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Comparing respiratory disease treatment rates in preconditioned calves vaccinated with 4-way killed or modified-live virus vaccine

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Abstract

This prospective longitudinal study was conducted in a commercial backgrounding operation to compare bovine respiratory disease (BRD) treatment rates of 2 groups of 491 lb (223 kg) preconditioned feeder calves (n = 772) during 2 backgrounding periods (average 134 days). The preconditioning program was the same for both groups of calves, with the exception that 1 group was vaccinated prior to delivery with 4-way killed-virus (KV) respiratory vaccine, and the other group with 4-way modified-live virus (MLV) respiratory vaccine. Assessment of vaccine efficacy was determined by BRD treatment rates during the backgrounding periods. Results demonstrated a treatment by weight interaction, as calves at the 25th percentile of the population for initial weight and vaccinated with MLV respiratory vaccine had a significantly (P = 0.03) lower treatment rate compared with calves at the 25th percentile that were vaccinated with KV vaccine. Over both backgrounding periods, 66 of 380 calves (17%) that received KV vaccine were treated for disease and 56 survived, whereas 17 of 381 calves (4%) that received MLV respiratory vaccine were treated and 9 survived. An analysis of risk factors showed that the relative risk that calves receiving KV vaccine would require treatment for BRD was 26% higher than for calves receiving MLV vaccine; that 74% fewer calves were treated for BRD when MLV vaccines were administered; and that for every 8 calves vaccinated with MLV vaccine, 1 fewer calf would require treatment for BRD than if the same number of calves were vaccinated with KV vaccine.

Key words: *cattle, BRD, preconditioning, vaccine*

Résumé

Cette étude longitudinale prospective a été menée dans une entreprise de pré-engraissement commerciale afin de comparer le taux de traitement pour le complexe respiratoire bovin dans deux groupes de veaux en pré-conditionnement de 491 lb (223 kg) (n = 772) lors de deux périodes de pré-engraissement (en moyenne 134 jours). Le programme de pré-conditionnement était le même pour les deux groupes de veaux. Dans un des groupes, les veaux ont été vaccinés avant leur départ avec un vaccin respiratoire tétravalent à virus inactivés (KV). Les veaux dans l'autre groupe ont été vaccinés avec un vaccin respiratoire tétravalent à virus vivants modifiés (MLV). L'efficacité du traitement a été jugée en fonction du taux de traitement pour le complexe respiratoire bovin durant les périodes de pré-engraissement. Les résultats ont mis en évidence une interaction entre le traitement et la masse : les veaux dans le premier quartile de la population pour la masse initiale et vaccinés avec le vaccin MLV avaient un taux de traitement pour le complexe respiratoire bovin moins élevé (P = 0.03) que les veaux de ce même quartile mais qui avaient reçu le vaccin KV. Lors des deux périodes de pré-engraissement, 17% des veaux (66 sur 381) qui avaient reçu le vaccin KV ont été traités pour la maladie et 56 ont survécu alors que 4% des veaux (17 sur 381) qui avaient reçu le vaccin MLV ont été traités et neuf ont survécu. Le risque qu'un veau nécessite un traitement pour le complexe respiratoire bovin était 26% plus élevé dans le traitement KV que dans le traitement MLV. De plus, 74% moins de veaux ont été traités pour le complexe respiratoire bovin avec le vaccin MLV. Finalement, pour chaque huit veaux vaccinésavec le vaccin MLV, un de moins nécessiterait un traitement pour le complexe respiratoire que si le même nombre de veaux avaient été vaccinés avec le vaccin KV.

Introduction

Bovine respiratory disease (BRD) remains the most significant health problem facing both the stocker and feedlot segments of the beef cattle industry in the United States, with an annual cost estimated at $750 to $900 million.[4,6,14,16,36,38,42] Factors contributing to the lower economic returns of sick cattle are higher mortality, higher medical costs, increased cost of gain, and reduced carcass value (reduced marbling and tenderness).[14,16,24–29,31,33,35–38] Respiratory tract diseases account for approximately 90% of all clinical treatments during the first 4 to 5 weeks at the feedyard and often recur throughout the finishing phases.[21,22] Results of a study conducted in 2000 and 2001 in a commercial feedlot by investigators at Oklahoma State University showed that calves treated once

for BRD returned $40.64 less, those treated twice, $58.35 less, and those treated 3 or more times, $291.93 less compared with calves that were not treated.[13] Subclinical losses associated with BRD, while more difficult to quantify, also affect profitability. In a study conducted by Wittum et al in which the lungs of beef cattle were examined at slaughter, 68% of calves had lung lesions even though the cattle had never been treated for BRD. In that study, lung lesions detected at slaughter were associated with a reduction in average daily gain (ADG) of 0.17 lb (0.077 kg)/day.[41]

