A comparison of two modified-live viral vaccine programs on the performance and health outcomes of beef heifers being finished in a commercial feedlot.

TECHNICAL BULLETIN – 2022

CATTLE

KEY HIGHLIGHTS

1. The objective of this study was to evaluate differences in health and performance outcomes in beef heifers that received one of two different modified-live viral (MLV) vaccine protocols in a large-pen commercial feedlot setting.
2. The Bimeda group vaccine protocol consisted of Stimulator® 5[1], Stimulator 3 and Stimulator 2 + BRSV, the Control group vaccine protocol included Pyramid® 5[2], Pyramid 3 and Inforce® 3[3].
3. First pull BRD morbidity was significantly lower for the Bimeda vaccinated cattle than the Control vaccinated cattle.
4. There were no significant differences between the two groups in any other measured health or performance outcomes evaluated.

ABSTRACT:

Two thousand nine hundred sixty-six (2,966) moderate-risk beef heifers were utilized in a randomized complete block design to compare the health and performance outcomes between two different modified-live viral (MLV) vaccination programs. Twelve blocks, consisting of two pens each were used in this study, resulting in a total of 24 pens of heifers which averaged 571 lbs. on arrival (range of 486-695 lbs.). Heifers were fed for an average of 229 days (range of 188-277 days). First pull BRD morbidity was significantly lower for the Bimeda (BIM) vaccinated cattle compared to the Control (CON) vaccinated cattle (P=0.014). No differences were noted for average weight at enrollment, average final weight, average daily gain, dry matter intake, or feed-to-gain ratio in either the deads and removals in or the deads and removals out analysis. Overall morbidity, BRD treatment success, case fatality rate, total mortality, and total outs were not different between the two groups.

INTRODUCTION:

Bovine Respiratory Disease (BRD) continues to be a significant health challenge for growing and finishing cattle. Vaccination against viral pathogens is a common strategy used to mitigate the effects of BRD. Upon arrival to a U.S. feedlot, 96% of cattle receive a respiratory vaccine.[4] In this study, multi-product vaccination programs were compared. At initial processing, both programs received parenteral 5-way MLV vaccines with strains of IBR, BVD Types I and II, PI_3, and BRSV. Similarly, each group received parenteral 3-way MLV vaccines at approximately day 13 with IBR and BVD Types I and II. Vaccination at terminal implant did differ in route of administration, with the BIM group receiving a parenteral 3-way MLV vaccine with IBR, PI_3, and BRSV strains while the CON group received an intranasal 3-way MLV vaccine containing IBR, PI_3, and BRSV.

1 – Stimulator®, Bimeda Biologicals Inc. , San Angelo, TX
2 – Pyramid®, Boehringer Ingelheim Animal Health USA Inc., Duluth, GA
3 – Inforce®, Zoetis Animal Health, Parsippany, NJ
4 – USDA, Vaccine usage in the U.S. feedlots. No 672.0513. Fort Collins (CO): USDA, Animal and Plant Health Inspection Service, Veterinary Services Centers for Epidemiology and Animal Health; 2013

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MATERIALS AND METHODS:

Cattle – Heifers of similar age, background, health status, body weight and breed type were used in a randomized complete block design to compare the effects of two MLV vaccination programs on the health and performance outcomes of moderate-risk cattle fed in a commercial Central Plains feedyard. Cattle were sourced from four sale barns in Kansas and Oklahoma between 2/3/2021 and 3/17/2021.

Heifers with dairy breed influence or Mexican origin were not permitted to be enrolled in the study. Cattle that failed an on-arrival visual health inspection or displayed a pre-existing abnormal health condition were declared ineligible to participate.

