PEER REVIEWED

The Effect of Bovine Respiratory Syncytial Virus Vaccination on Health, Feedlot Performance and Carcass Characteristics of Feeder Cattle

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Abstract

A two-year study was conducted to determine the effects of a feedlot-arrival modified-live viral vaccination protocol containing adjuvanted bovine respiratory syncytial virus (BRSV) compared to a vaccination protocol not including adjuvanted BRSV on health, feedlot performance and carcass characteristics of feeder cattle. The vaccine products compared were a multivalent adjuvanted modified-live bovine rhinotracheitis, virus diarrhea, parainfluenza-3, respiratory syncytial virus vaccine (4-WAY) and a multivalent adjuvanted vaccine of similar formulation which did not contain BRSV (3-WAY). A total of 50 blocks, evenly divided between steers and heifers, were allocated to the study involving 19,099 cattle. Yearling feeder cattle were primarily used, with 161 average days on feed. Interactions were not observed between vaccine treatment and feedlot location, placement season, animal sex or animal age. Percent of overall morbidity due to respiratory disease was less (P = 0.0629) for cattle vaccinated with 4-WAY vaccine compared to 3-WAY. Overall mortality, expressed as the number of animals per pen that died (P = 0.0020) and percent deaths per pen (P = 0.0007), was improved for cattle vaccinated with 4-WAY versus 3-WAY vaccine. The number of animals per pen that died due to respiratory disease was less (P = 0.0060) for 4-WAY compared to 3-WAY. Overall case fatality, expressed as the number of treated animals per pen that died (P = 0.0116) and percent of treated animals that died (P = 0.1027), was improved for cattle vaccinated with 4-WAY versus 3-WAY vaccine. The number of animals treated for respiratory disease per pen that died was less (P = 0.0132) in the 4-WAY group compared to 3-WAY. Medical treatment cost per animal treated was $2.01 per head less ($P$ = 0.0688) for cattle vaccinated with 4-WAY. All other health parameters measured were similar between the two vaccine treatments.

Feedlot performance variables such as dry matter feed intake, average daily gain and feed conversion were not different between the two vaccine treatments. The majority of carcass characteristics measured were similar for the two vaccine treatments; however, the percent Yield Grade 2 carcasses were less (P = 0.0501) and the percent Yield Grade 3 carcasses greater (P = 0.0561) for cattle vaccinated with 4-WAY compared to 3-WAY. Net feedlot margin was numerically increased $4.33 per head for cattle vaccinated with 4-WAY vaccine, but this difference was not statistically different (P = 0.3057). It appears from this study that feedlot health parameters and some production costs can be improved for feeder cattle immunized for BRSV with an adjuvanted modified live antigen.

Résumé

Une étude de deux ans a été menée pour déterminer les effets de l'utilisation d'un protocole de vaccination dès l'arrivée au parc d'engraissement avec des virus vivants modifiés et un adjuvant de virus respiratoire syncytial bovin (BRSV) par rapport à un protocole sans adjuvant de BRSV sur la santé, la performance d'engraissement et les caractéristiques de la carcasse chez les bovins de boucherie. Le vaccin avec le virus respiratoire syncytial bovin (tétravalent) comprenait un adjuvant multivalent de virus vivants modifiés de la rhinotrachéite bovine, de la diarrhée et de parainfluenza-3 alors que l'autre type de vaccin comprenait un adjuvant multivalent similaire mais sans le BRSV (trivalent). Un total de 50 blocs, partagés également entre les bouvillons et les taures, ont été utilisés dans l'étude qui comprenait 19 099 bovins. Des

