbrook, Lenexa, KS) and a vitamin and mineral drench (Bovitalize; Bimeda, Schaumburg, IL), with a second treatment of enrofloxacin (Enroflox 100; Norbrook, Lenexa, KS), and a third treatment of oxytetracycline (Noromycin 300 LA; Norbrook, Lenexa, KS). Heifers that continued to show signs of illness after the third treatment were declared as chronic and removed from the experiment. During the trial, five animals were found dead in pen (White A - 2, Red B - 1, and Blue C - 2). Necropsy confirmed animal death was related to bronchopneumonia linked to bovine respiratory disease complex. A total of 22 animals were removed from the study including 19 due to chronic respiratory cases (A - 6, B - 9, and C- 4), two for lameness (B - 1 and C - 1), and one for chronic bloat (Treatment A).

To measure water usage, iPERL water meters (SENSUS, Morrisville, NC) were connected to individual automatic waterers (Lil' Spring 3000; Miraco Livestock Water Systems, Grinnell, IA) for each pen. To measure DM intake, all calves were fed a common diet composed of 40.00% Sweet Bran (Cargill Animal Nutrition, Blair, NE), 30.01% prairie hay, 24.37% dry-rolled corn, and 5.63% pellet supplement. This ration was formulated to provide 53 Mcal net energy for gain and offered at *ad libitum* intake. Feed bunks were read at 7:00 a.m. each day and were targeted to be empty when feed was delivered at 8:00 a.m. When a feed refusal was present, the uneaten feed was weighed, a sample was taken for DM determination, the feed was not returned to the bunk, and a feed call adjustment was made for that day. Pen weights were collected on days 0, 28, and 56 of the study using a pen scale (Rice Lake Weighing Systems, Rice Lake, WI). Pen weights and head counts were used to determine the average weight of individual animals to calculate average daily gain (ADG) for the study.

Performance, DM intake, and water usage data were analyzed using the MIXED procedure of SAS (version 9.4; SAS Institute., Cary, NC). The model for BW, ADG, and feed efficiency included treatment as a fixed effect and block as a random effect. For DM intake and water usage, the initial model included fixed effects for treatment, day, and treatment ′ day. No treatment ′ day interactions were present ($P = 0.82$); therefore, the final model included a fixed effect of treatment and random effect of block. Health data were analyzed as binomial proportions of first, second, and third respiratory treatment and mortality using the GLIMMIX procedure of SAS (version 9.4; SAS Institute, Cary, NC). The model included fixed effects of treatment and random effects of block.

Results and Discussion

Following the 56-day backgrounding period, heifer final BW and ADG did not differ ($P \geq 0.35$; Table 1) between treatments. DM intake and feed efficiency showed no difference ($P \geq 0.53$) among treatments. Additionally, water usage did not differ ($P = 0.51$; Table 1) among treatments.

Implications

These data suggest that the combination of vaccine treatments used upon arrival in this study had no negative effects on the growth performance, feed efficiency, or health outcome of heifers. It is important to consider the health status of the cattle being vaccinated, as well as the number of injections given during a processing event.

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References

Richeson, J.T., H.D. Hughes, P.R. Broadway, and J.A. Carroll. 2019. Vaccination management of beef cattle: Delayed vaccination and endotoxin stacking. Veterinary Clinics of North America: Food Animal Practice 35(3):575-592. https://doi.org/10.1016/j.cvfa.2019.07.003

Table 1. Effect of arrival vaccine on growth performance, feed intake, feed efficiency, and water usage of newly received beef heifers

	Treatment[1]				
Item	Pyramid	Stimulator	Bovi-Shield Gold	SEM[2]	*P*-value[3]
Number of observations	9	9	9		
Number of heifers	122	120	124		
Body weight, lb					
day 0	500	499	499	2.4	0.82
day 28	595	589	601	4.9	0.16
day 56	675	672	682	5.0	0.36
Average daily gain, lb/day					
0-28	3.41	3.23	3.67	0.159	0.16
28-56	2.83	2.96	2.88	0.168	0.71
0-56	3.12	3.09	3.27	0.092	0.35
Dry matter intake, lb/day					
0-14	10.11	10.34	10.49	0.287	0.65
15-56	16.66	16.79	17.24	0.414	0.59
0-56	15.02	15.18	15.55	0.359	0.57
Gain:feed, lb/lb					
0-56	0.21	0.20	0.21	0.005	0.53
Feed:gain, lb/lb					
0-56	4.82	4.92	4.77	0.106	0.46
Water usage, gal/day					
0-14	4.54	4.48	4.86	0.200	0.36
15-56	5.08	5.13	5.31	0.249	0.62
0-56	4.94	4.97	5.20	0.171	0.51

[1] Vaccine treatments applied on day 0: Pyramid (Pyramid 5 + Presponse SQ [Boehringer Ingelheim, Ridgefield, CT] and Vision 7 Somnus [Merck Animal Health, Rahway, NJ]); Stimulator (Stimulator 5 [Bimeda, Schaumburg, IL], Pro-Bac 4 [Bimeda, Schaumburg, IL], and Vision 7 [Merck Animal Health, Rahway, NJ]); and Bovi-Shield Gold (Bovi-Shield Gold One Shot [Zoetis Inc., Parsippany, NJ] and Vision 7 Somnus [Merck Animal Health, Rahway, NJ]).
[2] Largest standard error of the mean.
[3] Treatment main effect.

Table 2. Effect of arrival vaccine on health of newly received beef heifers

	Treatment[1]				
Item	Pyramid	Stimulator	Bovi-Shield Gold	SEM[2]	*P*-value[3]
Morbidity, %					
Treated once[4]	52.67	45.04	41.22	0.327	0.17
Treated twice[5]	25.95	27.48	16.03	0.264	0.10
Treated thrice[6]	7.63	13.74	7.63	0.355	0.37
Chronic[7]	4.58	7.63	3.05	0.533	0.76
Mortality,[8] %	1.53	0.76	1.53	1.049	1.00

[1] Vaccine treatments applied on day 0. Pyramid (Pyramid 5 + Presponse SQ [Boehringer Ingelheim, Ridgefield, CT] and Vision 7 Somnus [Merck Animal Health, Rahway, NJ]); Stimulator (Stimulator 5 [Bimeda, Schaumburg, IL], Pro-Bac 4 [Bimeda, Schaumburg, IL], and Vision 7 [Merck Animal Health, Rahway, NJ]); and Bovi-Shield Gold (Bovi-Shield Gold One Shot [Zoetis Inc., Parsippany, NJ] and Vision 7 Somnus [Merck Animal Health, Rahway, NJ]).

[2] Largest standard error of the mean.

[3] Treatment main effect.

[4] Percentage within treatment of heifers treated once for bovine respiratory disease (BRD).

[5] Percentage within treatment of heifers treated a second time for BRD out of total population (heifers treated twice ÷ total population).

[6] Percentage within treatment of heifers treated a third time for BRD out of total population (heifers treated thrice ÷ total population).

[7] Percentage within treatment of heifers removed from the experiment due to BRD (removed heifers ÷ total population).

[8] Percentage within treatment of heifers within treatment that died from BRD-related illness.