Bovine respiratory disease is a multi-factorial problem resulting from complex interaction between stressors associated with weaning, marketing, transportation, changes in nutrition, genetics, health history, and exposure to infectious agents, including bovine herpesvirus-1 (BHV-1), bovine viral diarrhea virus (BVDV), parainfluenza-3 virus (PI3V), bovine respiratory syncytial virus (BRSV), *Mannheimia haemolytica*, *Pasteurella multocida*, *Mycoplasma bovis*, and *Histophilus somni*.[5,8,9,11,15,32] During the past 4 decades, numerous calf health management and preconditioning programs have been developed to combat the effects of BRD. A primary objective of these programs is to reduce the incidence of respiratory tract disease in calves during the period between weaning and slaughter by increasing each calf's immunity to organisms that cause BRD and reducing stress on calves before, during, and after shipment from the farm or ranch of origin.[38] Preconditioning programs usually require weaning calves 30 to 45 days before shipping, vaccination against clostridial and BRD pathogens, dehorning, castration of males, administration of parasiticides, and proper nutrition.[1]

A growing number of studies have shown that improved health associated with preconditioning programs contributes to improved stocker and feedlot performance, more desirable carcass traits, and greater profitability.[3,10,19,29,33,34] Roeber et al observed that cattle from 2 preconditioning programs had a significantly ($P \leq 0.05$) lower average number of hospital visits compared with cattle of unknown vaccination history.[33] One important finding from the Texas A&M Ranch to Rail program was the effect that health had on the ability of cattle to express their genetic potential, in both feedlot performance and carcass traits.[30] Managers of the Texas Cattle Feeders Association's member feedlots estimated performance advantages for preconditioned calves versus non-preconditioned calves in each of the following categories: reduced morbidity, reduced mortality, increased average daily gain (ADG), improved feed conversion, increased percentage of USDA Choice grade carcasses, and decreased nonconforming or severely discounted carcasses.[2]

Although an early study suggested that preconditioning programs were not profitable for producers or feedlot operators,[7] more recent studies have found that preconditioned calves bring higher net returns for feedlots compared with net returns for calves with an unknown vaccination history.[10,18–20,30] One study conducted at 2 feedlots showed that preconditioned calves enrolled in a 45-day program at the farm or ranch of origin received $9.92/100 lb (45.4 kg) and $11.04/100 lb (45.4 kg) more at feedlot entry than calves not enrolled in a preconditioning program.[10] A 10-year study showed that preconditioning programs consistently increased the value of beef calves sold compared with similar groups of calves that were not weaned or vaccinated against BRD pathogens.[18] Additionally, in recent years, the premiums paid for the high-health-status calves have increased.[18]

Little scientific research, however, has been done since the introduction of preconditioning programs in the 1960s to document whether differences exist in morbidity rates between calves administered killed-virus (KV) or modified-live virus (MLV) respiratory vaccines prior to entering a backgrounding or feedlot environment. In a retrospective study of cattle enrolled in standardized steer tests from 1995 through 1997, investigators at Iowa State University showed that the most important difference between calves vaccinated with KV or MLV respiratory vaccines was a higher percentage of calves in the KV vaccine groups that required treatment 3 or more times. Calves treated 3 or more times produced $174 less net income than calves not treated. An odds ratio analysis of study results showed that, independent of other factors, calves vaccinated with KV respiratory vaccines were 2.2 times more likely to experience BRD than calves vaccinated with MLV vaccines.[12] In 2002, Grooms and Coe at Michigan State University measured virus-neutralizing (VN) antibody titers as a surrogate method for determining protection against BRD pathogens. Results showed that calves on a vaccination program that included at least 1 dose of MLV vaccine had higher VN antibody titers to BVDV than did calves receiving only KV vaccine; that calves on a program with a combination of MLV and KV vaccines had higher VN antibody titers to BHV-1 than did calves receiving only KV or only MLV vaccine; and that calves that received only killed BHV-1 vaccine had the lowest titers among vaccinated calves.[17] In a commercial feedlot study conducted by investigators at Oklahoma State University, calves with the highest morbidity rates received KV vaccine on the farm or ranch of origin; however, the label-recommended booster dose was not given or was delayed until delivery or 2 days before delivery. In contrast, calves with the lowest morbidity rates received MLV vaccine, either 2 doses at approximately 7 and 3 weeks before delivery or 1 dose at approximately 7 weeks before delivery.[13]

