Effects of On-arrival vs. Delayed Modified Live Virus (MLV) Vaccination on Health, Performance, and Serum Infectious Bovine Rhinotracheitis (IBR) Titer Levels of Newly Received Stocker Cattle

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Story in Brief

Stress associated with weaning and shipment of stocker cattle is known to compromise immune function; thereby, reducing the effective response to vaccination. The objective of this study was to evaluate the effect of timing of modified live virus (MLV) vaccination on health, performance, and immune response of newly-received stocker cattle. Crossbred bull and steer calves (n = 524) were weighed (BW = 433.4 ± 5.3 lb) and randomly assigned to two MLV vaccination treatments: 1) vaccination upon arrival (AV), or 2) delayed (14 d) vaccination (DV). All cattle were processed according to routine procedures with the exception of initial MLV vaccination timing. Subsequent weights were recorded on d 14, 28, and 42. Blood samples were collected on d 0, 14, 28, and 42 to determine differences in serum infectious bovine rhinotracheitis (IBR) titer levels, and comparisons were made on an equivalent post-vaccination period basis. Body weight gain per day was greater ($P < 0.01$) for DV calves from d 1 to 14 (1.94 vs. 2.55 lb/d) and from d 1 to 42 (1.43 vs. 1.65 lb/d, $P = 0.05$). Days to first pull, total treatment cost, percentage death loss, and pasture ADG after the 42-d receiving period did not differ ($P > 0.15$). Treatment rate for bovine respiratory disease was high for both AV and DV (75.3 and 70.2%, respectively) calves, but did not differ ($P = 0.21$). Serum IBR titer levels were greater ($P = 0.04$) for DV calves 14 d following re-vaccination (AV = d 28 vs. DV = d 42). Delaying vaccination 14 d may increase ADG in stocker cattle during the receiving period compared to vaccinating upon arrival; however, overall gain was not different during the subsequent grazing period. Serum IBR titer levels were greater in DV calves, indicating improved immune response to vaccination.

Introduction

Bovine respiratory disease (BRD) complex is among the most economically important diseases in stocker or feedlot cattle. Current recommended beef cattle receiving strategies include classification of cattle groups into 1 of 3 risk categories (high-, medium-, or low-risk) for BRD. This allows a producer to assess the probability of a particular shipment of cattle in developing BRD complex, and manage specified risk categories accordingly. Risk category is determined by several factors including level of stress, immune status, nutritional condition, pathogen load, environment, mineral level status and the skill level of management personnel. Traditionally, receiving protocols include vaccination against BRD viruses within 24 h after arrival for low- and medium-risk cattle, and 24 to 48 h after arrival for high-risk cattle.

In high-risk calves, previous studies suggest that the transportation stress period can endure for as long as 15 d post-arrival (Purdy et al., 2000). Although little is known about how vaccine response (titer levels) is affected by timing of vaccination during this stressful period, it is well documented that stress compromises immune function and therefore the ability to properly respond to vaccination (Chirase et al., 2004). Other complications with on-arrival administration of a modified live virus (MLV) vaccine may include reduced gain performance due to effects of the antigens contained in the vaccine. The objective of this study was to evaluate the effect of delayed (14 d) MLV vaccination vs. traditional on-arrival MLV vaccination on health, performance, and serum infectious bovine rhinotracheitis (IBR) titer levels of newly received stocker calves.

Experimental Procedures

Five hundred and twenty-four crossbred bull and steer calves (BW = 433 ± 5.3 lb) were procured from a local Arkansas sale barn and shipped to the University of Arkansas Livestock and Forestry Branch Station located near Batesville. Four separate shipment dates representing each block in the experimental model were received on September 9, 2004 (Block 1, n = 110), September 16, 2004 (Block 2, n = 87), January 13, 2005 (Block 3, n = 160) and February 17, 2005 (Block 4, n = 167).

Upon arrival, cattle were weighed, assigned a unique ear identification tag and arrival gender (bull vs. steer) was determined. The following day (d 0), bulls and steers were evenly distributed and randomly assigned to 1 of 2 treatments; (1) arrival (d-0) vaccination (AV), or (2) 14-d delayed vaccination (DV). Calves were re-weighed, administered a clostridial bacterin with tetanus toxoid (Covexin-8®; Schering-Plough Animal Health, Inc., Elkhorn, Neb.), treated for internal and external parasites (Ivomec®; Merial, Iselin, N.J.), and bull calves were castrated using the California banding method. Moreover, AV treatment calves were vaccinated with a 5-way MLV vaccine (Express® 5; Boehringer-Ingelheim Vetmedica, Inc., St. Joseph, Mo.). Delayed vaccination cattle did not receive a 5-way MLV at this time. Cattle were then sorted into their assigned 1.0 acre pens and provided 1% of BW (DM basis) of a receiving supplement (Table 1) and free-choice access to bermudagrass hay for the entire 42-d receiving trial.

