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# Long-Term Protection from Bovine Viral Diarrhea Virus in Feedlot Cattle

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**CATTLE 96-9**

## Summary

Bovine viral diarrhea virus (BVDV) causes respiratory and reproductive disease. The duration of immunity of an inactivated vaccine (Virashield 5: Grand Laboratories, Freeman, SD) was measured in two challenge studies. In both studies the vaccinated animals demonstrated fewer clinical signs when challenged with Type II BVDV at 11 or 13 months post vaccination. These results indicate that an inactivated vaccine administered properly can protect animals against disease up to at least a year post vaccination.

**Key Words:** Bovine viral diarrhea virus, BVDV, Vaccine, Challenge

## Introduction

Bovine viral diarrhea virus (BVDV) has emerged as the major viral disease of cattle. BVDV is the predominant virus isolated from bovine respiratory disease (BRD) and from abortions at the Animal Disease Research and Diagnostic Laboratory at South Dakota State University. BVDV was isolated from 100 submissions and represented 89% of all BRD viral isolations made in 1995. Two biotypes of BVDV virus have been recognized. Type I BVDV is the major type that has been responsible for most clinical BVDV in South Dakota. Type II BVDV has emerged in several areas of the country and has been implicated in acute BVDV outbreaks.

BVDV vaccines have traditionally been either modified live virus (MLV) or inactivated viruses. MLV vaccines have been touted on their ability to produce cell immunity and to have a longer duration of action.

This study was designed to assess the efficacy and duration of cattle vaccinated with the inactivated Virashield 5 (Grand Laboratories, Freeman, SD) by challenging the animals with BVDV. This report details the results of these clinical trials.

## Materials and Methods

### *Animals*

#### Trial 1

**Vaccinates.** Six crossbred calves (Charolais cross, 500-750 lb) seronegative for BVDV were vaccinated in June 1994 with 5 ml of Virashield 5 intramuscular. A second dose was administered 1 month later.

**Control.** Three crossbred calves (Charolais cross, 400-500 lb) seronegative for IBR, BVDV, and BRSV were used as controls.

#### Trial 2

**Vaccinates.** Six yearling calves (Holstein cross, 1100-1200 lb) seronegative for BVDV were vaccinated in October of 1994. The animals were injected with 5 ml of Virashield 5 intramuscular. A second dose was administered

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one month later. In November 1995, the animals were moved to the Department of Veterinary Science, South Dakota State University.

Control. Three yearling calves (Holstein cross, 1100-1200 lb) seronegative for BVDV were used as controls.

### *Challenge*

Virus. The BVDV challenge virus was from the National Veterinary Service Laboratory, Ames, IA. The challenge vials were labeled "NVSL BVD Challenge Virus (890) Lot# 94-9. The challenge upon dilution with 2.8 ml of diluent was  $10^{7.2}$  tissue culture infectious dose 50 (TCID<sub>50</sub>:the amount of virus required to kill 50% of the cells) per animal.

### Virus Inoculation

#### Trial 1

Nine animals were challenged 11 months following the first vaccination with the BVDV virus inoculum described above. Each calf was swabbed prior to challenge, 2 ml per nostril (4 ml total) of inoculum was administered with an atomizer in each nostril and the calves were swabbed for virus isolation post inoculation.

#### Trial 2

Nine animals were challenged 13 months following the first vaccination with the BVDV virus inoculum described above. Each calf was swabbed prior to challenge, 2 ml per nostril (4 ml total) of inoculum was administered with an atomizer in each nostril, and the calves were swabbed for virus isolation post inoculation

### *Testing Procedures*

Clinical Respiratory Signs and Body Temperature. During each challenge, animals were observed daily for clinical signs beginning 3 days prior to challenge and continued until 14 days post challenge. The animals were observed for lacrimation, conjunctivitis, dyspnea, and nasal discharge and clinical scores assigned. The basal body temperature was also measured rectally with a digital thermometer

beginning 3 days prior to challenge and continued until 14 days post infection. Statistical analysis was done using a student T-test with significance cutoff of 0.05.