The purpose of the current study was to evaluate BRD treatment rates during 2 backgrounding periods in preconditioned feeder calves administered either 4-way KV or MLV respiratory vaccine to determine which regimen represented a better health management option for use in beef calf preconditioning programs.

Materials and Methods

Study Facility

This prospective longitudinal study was conducted during the fall of 2 consecutive years (experiments (EXP) 1

and 2) at a commercial backgrounding operation in Guthrie County, Iowa. Each year, study calves were housed in open-air, dirt-floor lots. Bunk space was 19 inches (48.3 cm)/calf, and rations designed to provide sufficient energy and protein for calves to achieve 2.0 lb (0.91 kg) of ADG were fed free choice once daily into fence-line bunks. Water was continuously available free choice to the calves from automatic waterers.

Animals

In EXP 1, a total of 565 crossbred, short-haul, multiple-source feeder calves (183 heifers, 382 steers) from 19 different pastures were entered into the Raccoon Valley Cow Calf Association (RVCCA) backgrounding program. An additional 207 crossbred, short-haul, multiple-source feeder calves (103 heifers, 104 steers) from 6 different pastures were entered in the fall of year 2 (EXP 2). In EXP 1, study calves were sorted at arrival into 8 pens (7 pens by weight and sex and an eighth pen of smaller calves containing both steers and heifers); in EXP 2, no attempt was made to sort study calves by sex or weight into pens of equal numbers. Prior to entering the backgrounding facility, all calves were processed in accordance with the requirements of the RVCCA backgrounding program (Table 1).

During EXP 1, 3 heifers were removed from the MLV vaccine group for being oversized (average weight 800 lb; 362.9 kg) and 1 heifer was removed from the KV vaccine group for being undersized (200 lb; 90.7 kg). During EXP 2, 5 heifers were removed for breeding from the KV vaccine group. An additional 17 animals (2 in the KV group in EXP 1 and 8 in EXP 2, and 7 in the MLV group in EXP 2) died prior to the re-implant date. Cause of death was severe BRD as determined on the basis of each animal's clinical depression score (displaying labored breathing to moribund). Three steers (1 each from the MLV and KV groups in EXP 1 and 1 from the MLV group in EXP 2) were also removed from the study for miscellaneous reasons (rectal prolapse, eye disease, club calf). This left 743 animals (772 – 3 oversized animals – 1 undersized animal – 5 breeding heifers – 17 dead animals – 3 miscellaneous removals = 743 calves) in the longitudinal study (Table 2), comprising 266 heifers and 477 steers. Of this total, 370 calves were vaccinated with a 4-way KV respiratory vaccine and 373 calves were vaccinated with a 4-way MLV respiratory vaccine prior to entering the backgrounding facility. The calves were backgrounded an average of 134 days.

Table 1. Pre-entry requirements for the Raccoon Valley Cow-Calf Association backgrounding program.*

7-way clostridial bacterin-toxoid
Histophilus somni bacterin
BHV-1 vaccination (optional KV or MLV vaccine)†
BVD vaccination (optional KV or MLV vaccine)†
PI3 vaccination (optional KV or MLV vaccine)†
BRSV vaccination (optional KV or MLV vaccine)†
Castration
Dehorning (if needed)
Mannheimia haemolytica bacterin-toxoid

*Producers were required to perform procedures at least 10 days prior to delivery. No specific brand name products for pre-entry vaccinations were requested.

†Both doses of label-specified 2-dose KV vaccines highly recommended.

