



# EFFICACY AND SAFETY OF THE BIOBOS RCC VACCINE

## Introduction

BioBos RCC is a single dose, trivalent maternal vaccine which contains bovine rotavirus (BRV), bovine coronavirus (BCV) and enteropathogenic *Escherichia coli* (*E.coli*). This technical bulletin outlines four vaccination-challenge studies and a multi-site field efficacy and safety study.

## Materials & Methods

Pregnant Friesian/Friesian-cross cows were selected for the studies. Cows in the treatment groups were vaccinated with a single 2mL intramuscular dose of BioBos RCC between 12 and 3 weeks prior to calving. Control animals were injected with a placebo in the vaccine challenge studies, or untreated in the field study. Following calving, the colostrum and transition milk sourced from vaccinated dams was fed to newborn calves (and control calves were fed colostrum and milk from unvaccinated dams) for 7 days (challenge studies) or for 14 days (field study), followed by milk replacer.

In three vaccine challenge studies, efficacy/onset of immunity (OOI) was tested by administering an oral infective dose (challenge) of the respective antigen to each calf in the vaccinated (n=10) and control (n=5) groups. Calves in the rotavirus and coronavirus challenge studies were challenged at 7 days of age. Calves in the *E.coli* challenge study were administered an oral infective dose just 12 hours after birth.

The fourth vaccine challenge study assessed duration of immunity for bovine coronavirus. In this study the challenge dose was administered to the calves at 14 days of age.

## Outcomes

Safety was evaluated in all studies, by observation of the dams after vaccination, monitoring rectal temperature, and by visual examination and palpation of the injection sites.

Serum antibody concentrations against BRV, BCV and *E. coli* were measured in cows prior to vaccination, on the day of calving, and in the vaccine challenge studies 3 weeks after vaccination, as well as in colostrum/milk once daily at least ten times after calving. Serum antibody concentrations were also measured in the calves on several occasions.

Calves were monitored daily before and for 7 days after challenge. This included clinical observation of feeding and general demeanour, rectal temperature, and faecal samples. In the vaccine challenge studies, the degree of diarrhoea was scored (normal, mild, moderate or severe) and faecal viral RNA quantified using RT-PCR.

## Results - Safety

### Systemic Reactions

No adverse events, or changes in appetite, general health or calving outcomes were associated with vaccination in any cow.

Slight temperature increases were noted for up to 48 hours in vaccinated cows. Mean peak temperature increases ranged from 0.4 to 0.7°C across all studies.

### Site Reactions

In the field study, no injection site reactions were observed on two of the farms. On the third farm, three of the twenty vaccinated cows had a small swelling at the injection site that resolved within two days.

## Results - Efficacy

### Antibody Concentration

Across all studies, every cow responded to vaccination (challenge studies - Figure 1, Field study - Figure 2), with mean serum antibody concentrations significantly ( $p < 0.05$ ) increased after vaccination compared to control animals for all three antigens. The declining antibody concentration in control cows indicated no natural exposure during the challenge studies and very limited/no exposure in the field studies.

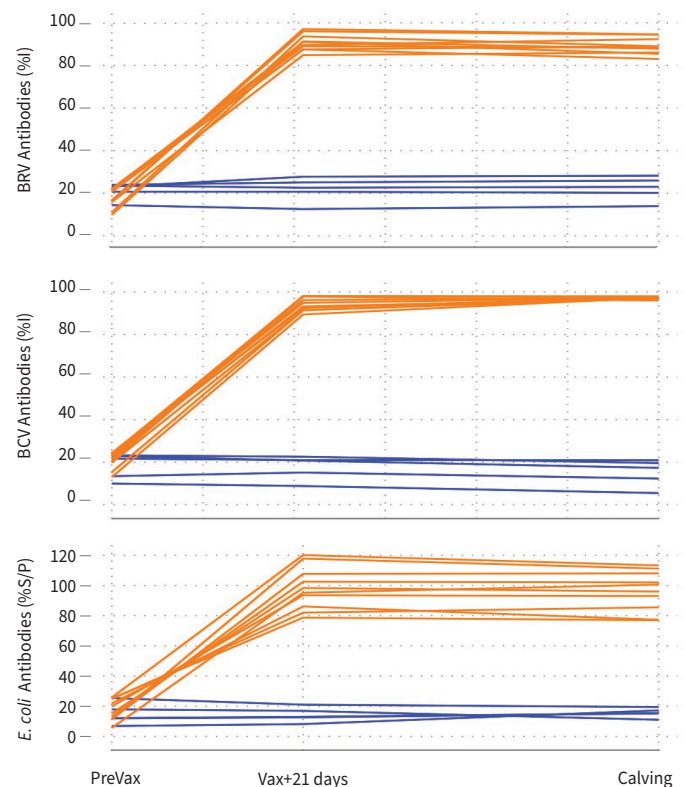


Figure 1. Vaccine challenge studies showing individual cow antibody response in vaccinated (orange lines) and unvaccinated (blue lines) cows