Randomization and Processing – Heifers that qualified for study enrollment were randomly assigned to treatment group during arrival processing using a randomization scheme that consisted of sequential, independent permutations of the two treatments. A separate randomization was generated for each block. Upon arrival to the feedyard, heifers were placed in receiving pens according to origin and provided *ad libitum* access to hay and water. Heifers received their initial vaccination and were processed and handled according to the standard feedlot procedures within 72 hours after arrival of the last heifer procured for the block. In addition to the vaccine, all cattle received the following products at initial processing: 1% ivermectin injection, topical diflubenzuron and permethrin anti-parasiticide, oral benzimidazole drench dewormer, macrolide antimicrobial injection, a long-acting trenbolone acetate/estradiol combination implant, and a *Fusobacteria necrophorum* bacterin vaccine. The heifers enrolled in this study were revaccinated according to the treatment group at an average of 13 days on feed after arrival processing (range of 11 to 19 days). Both pens within a block were revaccinated on the same day. No other products were administered during revaccination. The heifers enrolled in this study were administered two growth-promoting implants while at the feedlot. The first implant contained 200 mg trenbolone acetate and 28 mg estradiol with a porous polymer film for extended pay-out and was administered during arrival processing. The second (terminal) implant administered also contained 200 mg trenbolone acetate and 28 mg estradiol and was administered an average of 112 days before close-out (range of 69 to 161 days). The heifers received their final respective vaccine concurrent with the administration of the terminal implant. No other products were administered concurrent with re-implant. Both pens within a block were re-implanted on the same day.

TREATMENT GROUP	BIMEDA	CONTROL
ARRIVAL	Stimulator 5	Pyramid 5
REVACCINATION	Stimulator 3	Pyramid 3
RE-IMPLANT	Stimulator 2 + BRSV	Inforce 3

Pens and Feed Management – Heifers were housed outside in dirt-floored pens with a concrete bunk apron, typical for the beef industry. Pens utilized for housing of study heifers were similarly designed and had similar pen square footage, feed bunk and water tank space. Feed and bunk management was similar for all pens. Each pen of heifers was acclimated to the finishing diet using a step-up program based on increasing diet concentrate levels. Feed bunks were assessed daily by a trained observer who estimated orts and determined the amount of feed to be delivered daily in order to provide near *ad libitum* access to feed. Water was available *ad libitum*.

Animal Health Management – Trained feedlot personnel evaluated the heifers daily for health. On any given day, both pens within a block were observed by the same individual to prevent confounding of the treatments by observer.

BRD Therapies – A five-day post-metaphylaxis interval was used during which only severe cases of bovine respiratory disease were eligible for treatment. Following this moratorium, heifers suspected to be affected by bovine respiratory disease, regardless of severity were taken to the hospital for evaluation including visual clinical signs, rectal temperature, body weight, and estimated degree of lung pathology based on thoracic auscultation. If warranted, first pull cattle received florfenicol/flunixin meglumine injection, cattle that required a second BRD treatment (second pull) received tulathromycin injection, cattle treated for a third time (third pull) received an enrofloxacin injection.

Heavy Respiratory/AIP Therapy – Cattle with less than 50 days until their projected harvest date, that weighed greater than 1,100 lbs, or both, suspected to be morbid with BRD or acute interstitial pneumonia (AIP) were permitted to receive a different therapeutic regimen with considerations given to drug withdrawal time and the ability to rail or send for emergency harvest. For their first treatment cattle received a danofloxacin injection, cattle that required a second treatment received a ceftiofur hydrochloride injection.

Necropsies were performed on cattle that were euthanized or found dead. All necropsies conducted for this study were performed by a veterinarian or trained feedlot employees.

Trial Completion – Heifers were shipped by block to a commercial packing plant as they became market ready between August and November 2021.

Statistical Analysis – Data were analyzed as a randomized complete block design with pen serving as the experimental unit. Continuous variables were analyzed using a linear mixed model and binary outcomes were analyzed using a generalized linear mixed model (PROC GLIMMIX; SAS Institute, Cary, NC). Models included the fixed effect of treatment and the random effect of block. The model estimation for binary variables was performed using a logit scale to link the events/trials response to a binomial distribution.