Pre-Entry and Entry Requirements

The RVCCA stipulated that ranchers precondition calves, including castration of male calves, dehorning, and vaccination with clostridial and respiratory vaccines at least 10 days before delivery. Producers had the option of administering either a 4-way KV or a 4-way MLV respiratory vaccine. Third-party validation by a licensed veterinarian was required of all pre-entry vaccinations. If KV respiratory vaccine was given, the RVCCA highly recommended that both doses of the label-specified 2-dose regimen be administered; however, it could not be determined whether the recommended second dose of KV respiratory vaccine was administered. Altogether, 370 calves from 13 pastures were administered either 1 or 2 doses of KV respiratory vaccine, and 373 calves from 12 pastures were administered 1 dose of MLV respiratory vaccine.

Upon entering the backgrounding facility, all 772 calves received the same standard arrival program (Table 3), including a 7-way clostridial bacterin-toxoid, *Histophilus somni* bacterin, 4-way MLV vaccine[a] (BHV-1, BVDV, PI3V, BRSV), an endectocide[b], a growth promotant implant, and double ear tags. All calves were re-implanted at 80 to 90 days after entering the lot.

Feeding Program

Calves were fed standard complete diets formulated to meet or exceed their nutritional requirements. Diets consisted of blended tub-ground hay, corn gluten, corn, corn silage, and a premix. The feed was weighed and delivered to pens once daily. All calves were started on a 44 Mcal net energy gain/100 lb (45.4 kg) (dry matter basis) ration, and transitioned to a 56 Mcal grower ration.

Treatment Protocol

Calves showing signs of BRD, including depression, anorexia, lack of rumen fill, or respiratory distress, during the backgrounding period were removed from their pen and treated according to the standard RVCCA treatment protocol (Table 4). All treatment (hospital) pens were observed twice daily (morning and evening). At the time of sale, calf health records were examined to correlate pre-entry vaccination group (KV or MLV respiratory vaccines) with BRD treatment histories.

Analysis

Assessment of vaccine efficacy was determined by BRD treatment rates during the backgrounding period. The binary responses for BRD morbidity and mortality were analyzed with a generalized linear mixed model (PROC GLIMMIX[c])

Table 2. Pre-entry* vaccination groups (4-way KV† or MLV‡ BRD) and number of calves evaluated at re-implant.

Pasture of origin	Pre-entry vaccine type KV	MLV	No. calves enrolled (no. heifers, no. steers)	No. breeding females removed	No. calves removed for size	No. calves died	No. calves evaluated (no. heifers, no. steers)
EXP 1§							
1		X	18 (10, 8)	0	0	0	18 (10, 8)
2		X	39 (0,39)	0	0	0	39 (0,39)
3		X	4 (1, 3)	0	0	0	4 (1, 3)
4		X	7 (1,6)	0	0	0	6 (1, 5)¶
5		X	26 (2, 24)	0	0	0	26 (2, 24)
6		X	5 (1, 4)	0	0	0	5 (1, 4)
7		X	26 (6, 20)	0	0	0	26 (6, 20)
8		X	110 (60, 50)	0	3	0	106 (57, 49)¶
9		X	24 (0, 24)	0	0	0	24 (0, 24)
10	X		8 (2, 6)	0	0	0	8 (2, 6)
11	X		59 (0, 59)	0	0	0	59 (0, 59)
12	X		15 (0, 15)	0	0	0	15 (0, 15)
13	X		19 (5, 14)	0	0	0	19 (5, 14)
14	X		16 (4, 12)	0	0	0	15 (4, 11)¶
15	X		10 (0, 10)	0	0	0	10 (0, 10)
16	X		57 (23, 34)	0	0	0	57 (23, 34)
17	X		16 (12, 4)	0	0	0	16 (12, 4)
18	X		51 (29, 22)	0	1	1	49 (27,22)
19	X		55 (27, 28)	0	0	1	54 (27, 27)
EXP 2‖							
20		X	50 (35, 15)	0	0	3	47 (33,14)
21		X	40 (24, 16)	0	0	3	37 (22,15)
22		X	36 (18, 18)	0	0	1	35 (17,18)
23	X		46 (17, 29)	0	0	7	39 (14, 25)
24	X		18 (0, 18)	0	0	0	18 (0, 18)
25	X		17 (9, 8)	5	0	1	11 (2, 9)
Totals	13	12	772 (286, 486)	5	4	17	743 (266, 477)¶