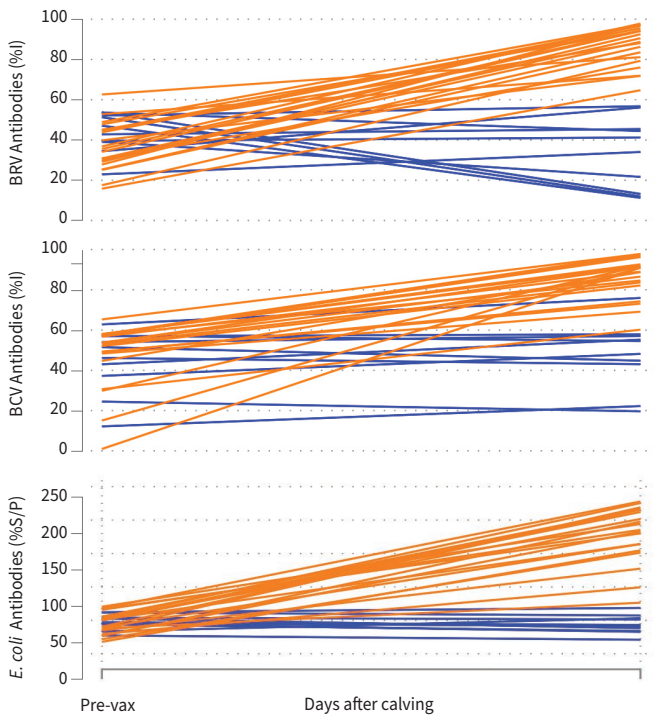


Figure 2. Field study individual cow serum antibody concentrations on one farm, in the vaccinated (orange lines) or unvaccinated (blue lines) cows.

The elevated serum antibody concentrations in vaccinated cows were echoed by significantly higher antibody concentrations in colostrum and transitional milk (Figure 3), and in the serum of calves that were fed their colostrum<sup>1</sup>.

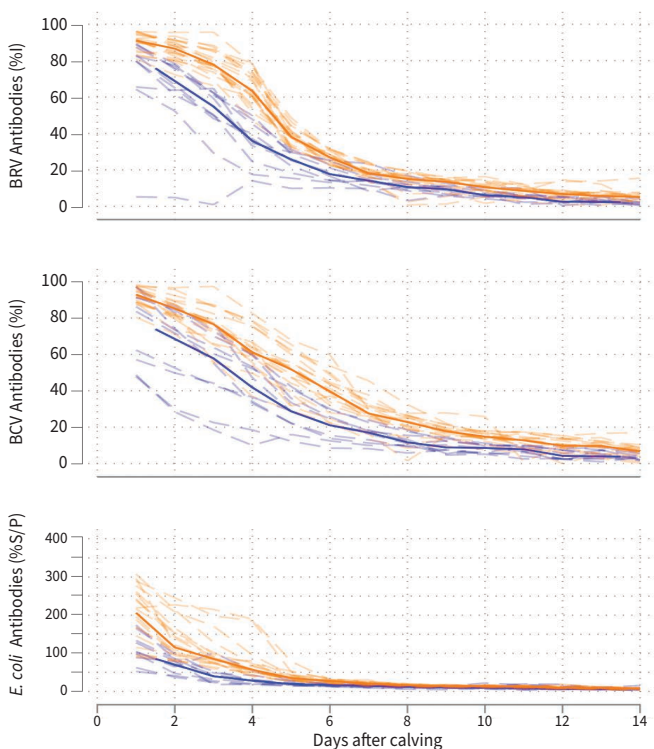


Figure 3. Field studies showing individual cow colostrum/milk antibody concentration response in vaccinated (orange lines) and unvaccinated (blue lines) cows

**Calf outcomes**

None of the calves fed colostrum from vaccinated dams developed diarrhoea following challenge with enteropathic *E. coli* at 12 hours, or rotavirus or coronavirus at 7 days of age (Figure 4).

Conversely, there was significantly more diarrhoea ( $p < 0.01$ ) in calves fed colostrum from unvaccinated dams, with every calf having diarrhoea for at least 3 days. 14 out of these 15 calves experienced moderate or severe diarrhoea for at least one day, and 3 calves died. In addition, 3 of the 12 surviving calves still had diarrhoea at the end of the study period.