bovins de boucherie de l'année ont surtout été utilisés avec en moyenne 161 jours passés à l'engraissement. Il n'y avait pas d'interaction entre le traitement avec vaccin et la localisation dans le parc, la saison d'engraissement, le sexe ou l'âge de l'animal. Le pourcentage global de morbidité associée à des problèmes respiratoires était moindre (p = 0.063) chez le bétail vacciné avec le vaccin tétravalent qu'avec le vaccin trivalent. La mortalité globale, définie comme étant le nombre d'animaux morts par enclos (p = 0.002) et le pourcentage de mortalité par enclos (p = 0.0007) était moindre chez les animaux recevant le vaccin tétravalent plutôt que le vaccin trivalent. Le nombre d'animaux morts par enclos en raison de problèmes respiratoires était moindre avec le vaccin tétravalent qu'avec le vaccin trivalent (p = 0.006). La fatalité globale, définie comme étant le nombre d'animaux traités morts par enclos (p = 0.012) et le pourcentage d'animaux traités qui sont morts (p = 0.103) était moindre chez les animaux recevant le vaccin tétravalent plutôt que le vaccin trivalent. Le nombre d'animaux traités morts par enclos en raison de problèmes respiratoires était moindre (p = 0.013) avec le vaccin tétravalent qu'avec le vaccin trivalent. Le traitement médical pour les animaux traités coûtait $2.01 de moins par tête chez le bétail vacciné avec le vaccin tétravalent. Les autres paramètres de santé étaient similaires entre les deux groupes de vaccination (les valeurs de p allant de 0.189 à 0.797).

Les variables reliées à la performance dans le parc, tels la prise alimentaire de matières sèches, le gain moyen quotidien et la conversion alimentaire, n'étaient pas différentes entre les deux groupes de vaccination (les valeurs de p allant de 0.748 à 0.996). La majorité des caractéristiques de carcasse mesurées étaient similaires (les valeurs de p allant de 0.232 à 0.974) dans les deux types de traitement. Toutefois, le pourcentage de carcasses avec le grade de rendement 2 était moindre (p = 0.050) alors que le pourcentage de carcasses avec le grade de rendement 3 était plus élevé (p = 0.056) avec le vaccin tétravalent qu'avec le vaccin trivalent. Le gain marginal net dans le parc était accru de $4.33 par tête de bétail vacciné avec le vaccin tétravalent mais cette hausse n'était pas statistiquement significative (p = 0.306). Il semble ressortir de cette étude que les paramètres de santé et les coûts de production peuvent être changés pour le mieux chez le bétail d'engraissement immunisé contre le BRSV avec un adjuvant d'antigènes vivants modifiés.

Introduction

Bovine respiratory syncytial virus (BRSV) is a pneumovirus in the family Paramyxoviridae.[2,6] BRSV can infect young and adult cattle resulting in inappetence, fever, coughing, dyspnea and abnormal lung sounds indicating interstitial pneumonia, with death occurring in animals with severe respiratory distress.[13] Surveys of feedlot cattle routinely demonstrate seroconversion to BRSV within the first month following arrival.[9] Seroconversion to BRSV can occur in animals that develop respiratory disease or remain clinically normal. However, when compared to calves with higher BRSV titers, calves with lower BRSV titers at feedlot arrival were at increased risk of developing respiratory disease. BRSV seroconversion can be high in various populations of cattle with minimal evidence of clinical respiratory disease associated with the virus.[8]

Over approximately the last 20 years, numerous studies have been conducted to determine the effect of BRSV vaccination on health and performance of growing and finishing cattle. In a summary of peer-reviewed field efficacy studies based on scientific methodology, a variety of results were reported for cattle administered a BRSV-containing vaccine upon arrival at the production unit.[12] In some studies, positive effect on cattle health was observed.[4,17] In other studies, no differences were found between BRSV vaccinates and control animals.[1,4,5,10,17]

In studies conducted with transported auction-market calves and transported freshly weaned calves, beneficial health results were observed when a killed BRSV vaccine was administered upon arrival at the production unit.[4] With the auction-market derived calves, BRSV vaccination reduced 60-day treatment rates from 45 to 29% (OR = 2.0; $P = 0.00001$). Sixty-day morbidity levels were improved from 16.5 to 12% (OR = 1.4; $P = 0.001$) in the freshly weaned calves given a BRSV vaccine. However, treatment rates for freshly weaned calves that were given a killed BRSV vaccine but not transported did not differ from the calves in the control group ($P = 0.75$). In this study, treatment rates were extremely low, 1.3% for the BRSV group versus 0.5% for the control cattle.[4]

In another study conducted in a commercial feedlot, calves given a modified-live viral vaccine containing BRSV experienced an improvement in treatment rate from 21 to 17% ($P < 0.05$) during an eight-week observation period.[17] In this same study, no differences were determined for yearling age cattle.