*Vaccinations administered on the farm of origin prior to entry into the Raccoon Valley Cow-Calf Association backgrounding program.
†KV=killed virus vaccine
‡MLV=modified-live virus vaccine
§EXP 1=experiment 1 conducted in the fall of 2000
‖EXP 2=experiment 2 conducted in the fall of 2001
¶One steer was removed from each of pasture of origin groups 4, 8, and 14 for miscellaneous reasons (rectal prolapse, eye disease, club calf).

using the logit link function. The model included the fixed effect of vaccine, and the random effect of pasture-year (the experimental unit). Average daily gain, average cost of treatment, and average gross income for calves in each treatment group were analyzed with a linear mixed model with the same effects. Initial weight and vaccine by initial weight were tested for inclusion in all models as covariates. Health effects were measured through the entire backgrounding period, while ADG effects were measured until the calves were re-implanted.

The study was conducted in compliance with applicable animal welfare guidelines and regulations.

Results and Discussion

Animals

Study calves weighed an average of 491 lb (222.7 kg) at arrival, and 687 lb (312 kg) at reimplant. The initial average weight of calves in the KV vaccine group (n = 370) was 497 lb (225.4 kg), while the initial average weight of calves in the MLV vaccine group (n = 373) was 484 lb (219.5 kg) (P = 0.78; Table 5). At re-implant, calves in the KV vaccine group weighed an average of 696 lb (315.7 kg), and those in the MLV vaccine group averaged 678 lb (307.5 kg). The estimated least squares means for ADG at re-implant was 2.41 lb (1.09 kg)/

Table 3. Receiving protocol for Raccoon Valley Cow-Calf Association backgrounding program.

7-way clostridial bacterin-toxoid
Histophilus somni bacterin
MLV (BHV-1-BVD-PI3-BRSV) vaccine*
Endectocide†
Progesterone USP 100 mg-estradiol benzoate 10 mg growth-promoting implant
Double ear tags
Data entry
Optional 4-way MLV booster vaccination 7 to 10 days after arrival (not used)
Re-implant 80 to 90 days after arrival

*Bovi-Shield 4, Zoetis, Florham Park, NJ
†Dectomax Pour-on, Zoetis, Florham Park, NJ

Table 4. Protocol for treatment of BRD in calves in the Raccoon Valley Cow-Calf Association backgrounding program.

First treatment: tilmicosin* at 1.5 mL/100 lb subcutaneously in the neck; 10 mL maximum/injection site.
Second treatment: at day 3 or later if needed, florfenicol† at 6 mL/l00 lb subcutaneously in the neck; 10 mL maximum/injection site. Any calf treated within 21 days of the first treatment was considered a first relapse, and treated with florfenicol.
Third treatment: if needed 2 to 3 days or more after second treatment, long-acting oxytetracycline‡ at 4.5 mL/100 lb subcutaneously in the neck; 10 mL maximum/injection site.

*Micotil 300, Elanco Animal Health, Greenfield IN
†Nuflor, Merck Animal Health, Madison, NJ
‡Liquamycin LA-200, Zoetis, Florham Park, NJ

head/day for calves in the KV vaccine group, and 2.45 lb (1.11 kg)/head/day for calves in the MLV vaccine group ($P = 0.81$).

A total of 83 calves were treated for BRD (66 calves in KV group, 17 in MLV group) during both 134-day backgrounding periods (Table 6). Of the 66 calves in the KV vaccination group treated for BRD, 10 died and 56 survived. Of the calves treated in the MLV vaccination group, 8 died and 9 survived. The case fatality rate (CFR) in EXP 1 was 7.1% (2/28) for calves in the KV group and 0% (0/7) for calves in the MLV group. In EXP 2 the CFR was 21.1% (8/38) and 80% (8/10), respectively, for calves in the KV and MLV groups. The overall CFRs were 15.2% (10/66) for calves treated in the KV vaccination group, and 47.1% (8/17) for those in the MLV vaccination group. The overall CFRs and the CFRs in EXP 2 were higher than expected, especially for calves in the MLV vaccination group. The reason for this was not determined; however, it is important to not overinterpret this because of the small sample size of mortalities in the study.