Clinical Diarrhea Signs-BVDV. Fecal consistency was measured beginning 3 days prior to challenge and continued until 14 days post infection in the BVDV challenge. The scoring system was 0 = normal consistency; 1 = loose consistency, and 2 = watery consistency. Statistical analysis was done using a student T-test with significance cutoff of 0.05.

Serology. Blood samples were drawn from all animals in each challenge. The samples were drawn prior to infection and at -2, 5, 12, and 26 days post infection. Serum was harvested and stored at -70° C. The serum was shipped to Grand Laboratories, Larchwood, IA, for serum neutralization testing.

### Results and Discussion

BVDV Clinical Respiratory Scores (includes body temperature)

Trial 1. Prior to challenge, all the cattle had a mild serous nasal discharge. At day 7 post infection, there was a threefold increase over pre-challenge scores in the control animals. This continued out to day 13 post infection. There was a significant increase ( $P < .05$ ) in clinical scores between the two groups on days 8 to 13 of the BVDV experiment (Figure 1).

Trial 2. Prior to challenge, all the cattle had a mild serous nasal discharge. There was no difference in the clinical signs between the two groups. On days 7 and 8 post challenge, the controls had higher scores, but there was no clear trend. The body temperatures in these groups did not vary much. On days 8 and 9, the controls had temperatures 2° higher than the vaccinates (data not shown).

Clinical Diarrhea Scores BVDV

Trial 1. Fecal consistency was similar for both groups prior to challenge and up to day 7 post infection (Figure 2). On days 8, 10, and

11, there was a significant increase ( $P < .05$ ) in diarrhea in the control animals (Figure 2).

Trial 2. There was no difference in fecal scores between the two groups (data not shown).

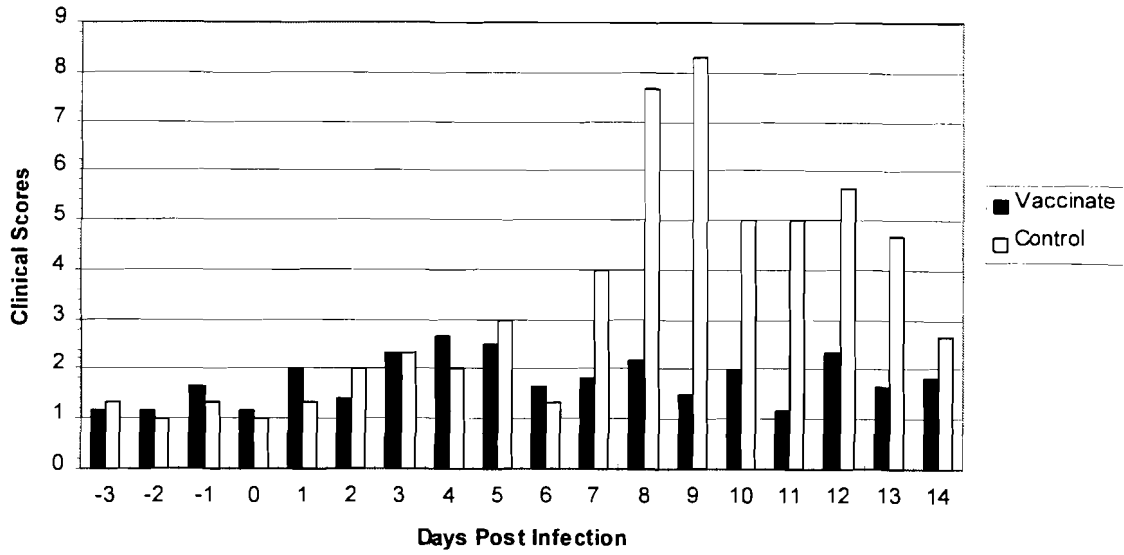
### Serology

Trial 1. Vaccinated animals developed BVDV serum titers that peaked 2 to 3 months following the first vaccination (Figure 3). Figure 3 is representative of the serological response in Trial 1 against either Type I or Type II BVDV. Following infection, the serum titers of the vaccinated animals reached very high levels compared to the controls.