No health advantage was found for bull calves given a modified-live BRSV vaccine upon arrival at a bull test station, compared to a non-BRSV treatment.[17] In two other studies utilizing either commercially fed, auction-market derived yearlings[17] or non-defined calves,[1] no health benefits were observed from a modified-live BRSV vaccine compared to a control treatment. No differences in health parameters were found in two additional studies with calves[10] and stocker cattle[5] given BRSV vaccines versus a control treatment. In these studies, the type of BRSV vaccine (modified-live or killed) was not described in the experimental procedures.

In the National Animal Health Monitoring System's (NAHMS) Feedlot '99 study, it was reported that 70.9% ± 4.2 SE (standard error) of all cattle placed into feedlots received an injectable vaccine containing BRSV,[16] while 96.9% ± 0.8 SE received an injectable vaccine containing infectious bovine rhinotracheitis (IBR). According to this study, the percentage of cattle vaccinated for BRSV was also different between small and large feedlots. In feedlots with a one-time capacity of 1,000 to 7,999 head, 87.3% of the cattle were vaccinated for BRSV, and those with a capacity of 8,000 head or greater were only vaccinating 67.8% of the cattle for BRSV.

The purpose of this study was to compare outcomes related to health, feedlot performance and carcass characteristics between feeder cattle vaccinated at arrival with a modified-live viral vaccination protocol containing adjuvanted BRSV and feeder cattle vaccinated at arrival using a modified-live viral vaccination protocol that did not contain adjuvanted BRSV.

Materials and Methods

The study was conducted at three commercial feedlots in northern Colorado. The feedlots are located at Greeley, Fort Lupton and Wellington, Colorado, and have onetime capacities of 20,000, 20,000 and 14,000 head, respectively. Design and construction of these facilities is typical of other commercial feedlot facilities in northern Colorado. Cattle were fed in open-air, dirt-floored pens providing approximately 200 square feet of pen space and 12 inches (30.5 cm) of feed bunk space per animal. At each feedlot location, facilities are available to administer processing and hospital treatments.

Crossbred beef steers and heifers were used for this study, and were obtained primarily from auction-market facilities located in the central and western parts of the United States. Cattle were transported by truck from points of purchase to the respective feedlot location. Cattle utilized in the study varied in age, however, the majority of animals were classified as yearlings. The first replication of treatments was started on March 16, 2001 and the final replication on April 17, 2003.

All truckload lots required to fill a block (replication) were received at the respective feedlot location at about the same time (maximum time to fill a block was seven days). Within truckload lot, cattle were of similar age, background, health status, weight and breed type. Upon arrival at each feedlot facility, cattle of the same sex were randomized within truckload lot to one of two processing groups. Within each block, only steers or heifers were utilized. Randomization of animals to processing group occurred by means of a working alley sort. In 33 blocks, cattle were sorted to processing groups by means of a two-by-two allotment; 13 blocks were randomized using a five-by-five sort; three blocks were allotted with a one-by-one sort; and one block was randomized with a three-by-three sort. Processing groups within any one block were of equivalent animal number. After animal allotment, processing groups were randomly assigned by coin toss to home pens, and one of two vaccine treatments: 1) a multivalent adjuvanted modified-live bovine rhinotracheitis, virus diarrhea, parainfluenzia-3, bovine respiratory syncytial vaccine[a] (4-WAY) or 2) a multivalent adjuvanted modified-live bovine rhinotracheitis, virus dirrhea, parainfluenza-3 vaccine[b] (3-WAY) of similar formulation, but did not contain BRSV.

Following animal and vaccine treatment randomization, all cattle were ear-tagged (pen/lot identification), implanted with a growth implant,[c] treated for internal and external parasites,[d] given their respective vaccine treatment and weighed. Weighing conditions were identical for treatment groups within a block. Processing group weights were prorated to purchase weights, and the prorated weights were used as initial study weights (initial study weight = processing group weight [purchase weight ÷ processing group weight]). At conclusion of the processing procedures, cattle were taken to their assigned home pens. Every attempt was made to equalize pen location effects when allocating treatment groups to pen locations. Pens within a block were of similar design, and had equivalent pen square footage, feed bunk and water space.

A total of 50 blocks were allocated to the study, involving 19,099 cattle. Table 1 provides a summary of number of cattle and pens (replications) across feedlot locations.