The effect of vaccine group, initial weight, and the interaction were all significant ($P \leq 0.05$) in the analysis of morbidity. Tests of vaccine group at each weight quartile revealed no significant differences in the incidence of calves treated for BRD between the 2 treatment groups at the 75th (540 lb (244.9 kg) initial weight; $P = 0.19$) and 50th (474 lb (215 kg) initial weight; $P = 0.07$) percentiles. At the 25th quartile (412 lb (186.9 kg) initial weight), significantly ($P = 0.03$) fewer calves administered MLV vaccine prior to entering the backgrounding yard were treated for BRD as compared to calves administered KV vaccine prior to entry.

Treatment cost analysis revealed that when amortized over all calves in each vaccination group, the average cost of treating the sick calves in the KV vaccine group was $4.30/head compared with an average of $1.60/head for treating

Table 5. Health and performance of calves enrolled at the Raccoon Valley Cow-Calf Association backgrounding program vaccinated pre-entry with a 4-way KV* or MLV† vaccine.

	Pre-entry vaccination group		
	KV	**MLV**	***P*-value**
No. enrolled	370	373	—
In weight, lb	497	484	0.78
Weight at re-implant, lb‡	696	678	—
LSM§ for average daily gain, lb	2.41	2.45	0.81
BRD morbidity,‖ %	17	4	0.01
BRD mortality,¶,# %	2.70	2.14	—

*KV = killed virus vaccine
†MLV = modified-live virus
‡Due to differences in days-on-feed between the 2 treatment groups at re-implant time, ADG was used as the measure of growth.
§LSM = least squares means
‖BRD morbidity = percentage of cattle treated for respiratory disease
¶BRD mortality = percentage of cattle in study that died of BRD
#Because of the low frequency of mortality in this study, statistical differences could not be estimated.

Table 6. Effects of pre-entry vaccination (4-way KV* or MLV† respiratory vaccine) on the health of backgrounded calves.

Pasture of origin	Pre-entry vaccine type		No. calves evaluated (no. heifers, no. steers)	No. treated for BRD	Treated calves mortality (no. heifers, no. steers)	Treated calves success	No. calves sold
	KV	MLV					
				EXP1‡			
1		X	18 (10, 8)	0	0	—	18
2		X	39 (0, 39)	0	0	—	39
3		X	4 (1, 3)	2	0	2	4
4		X	6 (1,5)	1	0	1	6
5		X	26 (2, 24)	0	0	—	26
6		X	5 (1, 4)	0	0	—	5
7		X	26 (6, 20)	2	0	2	26
8		X	107 (57, 50)	0	0	—	106‖
9		X	24 (0, 24)	2	0	2	24
10	X		8 (2, 6)	0	0	—	8
11	X		59 (0, 59)	1	0	1	59
12	X		15 (0, 15)	1	0	1	15
13	X		19 (5, 14)	6	0	6	19
14	X		15 (4, 11)	2	0	2	15
15	X		10 (0, 10)	0	0	—	10
16	X		57 (23, 34)	0	0	—	57
17	X		16 (12, 4)	1	0	1	16
18	X		50 (28, 22)	1	1 (1, 0)	0	49
19	X		55 (27, 28)	16	1 (1, 0)	15	54
				EXP2§			
20		X	50 (35, 15)	5	3 (2, 1)	2	47
21		X	40 (24, 16)	3	3 (2, 1)	0	37
22		X	36 (18, 18)	2	2 (1, 1)¶	0	34
23	X		45 (17, 28)	23	7 (3, 4)	16	38
24	X		18 (0, 18)	9	0	9	18
25	X		13 (5, 8)	6	1 (1, 0)	5	12
Totals	13	12	761#	83**	18	65	742

*KV=killed-virus respiratory vaccine
†MLV=modified-live virus respiratory vaccine
‡EXP 1=experiment 1 conducted in the fall of 2000
§EXP 2=experiment 2 conducted in the fall of 2001
‖One steer from pasture of origin group 8 was removed for an eye disease.
¶One steer from pasture of origin group 22 died after the re-implant date.
#Total does not include healthy calves (n = 11) removed prior to re-implant.
**Calves that died are included in the number treated total.

calves in the MLV vaccine group (P = 0.13). Gross income analysis (with calves valued at $160/100 lb (45.4 kg) at both arrival individual weights and re-implant individual weights less treatment costs, and calves that died valued at $0.00) showed that the average income for calves in the KV vaccine group was $278.70/head compared with $286.30/head for calves in the MLV group (P = 0.80).

