Clinical Evaluation of Prophylactic Regimens for Bovine Respiratory Disease

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Bovine Respiratory Disease (BRD), commonly called "shipping fever" is the major cause of losses in feedlot cattle, estimated at one third of a billion dollars annually. Vaccination of cattle to provide protective immunity against Infectious Bovine Rhinotracheitis (IBR) and Parainfluenza 3 (PI_3) viruses is a well established and apparently effective practice. Bovine Virus Diarrhea (BVD) vaccines are not as widely used as IBR vaccines because of post-vaccinal reactions encountered in stressed calves. The efficacy of bacterins for control of the bacterial etiologic component of BRD has been questioned. Amstutz, et al reported on the efficacy of a *Haemophilus somnus* bacterin in reducing the incidence and severity of BRD.[1] Unpublished reports suggest improved efficacy and reduced post-vaccinal reactions by oral rather than intramuscular administration of modified live BVD vaccines. Experiments were designed to evaluate the efficacy of *H. somnus* and *Pasteurella sp.* bacterins and also compare the oral and intramuscular route of administration of a BVD vaccine.

Materials and Methods:

Three-hundred-and-three crossbred steer calves with an average weight of 490 pounds were purchased by an order buyer in Kentucky. Animals with clinical signs of illness were excluded from the trial.

Health Processing: Cattle were processed and assigned to treatment groups immediately upon arrival at the feedlot. All cattle received an intranasal IBR vaccine (Nasalgen(R)), 2.5 million units of Vitamin A intramuscularly, three 36 mg implants of zearonol (Ralgro(R)), seven-way clostridial bacterin (Electroid-7(R)) and 2.72 mg per pound of levamisole (Levasole®). The cattle were weighed individually and ear tagged.

Experimental Design: The calves were randomly assigned to treatment groups by a random number table. The design was a 3 by 2 factorial to test that neither a *Pasteurella sp.* bacterin nor a *Haemophilus somnus* bacterin would reduce the incidence or severity of BRD as compared to unvaccinated controls and also that a BVD vaccine would be no more efficacious if administered orally than intramuscularly. The calves received their respective vaccinations and were separated into their assigned treatment groups as they were processed.

Forty-five randomly selected calves distributed among all treatment groups were bled during processing and re-bled 42 days postvaccination to collect paired samples. *Ration:* The receiving ration was good quality, first cutting, chopped hay (mixed orchard grass and alfalfa) thoroughly mixed with soybean oil (SBOM) and rolled corn fed to appetite. Initially, one half pound each of SBOM and corn was fed per head per day and increased gradually over a two week period to two pounds of each. Corn silage was introduced 12 days post-arrival and increased in amount over a three day period as chopped hay was removed from the ration. Starting with the sixth week the amount of corn was gradually increased and silage decreased to bring the steers into full feed. A 64% protein urea based supplement (1 lb. per head per day) was substituted for SBOM on day 64 at which time the intake of rolled corn was 9.5 to 11 pounds per head. The corn silage intake was limited to 15 pounds per head per day for the rest of the trial. Trace mineral salt and a mineral mixture were offered *ad libitum.*

Clinical Observations: The cattle were checked daily by walking each individual pen. Steers with clinical signs of respiratory disease were examined and treated if indicated. The criteria for establishing a diagnosis of BRD were serous nasal discharge, respiratory rate, general attitude, gait and rectal temperature of 104.0 F or higher. Treatment was

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continued until the rectal temperature was below 104° F for two consecutive days. Any animal that did not respond following two treatments was classified as a non-responder and the treatment regimen adjusted.

Performance Measurement: The animals were weighed individually on arrival and days 34, 72 and 106. Daily feed consumption was determined for each treatment group by weighing each ingredient in the ration less the amount of the ration from previous feeding not consumed.

Results and Discussion

Effectiveness of Bacterins: The first steer was treated for respiratory disease (BRD) two days post-processing and seven additional steers were treated on day four. This indicated that some steers were in the prodromal phase of BRD on arrival. The control group, that received neither the pasteurella or the haemophilus bacterin, had 29 animals treated and BRD was diagnosed through day 24. The *H. somnus* treatment group had a total of 26 animals treated with the last one started on treatment on day 19. A total of 18 steers that received the pasteurella bacterin were treated with the last one diagnosed on day 15. Ten of the 18 (55%) were started on treatment on days 12 through 15. Clinical BRD occurred sooner in the control and *H. somnus* groups with 58% and 57.6% respectively of the steers treated prior to day 12.

The pasteurella bacterin significantly (P = 0.01) reduced the incidence of BRD and improved the response to treatment (table 1). Previously reported results indicated that the *H. somnus* bacterin reduced the incidence of BRD with twenty-one animals requiring treatment as compared to 33 in each of the pasteurella bacterin and control groups.[2] The efficacy of the single dose of the *H. somnus* bacterin was attributed to an anamnestic response as a result of a previous experience with the organism.