At all feedlot locations, cattle were fed diets containing steam-processed and flaked corn, corn silage, chopped alfalfa hay, liquid supplement and soybean meal. Cattle were started on a medium concentrate diet following feedlot arrival, and over a period of two to four weeks transitioned to a high concentrate diet containing greater than 90% concentrate for the remainder of the feeding period. Diets were formulated to meet or exceed the nutritional requirements for feedlot cattle, and cattle were fed *ad libitum* twice per day.[11] The finishing diet contained monensin[e] and tylosin[e] with the heifers blocks also receiving melengestrol acetate.[f] Diet and feed bunk management were similar for pens within a block. Feed amounts were recorded for all pens on a daily basis along with diet dry matter content. If feed was removed from the feed bunks, the amount was recorded with the respective weigh-back dry matter. Hospital, buller (cattle, normally steers, that are excessively ridden by their pen mates and consequently removed from their home pens to reduce the incidence of injury and production loss) and realizer (cattle typically not capable of finishing with their pen mates due to illness

Table 1. Summary of cattle and pens by feedlot location.

Feedlot location		3-WAY vaccine[a]		4-WAY vaccine[b]		
		Steers	Heifers	Steers	Heifers	Total, n
Greeley	Cattle, n	3225	3453	3225	3453	13356
	Pens, n	15	19	15	19	68
Fort Lupton	Cattle, n	1342	306	1342	306	3296
	Pens, n	6	2	6	2	16
Wellington	Cattle, n	517	707	515	708	2447
	Pens, n	4	4	4	4	16
Total	Cattle, n	5084	4466	5082	4467	19099
	Pens, n	25	25	25	25	100

[a]Pyramid® 3, Fort Dodge Animal Health, Ft. Dodge, IA
[b]Pyramid® 4, Fort Dodge Animal Health, Ft. Dodge, IA

or injury, and normally harvested at a different time than their pen mates) feed was accounted for and assigned to the appropriate home pen. Water was provided *ad libitum*.

Feedlot personnel observed the cattle on a daily basis and were blinded to the vaccine treatment status of each pen. Cattle husbandry practices (hospital pulls, treatments and recoveries plus buller and realizer management) were similar for pens within a block. Hospital pulls and treatments were recorded (reason pulled, treatment regimen, days spent in the hospital and recovery). Cattle removed from the study (deads, bullers and realizers) were documented (date removed, animal weight and reason for removal). Necropsies were performed on dead animals by the attending veterinarian or trained feedlot personnel.

Normal feedlot data were collected to include feed intake, animal weight, days on feed, morbidity, treatment relapses, mortality, case fatality, realizers and bullers. Final body weights were calculated using two methods. The final live weight for a pen of animals was calculated from weights obtained by weighing the cattle on the truck or weighing them on-foot on the scales at the feedlot prior to transportation and harvest. Final live weights were then shrunk 4 or 5%, respectively, depending on morning or afternoon weigh period. Carcass-adjusted final weight was calculated by dividing the hot carcass weight of the pen by the average dressing percentage of 63.0.

When it was determined that a complete block of pens was finished and ready for harvest, a final weigh day was scheduled. Cattle were allowed access to feed and water up to the time they were loaded onto trucks for shipment to the packing plant. Weighing conditions across pens within a block were similar. Harvest data collected included United States Department of Agriculture quality and yield grades, as well as hot carcass weights and incidence of dark cutting carcasses and carcass weights greater than 950 lb (432 kg). Harvest conditions were similar for pens within a block, with cattle being processed at the same packing plant and time interval.

Data were analyzed using SAS (SAS Institute Inc., Cary, NC, USA., Software Version 8). Continuous variables were analyzed using multivariate analysis of variance (ANOVA) procedures. Categorical variables were analyzed using Chi-square procedures. The model statement tested main effect and interaction terms for vaccine treatment, animal sex, animal age, feedlot location, placement season and block. An individual pen was the experimental unit for all analyses. Percentage variables were analyzed after transforming the data using the arcsine or square root transformation if needed. Financial information for comparative analysis was obtained from individual pen commercial closeout summaries.