Cattle were weighed at 14-d intervals during the trial (d 14, 28, and 42 of the trial). On d 14, both AV and DV cattle received a booster vaccination of Covexin-8®. The AV cattle received a booster vaccination of 5-way MLV, and DV cattle received their initial

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dosage of 5-way MLV. On d 28, DV cattle received a booster vaccination of 5-way MLV.

Calves were observed each morning by station personnel for symptoms of respiratory illness. Cattle with observed visual symptoms of BRD were pulled and considered morbid if rectal temperature was ≥ 104°F. Morbid animals were given antibiotic therapy following a pre-determined antibiotic treatment protocol. Treatment data were recorded for individual animal including treatment date, amount, type, and cost of antibiotic administered.

Blood samples were randomly collected from 3 animals in each pen to determine serum IBR titer level differences. Blood was collected via intervenous venapuncture on d 0, 14, 28, and 42 for AV and d 0, 28, 42, and 56 for DV. Titer level comparisons were made on both a trial day basis and post-vaccination equivalent basis. For the trial day basis, titer level results were compared for each treatment at the period ending date (d 0, 28, and 42). Post-vaccination period equivalent comparisons were made for IBR titer level based on the number of days post-initial vaccination (d 14 AV vs. d 28 DV).

Individual animal was considered the experimental unit and incorporated in a Randomized Complete Block design. Performance data, days to first pull, and treatment cost were analyzed using the MIXED procedure of SAS (SAS Inst., Inc., Cary, N.C.). Random effects included truckload block; whereas, gender and initial BW were used as covariates in the model. Morbidity and mortality rate were evaluated for main effects of block and treatment and analyzed using the CATMOD procedure of SAS.

Results and Discussion

Performance. Body weight was greater ($P = 0.007$) for calves in the DV treatment on d 14 and also tended ($P = 0.07$) to be greater on d 42 (Table 2). Average daily gain was greater ($P = 0.007$) for DV cattle from d 0 to14 of the trial (1.94 vs. 2.55 lb/d). Although non-significant ($P > 0.05$), it was interesting to note that AV cattle had a numerical advantage (1.34 vs. 1.17 lb/d) in ADG from d 14 to 28. Because of the performance reduction in AV cattle for d 0 to 14, and in DV cattle for d 14 to 28, results would suggest that stress associated with the initial vaccination of a MLV vaccine is detrimental to performance. There were no differences in gain performance between the 2 treatments from d 28 to 42 ($P = 0.12$); however, for the entire receiving period (d 0 to 42), ADG was greater ($P = 0.05$) for calves in the DV treatment. Perhaps the overall ADG advantage seen in DV cattle was due to the 14-d delay which allowed for animals to adjust to the new environment and recover from previous stress before receiving a 5-way MLV. However, no differences ($P > 0.05$) were detected for pasture ADG in the subsequent grazing period.

Health. No differences ($P > 0.05$) were detected for effects of MLV vaccination timing on morbidity, mortality, or treatment cost of stocker cattle during the receiving period (Table 3). Initial treatment rate for BRD was high for both AV and DV (75.3 and 70.2%, respectively) calves, but not different ($P = 0.21$). Overall, 93% of BRD pulls occurred within the first 14 days of receiving. Results of the current study would suggest no advantage when administering a 5-way MLV vaccine to high-risk stocker cattle on-arrival because the majority (93%) of BRD morbidity occurred between d 0 and 14, no difference in morbidity or mortality was noted for AV vs. DV calves, and performance for DV cattle was greater.

Serum IBR Titer Level. Vaccine response was evaluated using serum IBR titer analysis (Fig. 1). No differences were detected for IBR titer level on d 0. On an equivalent post-vaccination basis, DV had greater ($P \leq 0.05$) IBR titer levels 28 d and 42 d after initial vaccination. When treatments were compared at the conclusion of the receiving period (d 42) DV exhibited greater ($P = 0.006$) IBR titer levels. Results of IBR titer level comparisons would suggest an improved vaccine response for DV. However, it is important to note that natural exposure and subsequent host immune response may also contribute to increased IBR antibodies.

Implications

In newly received high-risk stocker cattle, delaying 5-way modified live virus (MLV) vaccination 14 days increased performance during the receiving period compared to on-arrival 5-way MLV vaccination. Serum infectious bovine rhinotracheitis (IBR) titer levels were greater when 5-way MLV vaccination was delayed, which would suggest an improved acquired immune response to IBR. Because no differences in morbidity or mortality were noted for vaccination upon arrival vs. delayed vaccination, and performance for delayed vaccination cattle was greater, results of the current study would suggest no production or economic advantage when administering a 5-way MLV vaccine on-arrival to high-risk stocker cattle.

Literature Cited

Chirase, N. K., et al. 2004. Am. J. Vet. Res. 65:860.
Purdy, C.W., et al. 2000. Am. J. Vet. Res. 61:1403.

Table 1. Composition of the receiving grain supplement (As-fed basis).