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RESULTS:

Health outcomes are displayed in TABLE 1. First pull BRD morbidity was significantly lower for the BIM vaccinated cattle ($P < 0.05$) than the CON vaccinated cattle. No differences were significant ($P > 0.05$) for the remaining health outcomes. Pen level growth performance summary statistics are displayed in TABLE 2. No differences were noted for average weight at enrollment, average final weight, Average Daily Gain, Dry Matter Intake, or feed-to-gain ratio in either the deads and removals in or the deads and removals out analysis.

TABLE 1: ***Health outcomes by MLV vaccine program***

VARIABLE	BIM[1], %	CON[2], %	SEM[3], %	P-VALUE
1st pull morbidity[4]	12.7	13.7	2.15	0.420
BRD 1st pull morbidity[5]	7.2	10.2	1.74	**0.014**
BRD 2nd pull morbidity[5],	1.2	1.4	0.48	0.574
BRD 3rd pull morbidity[5]	0.2	0.6	0.27	0.083
BRD 1st treatment success[6]	74.1	78.4	4.42	0.422
BRD 2nd treatment success[7]	54.7	51.5	11.43	0.838
BRD CFR[8]	14.3	9.6	3.21	0.255
BRD Respiratory CFR[9]	10.9	7.8	2.86	0.392
Mortality	2.17	2.04	0.450	0.804
BRD mortality	0.76	0.89	0.271	0.703
Digestive mortality	0.59	0.33	0.218	0.313
AIP mortality	0.20	0.33	0.164	0.498
Other mortality	0.61	0.47	0.202	0.627
Total Outs (Mortalities + Removals)	2.42	2.15	0.492	0.636
BRD Outs	0.83	0.96	0.280	0.713
Digestive Outs	0.59	0.33	0.218	0.313
AIP Outs	0.26	0.39	0.185	0.542
Other Outs	0.74	0.47	0.223	0.369

[1]BIM = Stimulator 5 during arrival processing (SQ in neck), revaccination with Stimulator 3 at 14 days on feed (SQ in neck), Stimulator 2 + BRSV during terminal reimplant processing (SQ in neck).
[2]CON = Pyramid 5 during arrival processing (SQ in neck), revaccination with Pyramid 3 at 14 days on feed (SQ in neck), Inforce 3 during terminal reimplant processing (intranasal).
[3]SEM = Standard Error of the Mean
[4]Percentage of heifers pulled and treated at least once for any ailment.
[5]Percentage of heifers who were treated once, twice, or three times for bovine respiratory disease, respectively.
[6]Percentage of heifers treated for BRD that did not die or require a 2nd treatment for BRD.
[7]Percentage of heifers treated a 2nd time for BRD that did not die or require a 3rd treatment for BRD.
[8]Percentage of heifers treated for BRD that died, regardless of cause.
[9]Percentage of heifers treated for BRD whose most probable cause of death was BRD or AIP.

TABLE 2: ***Live growth performance by MLV vaccine program***

VARIABLE	BIM[1], lbs.	CON[2], lbs.	SEM[3], lbs.	P-VALUE
Deads & Removals Out				
Enrollment weight	569.4	571.9	17.39	0.252
Final weight	1323.1	1323.4	8.24	0.951
Average daily gain	3.31	3.29	0.028	0.619
Dry matter intake	19.8	19.8	0.12	0.695
Feed-to-gain ratio	6.11	6.09	0.039	0.544
Deads & Removals In				
Enrollment weight	569.4	571.9	17.39	0.252
Final weight	1292.1	1295.3	8.74	0.691
Average daily gain	3.20	3.21	0.035	0.669
Dry matter intake	19.8	19.8	0.12	0.695
Feed-to-gain ratio	6.21	6.17	0.050	0.500