Risk Factor Analysis

A statistical analysis of risk factors was conducted to evaluate clinical implications of the study. Success/failure of pre-entry vaccination was defined by whether or not calves within each vaccination group required treatment for BRD during the backgrounding period. The control event rate (CER) was the percentage of calves administered KV vaccine pre-entry that required treatment (17%), and the principal event rate (PER) was the percentage of calves administered MLV vaccine pre-entry that required treatment (4%). Relative risk (RR) was a measurement of the likelihood 1 group of calves vaccinated prior to entering the backgrounding facility would be treated for BRD compared to the other group of calves. In this study, the RR that calves vaccinated with KV

vaccine would need to be treated for BRD was 25.7% greater than it was for calves vaccinated with MLV vaccine prior to entry into the backgrounding yard.

Absolute risk reduction (ARR) was simply the mathematical difference between the CER and PER, which indicated 12.9% fewer calves vaccinated pre-entry with MLV vaccine were treated for BRD than calves vaccinated pre-entry with KV vaccine. Relative risk reduction (RRR) was a measurement of the decrease in percentage of treatments given for BRD in calves administered 1 type of BRD vaccine pre-entry as compared with calves administered the other type of BRD vaccine pre-entry. The RRR calculation revealed that 74.30% fewer calves were treated for BRD when MLV vaccine was administered pre-entry as compared to vaccinating calves with KV vaccine pre-entry.

Number needed to vaccinate (NNV) was the number of calves that would need to receive either KV or MLV respiratory vaccine pre-entry in order to prevent 1 adverse outcome, which in this assessment was defined as treatment for BRD during the backgrounding period. The NNV value was 8, which indicated that for every 8 calves vaccinated pre-entry with a 4-way MLV respiratory vaccine, 1 less calf would require treatment for BRD than if the same number of calves were vaccinated pre-entry with 4-way KV vaccine. Applied to an operation vaccinating 3,000 head of calves, the NNV result showed that 375 fewer calves would require treatment for BRD if the calves were vaccinated pre-entry with 4-way MLV vaccine than if they were vaccinated with 4-way KV respiratory vaccine.

The relative risk of harm (RRH) represents the increased risk of treatment for BRD if calves received 1 type of vaccine prior to entry into a backgrounding program compared to pre-entry vaccination with another type of vaccine. In this analysis, the RRH value was 3.89, which indicated that calves vaccinated pre-entry with KV vaccine were 3.89 times more likely to be treated for BRD than if they had been vaccinated with MLV vaccine pre-entry.

Multiple studies found that source-verified, preconditioned beef calves are generally at reduced risk of developing BRD, thereby contributing to lower production costs.[3,10,18,19,23,33,34,37-41] The relative scarcity of studies comparing differences in BRD morbidity rates between source-verified, preconditioned calves vaccinated prior to entering a feeding environment with KV or MLV respiratory vaccines was the reason the current study was conducted. Statistical analysis of study data indicates an association between lower morbidity in the backgrounding phase and vaccination with MLV vaccine on the ranch of origin prior to entering a backgrounding yard, and higher morbidity in the backgrounding phase is associated with the use of KV vaccine prior to backgrounding. In the current study, calves in the lowest weight quartile that were vaccinated with MLV vaccine pre-entry were less likely ($P = 0.03$) to be treated for BRD than calves vaccinated pre-entry with KV vaccine.

Conclusions

Results of this study showed a reduction in morbidity rates between lightweight calves entering a backgrounding lot that received a 4-way MLV respiratory vaccine pre-entry compared to those that received a 4-way KV vaccine pre-entry, followed by vaccination with a 4-way MLV vaccine during arrival processing at the backgrounding facility. Predictions of likely clinical outcomes provided by risk analysis further underscored the cattle health benefits of vaccinating feeder calves with a 4-way MLV vaccine prior to entering a backgrounding lot as compared with vaccinating with 4-way KV vaccines. Mortality during the backgrounding period was similar in each treatment group, 2.7% in the KV group and 2.1% in the MLV group.

Endnotes

[a]Bovi-Shield® 4, Zoetis, Florham Park, NJ
[b]Dectomax® Pour-On, Zoetis, Florham Park, NJ
[c]SAS, Version 9.13

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