Results

A total of 100 pens and 19,099 cattle were allocated to the study, with average days on feed of 161 (Table 2). As indicated by the average days on feed, the majority of the cattle involved with this study were yearlings, with only five blocks described as calves. Blocks were evenly split between steers and heifers, with each having 25 replicates per vaccine treatment. Since cattle were placed onto study during a two-year period, this allowed for determination of potential interactive effects of placement season on vaccine treatment. Potential interactions of feedlot location, animal sex and animal age with vaccine treatment were also analyzed. None of these factors had a significant interaction with vaccine treatment.

The overall levels of morbidity and mortality observed in this study were relatively low, and would be characteristic of the class of cattle utilized for the research (Table 3). Overall morbidity and respiratory morbidity per pen were not affected (P = 0.7969 and 0.5031, respectively) by vaccine treatment. However, the total number of animals that died per pen was significantly reduced (P = 0.0020) in the 4-WAY treatment group compared to the 3-WAY. This was also true for the number of animals that died per pen due to respiratory disease; 4-WAY vaccine provided improved (P = 0.0060) results compared to 3-WAY. Overall treatment and respiratory treatment relapses per pen were not different (P = 0.5086 and 0.5184, respectively) between vaccine treatments. Overall case fatality and respiratory case fatality per pen were improved (P = 0.0116

Table 2. Ancillary data summary.

Parameter	3-WAY vaccine[a]	4-WAY vaccine[b]	P level	Analysis
Total pens, n	50	50	—	—
Steer pens, n	25	25	—	—
Heifer pens, n	25	25	—	—
Yearling pens, n	45	45	—	—
Calf pens, n	5	5	—	—
Average number of cattle per pen, n	191	191	0.9983	ANOVA
Total cattle, n	9550	9549	—	—
Smallest number of cattle per pen, n	73	73	—	—
Largest number of cattle per pen, n	420	420	—	—
Earliest start date	3/16/2001	3/16/2001	—	—
Latest start date	4/17/2003	4/17/2003	—	—
Shortest days on feed, d	125	125	—	—
Longest days on feed, d	200	200	—	—
Average days on feed, d	161	161	0.8679	ANOVA

[a]Pyramid® 3, Fort Dodge Animal Health, Ft. Dodge, IA
[b]Pyramid® 4, Fort Dodge Animal Health, Ft. Dodge, IA

Table 3. Health data summary – number of cattle per pen.

Parameter	3-WAY vaccine[a]	4-WAY vaccine[b]	P level[k]	Standard error
Overall morbidity, n[c]	17.2	16.5	0.7969	1.70
Respiratory morbidity, n[d]	9.6	8.7	0.5031	1.41
Overall mortality, n[e]	1.3	0.6	0.0020	0.26
Respiratory mortality, n[f]	0.7	0.3	0.0060	0.20
Overall treatment relapses, n[g]	4.8	4.2	0.5086	0.97
Respiratory treatment relapses, n[h]	3.9	3.3	0.5184	0.81
Overall case fatality, n[i]	0.6	0.3	0.0116	0.16
Respiratory case fatality, n[j]	0.5	0.2	0.0132	0.14

[a]Pyramid® 3, Fort Dodge Animal Health, Ft. Dodge, IA
[b]Pyramid® 4, Fort Dodge Animal Health, Ft. Dodge, IA
[c]Number of animals per pen that were given health treatments.
[d]Number of animals per pen that were treated for respiratory disease. Case definition for respiratory disease: rectal body temperature of approximately 103.5F or higher and abnormal clinical signs of the respiratory system. In the decision process for treatment, abnormal clinical signs were given more consideration than rectal body temperature.
[e]Number of animals per pen that died.
[f]Number of animals per pen that died due to respiratory disease.
[g]Number of treated animals per pen that required re-treatment.
[h]Number of animals treated for respiratory disease per pen that required re-treatment.
[i]Number of treated animals per pen that died.
[j]Number of animals treated for respiratory disease per pen that died.
[k]All parameters were analyzed using Chi-square procedures.

and 0.0132) for the 4-WAY vaccine group compared to the 3-WAY.