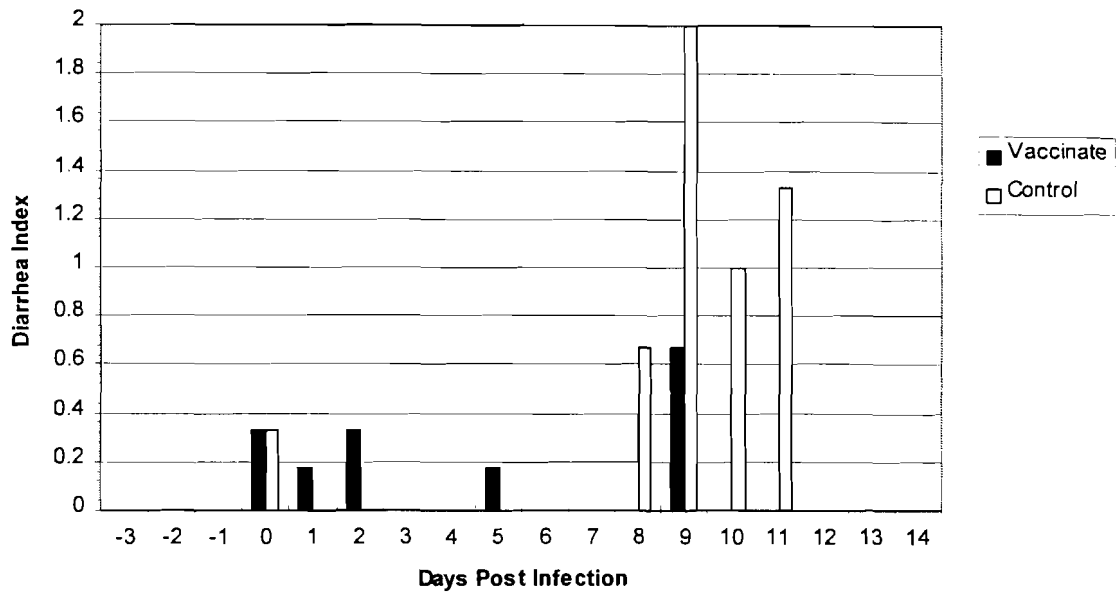
Trial 2. The serological response was similar to Trial 1 (Figure 4). Figure 4 is

representative of the serological response in Trial 2 against either Type I or Type II BVDV.