[1]BIM = Stimulator 5 during arrival processing (SQ in neck), revaccination with Stimulator 3 at 14 days on feed (SQ in neck), Stimulator 2 + BRSV during terminal reimplant processing (SQ in neck).
[2]CON = Pyramid 5 during arrival processing (SQ in neck), revaccination with Pyramid 3 at 14 days on feed (SQ in neck), Inforce 3 during terminal reimplant processing (intranasal).
[3]SEM = Standard Error of the Mean

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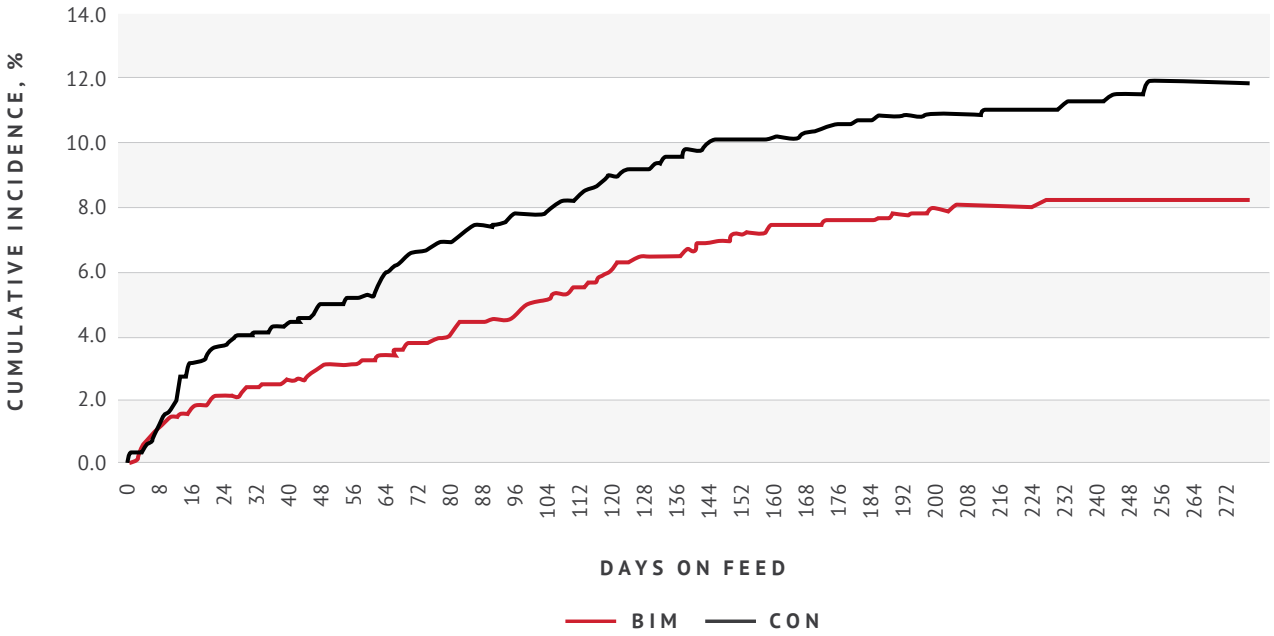
CONCLUSIONS:

Based on the results of this study, the cattle enrolled in the Bimeda group, which received the Stimulator vaccine protocol, had reduced first pull BRD morbidity as compared to the cattle enrolled in the Control group which received the vaccine protocol which included Pyramid and Inforce vaccines. While reduced first pull BRD morbidity at face value is an indication of better cattle health it can also be equated to other benefits that were not measured in this trial but are often top-of-mind for cattle producers. These additional benefits include lower labor costs and cattle stress associated with pulling and treating sick cattle, decreased antibiotic usage and lower treatment costs. Although multi-product vaccination protocols were compared in this study, most of the difference in first pull BRD incidence occurred between days 8 and 11. (GRAPH 1) which was before the revaccination.

GRAPH 1: ***BRD 1st pull morbidity cumulative incidence graph***



Note: model estimates in the results tables may vary slightly from the arithmetic mean depicted on the graph.

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