Overall morbidity rates for animals in each pen were not different (P = 0.7685) between vaccine treatments (Table 4). However, respiratory morbidity rates expressed as a proportion of overall morbidity were less (P = 0.0629) for cattle vaccinated with 4-WAY compared to 3-WAY. Overall treatment relapses and respiratory treatment relapses expressed as a percent of animals treated were not different (P = 0.1892 and 0.5212, respectively) between vaccine treatments. Percent overall mortality was improved (P = 0.0007) when 4-WAY vaccine was used versus 3-WAY. However, respiratory mortality rates were not different (P = 0.6970) between the two vaccine treatments. In pens of cattle given the 4-WAY vaccine, the overall case fatality rate tended to be less (P = 0.1027) compared to 3-WAY treated cattle. However, the respiratory case fatality rate and percent realizers were not different (P = 0.3955 and 0.5985, respectively) between the two vaccine treatments.

Medical treatment cost per animal treated was $2.01 per head less ($P$ = 0.0688) for cattle vaccinated with 4-WAY vaccine compared to those that received 3-WAY. Due to improvements in treatment response and associated costs along with reduction in mortality, net feedlot margin was numerically increased $4.33 per head for cattle vaccinated with 4-WAY compared to 3-WAY, however, this difference was not statistically different (P = 0.3057).

Average daily gains and feed conversions are summarized in Table 5. No significant differences (P values varied from 0.5743 to 0.9958) were observed between vaccine treatments for any of the feedlot performance factors measured during the study.

Carcass characteristics are summarized in Table 6 for the two vaccine treatments. With the exception of two yield grade classifications, no statistical differences (P values varied from 0.2323 to 0.9742) were observed between the two vaccine treatments for the various carcass characteristics measured during the study. Differences (P = 0.0501 and 0.0561, respectively) were observed for the Yield Grade 2 and 3 classifications between vaccine treatments, with carcass cutability being reduced for cattle vaccinated with 4-WAY compared to those vaccinated with 3-WAY.

Discussion

In this study, several health parameters were improved for pens of feeder cattle given an adjuvanted modified-live vaccine containing BRSV at feedlot arrival. In previous studies, statistically positive and neutral health effects were observed for cattle administered a BRSV vaccine compared to a non-BRSV control.[1,4,5,10,17] In the majority of these studies, animal numbers were quite limited, and none of the previous studies contained the number of animals or pen replications used in the

Table 4. Health data summary – percent incidence.

Parameter	3-WAY vaccine[a]	4-WAY vaccine[b]	P level[l]	Standard error
Overall morbidity, %[c]	5.89	5.70	0.7685	0.90
Respiratory morbidity, %[d]	86.98	79.91	0.0629	5.11
Overall treatment relapses, %[e]	42.84	35.71	0.1892	7.00
Respiratory treatment relapses, %[f]	36.19	32.21	0.5212	6.85
Overall mortality, %[g]	0.69	0.30	0.0007	0.15
Respiratory mortality, %[h]	53.25	43.62	0.6970	16.83
Overall case fatality, %[i]	6.30	3.63	0.1027	2.57
Respiratory case fatality, %[j]	6.14	4.76	0.3955	3.89
Realizers, %[k]	0.76	0.84	0.5985	0.20

[a]Pyramid® 3, Fort Dodge Animal Health, Ft. Dodge, IA
[b]Pyramid® 4, Fort Dodge Animal Health, Ft. Dodge, IA
[c]Percent of animals in each pen that were treated for health problems.
[d]Percent of overall morbidity that was due to respiratory disease. Case definition for respiratory disease: rectal body temperature of approximately 103.5F or higher and abnormal clinical signs of the respiratory system. In the decision process for treatment, abnormal clinical signs were given more consideration than rectal body temperature.
[e]Percent of treated animals that relapsed and required re-treatment.
[f]Percent of overall treatment relapses that were due to respiratory disease.
[g]Percent deaths per pen.
[h]Percent of overall mortality that was due to respiratory disease.
[i]Percent of treated animals that died.
[j]Percent of animals treated for respiratory disease that died.
[k]Percent of animals sold prior to finishing (abnormal performance due to illness or injury).
[l]Analysis of Variance.

Table 5. Feedlot performance data summary.