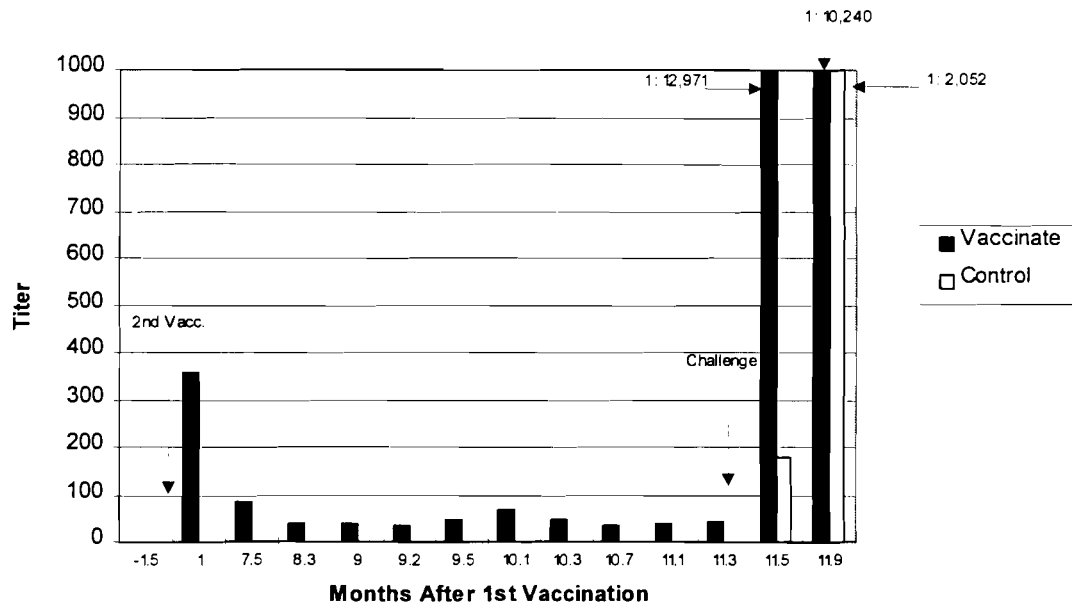
These results indicate that vaccination with a properly administered inactivated vaccine can result in protection of feeder cattle from challenge with BVDV Type II over a year after vaccination. Respiratory disease in feedlot cattle continues to be a serious problem in the cattle industry. One of the important questions yet to be answered concerns the protection of cows against fetal BVDV infection. This infection results in abortions and BVDV persistently infected calves in the herd. These persistently infected animals maintain the virus in the herd and are a threat to even well vaccinated animals. Future studies are planned to answer these questions.



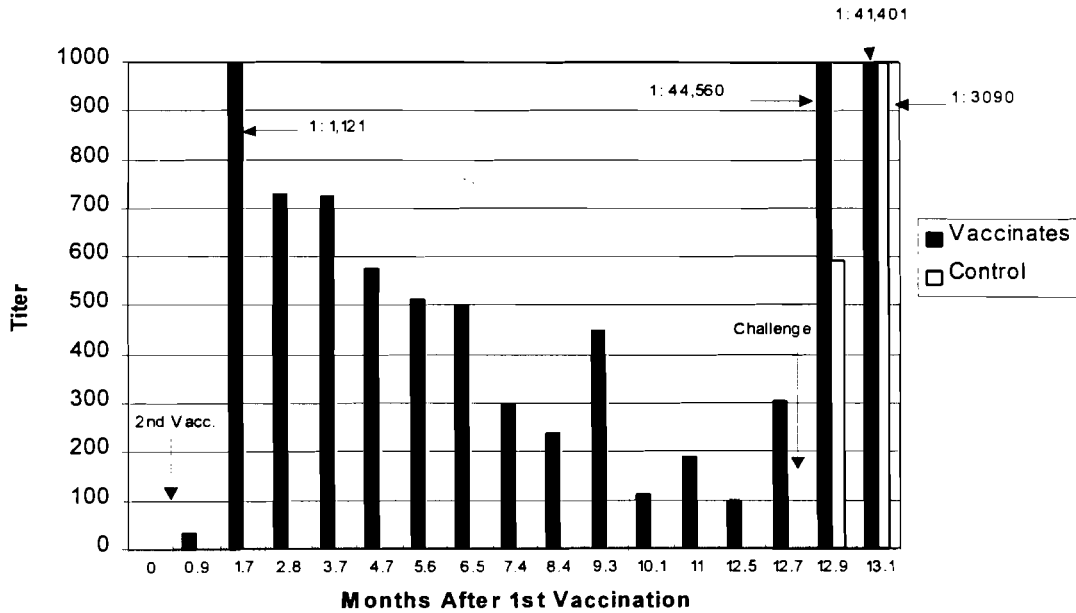
**Figure 1. Bovine Viral Diarrhea Virus Clinical Scores**



**Figure 2. Diarrheal Scores following BVDV Infection**



**Figure 3. BVDV-Trial 1 Serum Neutralization Titers**



**Figure 4. BVDV-Trial 2 Serum Neutralization Titers**