EFFECT OF BACTERINS ON INCIDENCE AND TREATMENT OF RESPIRATORY DISEASE

	Vaccination Treatment Group[1]		
	H. somnus[2]	*Pasteurella sp.*[3]	Control
Total Animals	96	96	96
Animals Treated	26	18	29
Total Treatments	106	67[4]	144
$\bar{x}$ Treatments/Animal	4.1	3.7	5.0
Deaths	2	0	2

1. All received Nasalgen®(IBR, PI_3): and Jencine®(BVD): Jensen-Salsbery Laboratories, Kansas City, MO 64141.
2. Somnugen®: Bio-Ceutic Laboratories, Inc., St. Joseph. MO 64502
3. Encon-P®: Bio-Ceutic Laboratories, Inc., St. Joseph, MO 64502
4. Significant (p = ⟨0.01)

The efficacy of the pasteurella bacterin in the current trial, obviously disagrees with the previous results. The first trial was done with heifers and the current one with steers. However, no indication of sex related differences in resistance or susceptibility to the two agents has been reported. It is more likely that between trial differences, e.g. prior exposure, movements in marketing channels or the virulence of the bacteria, influenced the results. The cost of the pasteurella bacterin was $24.00 for the 96 cattle in the treatment group and the additional labor required for administration during processing was not significant. The average cost of treating an animal for BRD in this trial was $13.45 of which $7.45 was medication and $6.00 labor. Eleven less animals required treatment in the pasteurella group as compared to the control group equal to a savings of $147.95 (11 x $13.45). This represents a sixfold return on the cost of vaccinating.

Virus Vaccination:

The BRD morbidity rate and response to treatment were not significantly different for the oral and intramuscular route of administration groups nor was the average daily gain and feed per pound of gain (Table II). Differences between the groups were apparent in deaths, 4 and 0, and relapses, 2 and 0 in the intramuscular and oral route groups respectively.

EFFECT OF ROUTE OF ADMINISTRATION OF BOVINE VIRUS DIARRHEA VACCINE[1] ON RESPIRATORY DISEASE

			Response to Treatment									
	Morbidity		Responded			No Response				Relapse		
Route	No. Calves	%	No.	(%)	$\bar{x}$ trts	No.	(%)	$\bar{x}$ trts	Died	No.	$\bar{x}$ trts	ADG
Oral	20/96	20.8	14	(70)	4.0	6	(30)	8	0	0	6	2.47
IM	52/192	27.1	37	(71)	3.4	15	(29)	8	4	2	4	2.40[2]

1. Jencine®(BVD): Jensen-Salsbery Laboratories, Kansas City, MO 64141
2. Required 0.13 pounds more dry matter per pound of gain.

The immune response to the BVD vaccine as measured by serum neutralization was of greater magnitude following oral administration as compared to the intramuscular route (IM). The geometric mean serum titer (GMT) of the oral route was 85 and 52 for the intramuscular route. The difference is probably greater than the GMT indicates. One third of the sera in the oral group had antibody titers $\leq$1:256 and end point titers were not determined which could result in an artifically low GMT. The highest end point titers recorded for the IM group was 1:128 (Table III).

The post-vaccinal BVD titers ranged from 1:16 to 1:128 in the IM group and 1:8 to $\geq$ 1:256 in the oral group. Caley reported that BVD vaccine administered orally to sero-negative calves did not result in an increase in titers by 42 days post-vaccination.[2] Sixteen of forty-five calves were seropositive on arrival. Six of eleven seropositive calves vaccinated intramuscularly had no rise in titer but all in the oral group had a rise. Of the calves that did not resond to the IM vaccination, three had initial titers of 1:16 and three of 1:128. Circulating neutralizing antibodies may have interfered with the effectiveness of the vaccine virus. Prevaccinal titers of the five seropositive calves in the oral

Infectious Bovine Rhinotracheitis and Bovine Virus Diarrhea Serology

Vaccine	Route	Titers[3]	
		Prevaccinal[4]	Postvaccinal
BVD[1]	Oral	2.5	85[5]
BVD	Intramuscular	3.3	52
IBR[2]	Intranasal	1.4	17

1. Jencine® (BVD): Jensen-Salsbery Laboratories, Kansas City, MO 64141
2. Nasalgen® (IBR, PI_3): Jensen-Salsbery Laboratories, Kansas City, MO 64141
3. Titers expressed as geometric mean titers
4. Prevaccinal at time of arrival and postvaccinal 42 days later
5. One third of sera $\geq$ 1:256 and end point titer not established; gmt may be lower than actual for oral route.

group ranged from 1:4 to 1:64. The circulating antibodies detected in the serum neutralization test are reported to protect against exposure to virulent BVD virus. The proposed mechanism is prevention of a BVD viremia limiting the primary infection.[3,4] It could be postulated that adequate viral replication to stimulate an immune response occurred in gut lymphoid tissue sequestered from circulating neutralizing antibody.

Six of 45 calves were seropositive for IBR on arrival at the feedlot. Three seropositive calves that did not have a rise in titer had titers of 1:8, 1:64 and 1:64. Eight of 39 seronegative calves did not seroconvert. This may have been due to not administering an adequate concentration of virus intranasally, inhibitory levels of interferon preventing the viral replication necessary to initiate an immune response or the animals were immunosuppressed as a result of movements through market channels. Improper handling of the modified live virus vaccine was not a possible problem.

Considering the group as a whole the response to the vaccine was probably adequate to have prevented an explosive outbreak of IBR. The effectiveness of a vaccine should not be evaluated by serological methods that in many cases do not detect or measure protective immunity. Effectiveness should be measured by significantly reducing the incidence of a given disease within a population. Clinical experience with the intranasal IBR vaccine indicates that the incidence of disease is reduced in vaccinated populations.

References

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