Ingredient	% of diet
Corn, cracked	67.0
Cottonseed meal	19.0
Corn gluten feed	12.5
Limestone	1.5
Rumensin® 80[a]	0.04

[a]Supplied 40 mg monensin/lb of supplement (Elanco Animal Health, Indianapolis, IN).

Table 2. Effect of Bovine Respiratory Disease (BRD) vaccination timing on performance of stocker cattle during the receiving period.

Weight or ADG	On Arrival[a]	Delayed[a]	SE[b]	P-Value
BW, lb [d]				
Day 0	435.4	431.4	2.42	0.33
Day 14	459.4	468.4	3.03	0.007
Day 28	478.8	484.4	2.93	0.16
Day 42	494.3	502.5	4.08	0.07
ADG, lb/d [c]				
D 0 to 14	1.94	2.55	0.22	0.007
D 14 to 28	1.34	1.17	0.15	0.45
D 28 to 42	0.99	1.23	0.10	0.12
D 0 to 42	1.43	1.65	0.09	0.05
Pasture ADG, lb[d]	1.96	1.85	0.08	0.15

[a]Treatments were vaccination of incoming stocker cattle with Express® 5 (Boehringer Ingelheim) modified live IBR, PI3, BRSV and BVD type I and II vaccine either on arrival at initial processing (d 0) or on d 14. Cattle were re-vaccinated 14 d following initial vaccination.
[b]Standard Error of the mean (n = 524).
[c]All analysis (except d 0 BW) was conducted using BW and gender on d 0 as covariates.
[d]Grazing performance calculated subsequent to the 42-d receiving period.

Table 3. Effect of Bovine Respiratory Disease (BRD) vaccination timing on morbidity, mortality and treatment cost of stocker cattle during the receiving period.

Item	On Arrival[a]	Delayed[a]	SE[b]	P-Value
Body Temperature on d 0, °F	103.3	103.2	0.23	0.83
Treatment, %				
Initial[c]	75.3	70.2	0.10	0.21
Re-treat[d]	29.4	35.1	0.11	0.08
Days to 1st treatment	5.7	5.1	1.10	0.44
Death loss, %	2.3	0.8	0.75	0.19
Treatment Cost, $[e]	10.29	10.64	2.36	0.75

[a]Treatments were vaccination of incoming stocker cattle with Express® 5 (Boehringer-Ingelheim) modified live IBR, PI3, BRSV and BVD type I and II vaccine either on arrival at initial processing (d 0) or on d 14. Cattle were re-vaccinated 14 d following initial vaccination.
[b]Standard Error of the mean (n = 524).
[c]Initial, cattle with observed symptoms of BRD and temperature in excess of 104° F were injected with Micotil (Elanco) at 1.5 cc/ 100 lb BW.
[d]Re-treat, 72 h following initial, cattle with observed symptoms of BRD and temperature in excess of 104° F were injected with Baytril (Bayer) at 4.0 cc/ 100 lb BW.
[e]Treatment cost for BRD assuming value of Micotil $1.10/cc and Baytril $0.53/cc.

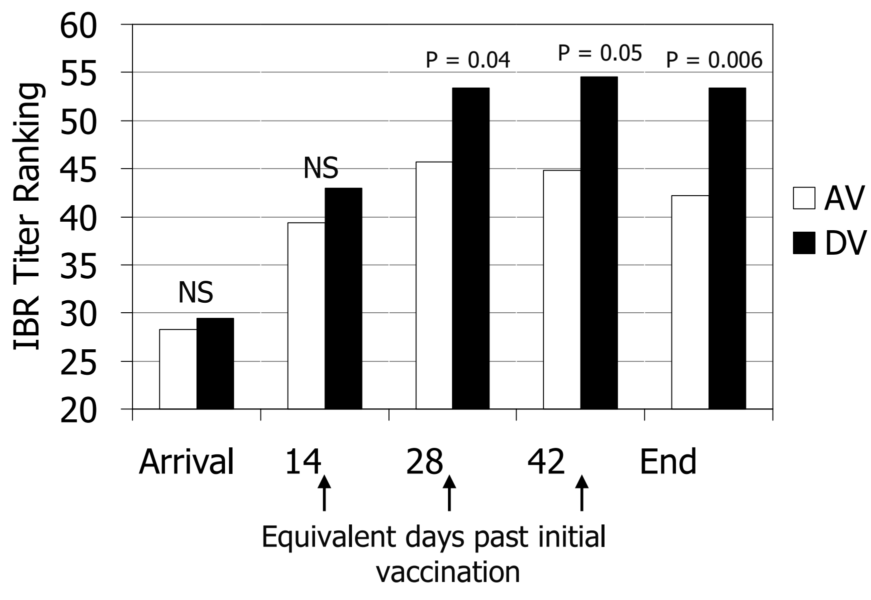

Fig. 1. Infectious bovine rhinotracheitis (IBR) titer level ranking for arrival vaccination (AV) or delayed vaccination (DV) at arrival (d 0), equivalent days past initial vaccination, and end (d 42).