Parameter	3-WAY vaccine[a]	4-WAY vaccine[b]	P level[h]	Standard error
Initial weight, lb	759	757	0.8157	7.36
Final weight (live), lb[c]	1300	1302	0.7357	7.08
Final weight (carcass adjusted), lb[d]	1329	1329	0.9931	5.95
Average daily gain (live), lb[c]	3.36	3.37	0.8678	0.05
Average daily gain (carcass adjusted), lb[d]	3.52	3.52	0.9906	0.04
Daily dry matter feed intake, lb	20.88	20.88	0.9958	0.20
Feed conversion (live), lb[c,e]	6.24	6.23	0.8674	0.09
Feed conversion (carcass adjusted), lb[d,e]	5.95	5.97	0.7478	0.07
Bullers, n[f]	6.4	6.1	0.8657	1.33
Bullers, %[g]	3.00	2.77	0.5743	0.56

[a]Pyramid® 3, Fort Dodge Animal Health, Ft. Dodge, IA
[b]Pyramid® 4, Fort Dodge Animal Health, Ft. Dodge, IA
[c]Final live weight shrunk 4 or 5%, respectively, depending on morning or afternoon weigh period.
[d]Carcass weight divided by 0.63.
[e]Pounds of feed per pound of gain.
[f]Number of bullers per pen.
[g]Percent bullers per pen.
[h]All parameters were analyzed using Analysis of Variance procedures except bullers, n which was Chi-square.

Table 6. Carcass characteristic data summary.

Parameter	3-WAY vaccine[a]	4-WAY vaccine[b]	P level[d]	Standard error
Hot carcass weight, lb	837	838	0.7109	3.80
Carcass yield, %[c]	64.31	64.31	0.9742	0.17
Prime quality grade, %	2.6	2.1	0.2323	0.50
Choice quality grade, %	57.2	55.6	0.3729	2.30
Select quality grade, %	37.1	38.8	0.4009	2.51
Standard quality grade, %	1.9	2.0	0.7521	0.69
Other quality grade, %	1.2	1.5	0.3890	0.43
Certified angus beef, %	6.0	6.7	0.3564	1.01
Dark cutting carcass, %	0.4	0.3	0.6759	0.15
Carcasses > 950 lb, %	7.7	8.2	0.4408	0.88
Yield Grade 1, %	5.7	5.0	0.2578	0.74
Yield Grade 2, %	39.0	35.3	0.0501	2.38
Yield Grade 3, %	52.1	56.0	0.0561	2.51
Yield Grade 4 + 5, %	3.2	3.7	0.2825	0.67

[a]Pyramid® 3, Fort Dodge Animal Health, Ft. Dodge, IA
[b]Pyramid® 4, Fort Dodge Animal Health, Ft. Dodge, IA
[c]Carcass weight divided by shrunk final live weight.
[d]Analysis of Variance.

current study. Results of this study demonstrate the importance of having sufficient statistical power (replication) to adequately detect small changes in health parameters that produced meaningful differences between the vaccine treatments.

Similar to previous studies,[4,17] respiratory morbidity rate was improved in this study for cattle vaccinated for BRSV versus the non-BRSV control. Additionally, in the current study, overall mortality (absolute number and rate) and respiratory mortality (absolute number) were reduced for the BRSV treatment. As importantly, overall case fatality (absolute number and rate) and respiratory case fatality (absolute number) were benefited by inclusion of BRSV in the arrival vaccination program. A recently published large feedlot study with fall placed, auction-market derived calves comparing 4-WAY[a] vaccine to IBR[g] only (1-WAY) demonstrated significant benefits for 4-WAY vaccinated calves relative to final animal weight, weight gain per animal, daily dry matter intake, average daily gain, initial undiffer-

entiated fever rate and first undifferentiated fever relapse rate.[14] Since this study compared a multivalent viral vaccine (bovine rhinotracheitis, bovine virus diarrhea, bovine parainfluenza-3 and bovine respiratory syncytial virus) to a univalent viral vaccine (bovine rhinotracheitis), it is difficult to determine which vaccine viral component(s) provided the observed benefits. However, this recent study does agree with the current study in that additional vaccine viral antigens may be important to the economic success of a feedlot arrival program.

Unlike many modified-live BRSV vaccines currently marketed that require both an initial BRSV dose and revaccination with BRSV vaccine for adequate protective immunity, the 4-WAY vaccine used in this study is licensed as a one-dose BRSV vaccine.[7,18] Since it was only administered once at initial processing and cattle were not revaccinated, similar health results obtained in this study when using an adjuvanted 4-WAY vaccine may not be achieved with other modified-live BRSV vaccines with a multiple-dose label for BRSV.