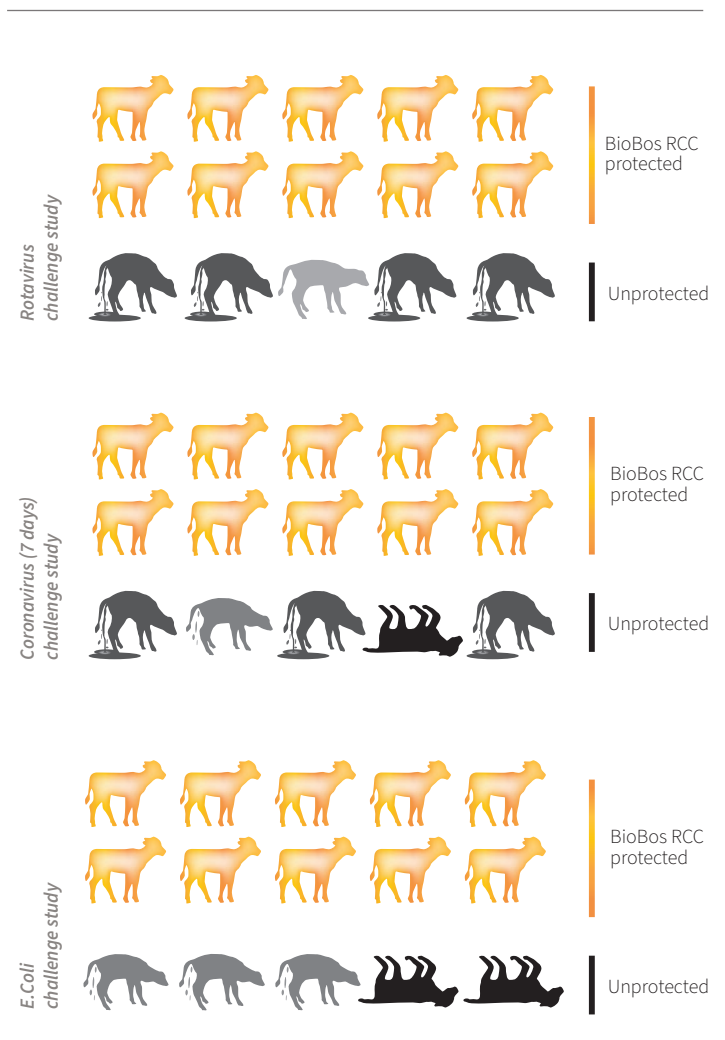
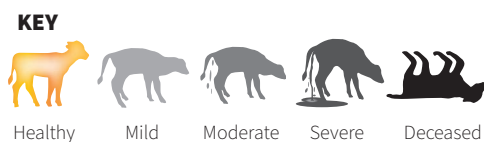


Figure 4. Calf health and diarrhoea outcomes following infective challenge dose



In the fourth vaccine challenge study, that assessed duration of immunity in calves, an infective dose of BCV was administered at 14 days of age, after these calves consumed calf milk replacer for a week.

Two of the calves fed colostrum from vaccinated dams had mild transient diarrhoea for 1 to 2 days, although they did not lose their appetite and had no other clinical signs. All of the unprotected calves (fed colostrum/transition milk from unvaccinated dams) had diarrhoea for at least 3 days ( $P = 0.005$ ), (Figure 5). In addition, 3 of these calves still had diarrhoea when the study period concluded.

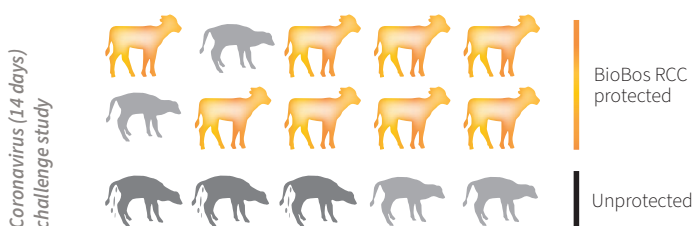


Figure 5. Calf health and diarrhoea outcomes following infective challenge dose in extended duration vaccine challenge study

### Faecal shedding

After challenge, viral shedding in the faeces of calves that had consumed colostrum from vaccinated dams was significantly reduced by up to 185 times compared to calves fed from non-vaccinated dams for BRV ( $P = 0.014$ ) and for BCV ( $p = 0.0027$ ) (Figure 6).