The adjuvant Metastim® is contained in Pyramid[a,b] vaccines used in this study. In theory, Metastim could serve two purposes relative to enhancement of the immune response: 1) efficient presentation of the antigen to the immune system and 2) antigen protection from existing antibodies present in the animal due to previous virus exposure.[15] In the case of BRSV, antigen protection from existing antibody may be important for optimum vaccine response, since it would be assumed that a large proportion of feeder cattle would have some level of circulating BRSV antibody present due to prior vaccination or natural exposure. In previous work, a positive BRSV serological response to adjuvanted 4-WAY vaccination was observed in cattle with pre-existing serum neutralization titers to BRSV.[3]

Conclusions

Results of this study indicate that feedlot health parameters and some production costs can be improved for feeder cattle immunized for BRSV utilizing an adjuvanted modified-live antigen.

Footnotes

[a]Pyramid® 4 (bovine rhinotracheitis-virus diarrhea-parainfluenza-3-respiratory syncytial virus vaccine, modified-live virus, 2 mL dose subcutaneous or intramuscular), Fort Dodge Animal Health, Division of Wyeth, Fort Dodge, IA.

[b]Pyramid® 3 (bovine rhinotracheitis-virus diarrhea-parainfluenza-3 vaccine, modified-live virus, 2 mL dose subcutaneous or intramuscular), Fort Dodge Animal Health, Division of Wyeth, Fort Dodge, IA.

[c]Cattle with a projected days on feed of 140 or less were given an implant (Revalor®-S [steer blocks], Intervet, Inc., Millsboro, DE; Synovex Plus® [heifer blocks], Fort Dodge Animal Health, Division of Wyeth, Fort Dodge, IA) at initial processing with no further implants administered during the feeding period. Cattle with a projected days on feed of greater than 140 days were given either a Synovex® S (steer blocks; Fort Dodge Animal Health, Division of Wyeth, Fort Dodge, IA.) or Synovex® H (heifer blocks; Fort Dodge Animal Health, Division of Wyeth, Fort Dodge, IA.) at initial processing and were provided a terminal implant of Revalor-S (steer blocks) or Synovex Plus (heifer blocks) approximately 100 days prior to harvest. Pens within a block were given their terminal re-implant on the same day. If blocks were re-implanted they were given a dose of Pyramid® IBR (Bovine Rhinotracheitis Virus Vaccine, modified-live virus, 2 mL dose subcutaneous or intramuscular, Fort Dodge Animal Health, Division of Wyeth, Fort Dodge, IA.) at time of re-implanting. Also, if blocks were re-implanted during the fall/winter period, they were provided a dose of Cylence® Pour-On Insecticide (12 mL dose topical, Bayer Animal Health Division, Shawnee Mission, KS).

[d]Dectomax® Injectable Solution (200 mcg/kg, subcutaneous or intramuscular), Pfizer, Inc., Animal Health Group, New York, NY. Cylence Pour-On Insecticide (blocks started on study during fall/winter period, 8 mL dose topical), Bayer Animal Health Division, Shawnee Mission, KS.

[e]Rumensin (monensin, 30 g/ton); Tylan (tylosin, 60 mg/head/day), Elanco Animal Health, Division of Eli Lilly & Co., Indianapolis, IN.

[f]MGA (melengestrol acetate, 0.4 mg/head/day), Pharmacia & Upjohn Co., Kalamazoo, MI.

[g]Pyramid® IBR (bovine rhinotracheitis vaccine, 2 mL subcutaneous or intramuscular), Fort Dodge Animal Health, Division of Wyeth, Fort Dodge, IA.

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Abstract

The Impact of Reduced Veterinary Visits During the 2001 Foot and Mouth Outbreak and its effect on Dairy Herd Reproductive Performance

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The lack of routine fertility visits for three months during the 2001 FMD outbreak did not significantly alter the parameters of calving to first service and pregnancy when compared to the same quartiles of 2000 and 2002. One herd in this study (with too few numbers to be of any statistical significance) had an extended calving to pregnancy interval during the period of no veterinary visits. It would appear that in an effort to reduce veterinary costs, fewer cows are presented for fertility treatment which may, in part, be responsible for the increase in calving indices. With the future likelihood of fewer farm staff and pressure on available work time this situation may be exacerbated i.e. fewer cows presented for veterinary examination.