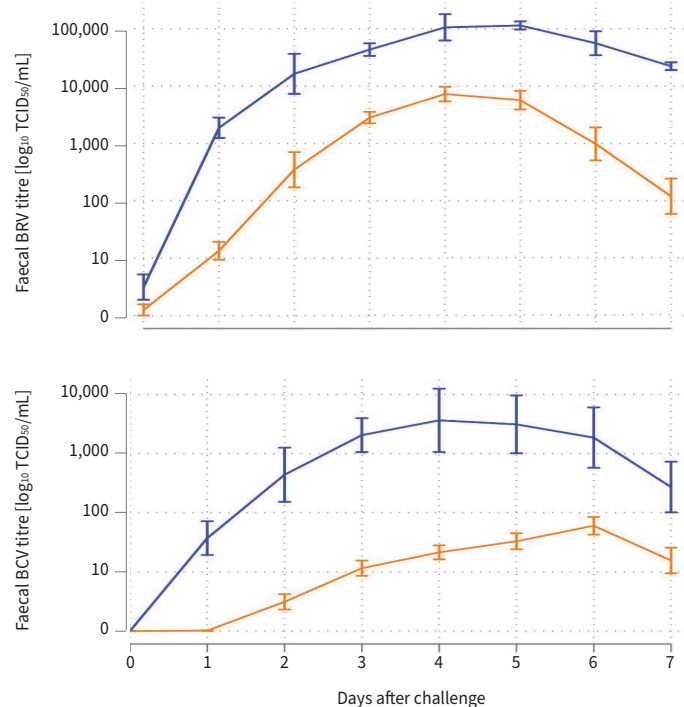


Figure 6. Viral titre in faeces of calves fed colostrum/milk from vaccinated (orange lines) or unvaccinated (blue lines) cows in challenge studies

## Conclusion

Neonatal calf diarrhoea is a multifactorial disease, so risk factors may vary substantially by farm. Regardless, the data generated in these studies clearly demonstrates that when colostrum/transition milk from BioBos RCC vaccinated cows was fed to calves it prevented diarrhoea in the face of severe challenge of all three antigen components. Moreover, the high concentrations of antibodies transferred to the calves via colostrum and transition milk, markedly decreased viral shedding.

This reduced viral shedding would presumably reduce challenge for their herdmates.

These outcomes were achieved without significant systemic or local reactions in vaccinated dams.

## Summary

The excellent level of vaccine efficacy and safety is due to a combination of factors including the use of highly antigenic strains, judicious inactivation, and a modern adjuvant system that stimulates production of IgG1 antibodies, the principal class of antibodies secreted into colostrum.

BioBos RCC is a new generation vaccine that markedly increases the level of pathogen-specific passive immunity available in colostrum and transitional milk of vaccinated heifers and cows. When calves consume this colostrum and transitional milk, the antibodies prevent neonatal diarrhoea caused by bovine rotavirus, coronavirus and *E. coli* expressing F5 (K99) adhesin, and reduce faecal shedding of these viruses.

## References

- Yarnall, M, et al. A novel vaccine demonstrating prevention of neonatal calf diarrhoea. *Large Animal Review* 30: 13-24; 2024
- BioBos RCC Registration Data on file





# BioBos RCC

## WHAT IS BIOBOS RCC?

Vaccine for cattle to prevent neonatal diarrhoea (calf scours) caused by Bovine rotavirus, Bovine coronavirus, and *E.coli*.

## WHAT IS BIOBOS RCC FOR?

BioBos RCC provides active immunisation of pregnant heifers and cows. Consuming colostrum from vaccinated cows provides calves with immunity against diseases caused by rotavirus, coronavirus and enteropathogenic *E. coli* strains.

The antibodies in colostrum and milk from vaccinated cows can prevent calf scours caused by rotavirus, coronavirus and *E. coli* (K99) and reduce virus shedding by infected calves.

## WHEN SHOULD YOU USE BIOBOS RCC?

Vaccinate all pregnant cows and heifers in the herd with BioBos RCC 12 – 3 weeks prior to calving. This boosts the level of antibodies in their colostrum and transitional milk.

These antibodies are transferred to newborn calves by feeding colostrum and transition milk from vaccinated cows.

## HOW DO YOU USE BIOBOS RCC?

Administer one annual dose of 2mL, by deep intramuscular injection to all pregnant cows and heifers in the herd, 3 - 12 weeks prior to calving.

Optimal protection of calves against infection is achieved if all cows and heifers in the herd are vaccinated, annually.

**Feeding calves with Colostrum:** In order to ensure effective prevention of disease in calves, it is essential that calves receive adequate colostrum from vaccinated cows or heifers. Newborn calves should receive at least 2 litres of this colostrum, preferably from the first milking, and within 6 hours. Calves should continue to receive colostrum and milk from vaccinated cows and heifers for at least 2 to 4 weeks after birth at the rate of 2.5 to 4 litres per day, to ensure maximal protection.

## WITHHOLDING PERIOD

**Milk: Nil**

**Meat: Nil**

## STORAGE

Store in a refrigerator (2°C – 8°C). Do not freeze.

Discard unused content 10 hours after opening.

## PACK SIZES

Available in 100mL (50 dose) and 250mL (125 dose) plastic bottles.

RESTRICTED VETERINARY MEDICINE  
ACVM Registration Number: A12072  
Refer [www.agrihealth.co.nz](http://www.agrihealth.co.nz) for details.