

Field vaccination of cattle using a bivalent modified-live vaccine against bluetongue virus serotypes 2 and 9: effect on milk production

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Summary

To evaluate the effect of bluetongue (BT) vaccination on milk production in cattle, 30 cows at various stages of gestation were vaccinated using a bivalent bluetongue virus serotype 2 (BTV-2) and BTV-9 modified-live vaccine produced by Onderstepoort Biological Products in South Africa. A second group of 30 pregnant cows was used unvaccinated controls. Blood samples were taken from all animals three times a week for two months. Virus titres were determined and the daily milk production of each cow was quantitatively and qualitatively evaluated. From 27 of the 30 vaccinated cows, BTV was isolated from day 4 to day 28 post vaccination. BTV vaccination had no effect on milk production, somatic cell count, pH, milk fat, protein and lactose content. It is concluded that the bivalent BTV-2/BTV-9 modified-live vaccine does not affect milk production in cows.

Keywords

Bluetongue – Cattle – Lactose – Milk fat – Milk pH – Milk protein – Milk production – Somatic cell count – Vaccine – Viraemia – Virus.

Introduction

The occurrence of bluetongue (BT) can result in the imposition of a trade ban on susceptible ruminant species and can have serious socio-economic effects on the livestock industry in infected countries. Since August 2000, when the first outbreak of BT was reported in Italy, four serotypes of the BT virus (BTV) (BTV-2, BTV-4, BTV-9 and BTV-16), have circulated in the country. Of these serotypes, BTV-2 and BTV-9 were by far the most widespread (Sicily and numerous central and southern peninsular regions). In an attempt to reduce direct losses due to disease and indirect losses due to virus circulation, the Italian Ministry of Health implemented a compulsory vaccination campaign using the bivalent BTV-2 and BTV-9 modified-live vaccine in areas where both serotypes prevailed. In 2001 and 2002 almost all domestic ruminants were vaccinated. As it was the first time that the combined BTV-2 and BTV-9 vaccine was used in the field, no data were available on its potential side-effects. This study evaluated its effect on milk production in dairy cattle.

Material and methods

Vaccine

A bivalent BTV-2/BTV-9 modified-live vaccine produced by Onderstepoort Biological Products in South Africa was used. Before inoculation, both serotypes were suspended in 100 ml of appropriate diluent. A single dose of vaccine contained $10^{4.37}$ TCID₅₀/ml BTV-2 and $10^{4.24}$ TCID₅₀/ml BTV-9.

Animals

Sixty cows, at various stages of pregnancy, were selected and thirty were vaccinated with the bivalent vaccine. All animals tested negative against the most common reproductive diseases (bovine viral diarrhoea, infectious bovine rhinotracheitis, bovine herpesvirus-4, salmonellosis, chlamydiosis, neosporosis and brucellosis) and no antibodies against BTV were detected. Temperatures were recorded daily and clinical signs monitored. Blood samples were taken from all animals three times a week for two months. Virus titres were determined

and the daily milk production from each animal was evaluated both quantitatively and qualitatively.

Virological and serological tests

Ethylene-diaminetetra-acetic acid (EDTA) blood samples were examined for the presence of BTV and, in viraemic animals, virus titres determined. The competitive enzyme-linked immunosorbent assay (c-ELISA) (2) and the virus neutralisation (VN) test (1) were used to detect BT antibodies. Intravenous egg inoculation, followed by two blind passages in Vero cells, was used to isolate BTV from EDTA blood samples according to the method described by Savini *et al.* (4). BTV isolation was attempted from the blood of viraemic animals and the serotype determined (5).

Milk production study

Milk samples were analysed for fat, protein and lactose content using the Milkoscan system 4000 and the somatic cell count determined using a Fossomatic 400. The pH was recorded using a Crison Micro TT250 electrode probe.

Statistical analysis

Differences between the weekly mean milk production of vaccinated and unvaccinated groups were analysed using the nonparametric Mann-Whitney test for independent groups.

Similarly, milk quality data were grouped and for each group the weekly mean value was calculated. Statistical differences between weekly quality data of vaccinated and unvaccinated groups were also determined using the Mann-Whitney test.

Results

No clinical signs were observed in vaccinated animals. Vaccine virus was isolated from the blood of vaccinated animals commencing on day 4 and continuing to day 28 post vaccination (pv); peak titres were observed on days 11 and 9 pv for BTV-2 and BTV-9, respectively. BTV-9 viraemia titres were much higher than those for BTV-2 and are shown in Figure 1. None of the negative controls developed detectable viraemia. No significant differences were observed in somatic cell count, pH, milk fat, protein and lactose content between vaccinated and unvaccinated groups. Similarly, no significant differences were observed in milk production between vaccinated and unvaccinated groups (Fig 2).

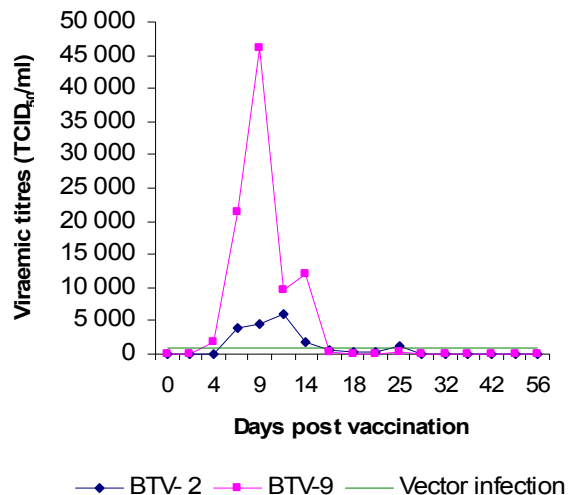


Figure 1
Bluetongue virus titres in cattle following vaccination with a bivalent BTV-2/BTV-9 modified-live vaccine

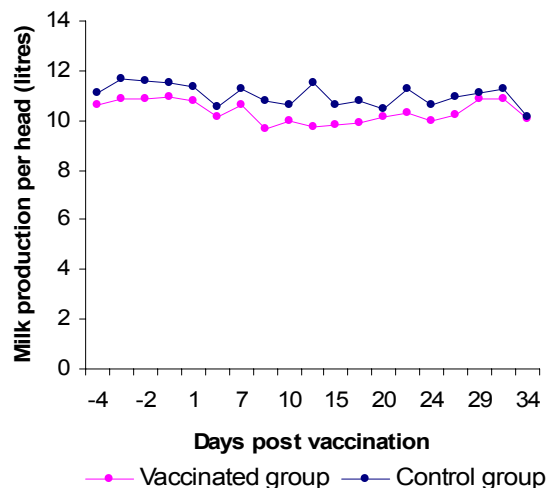


Figure 2
Mean milk production in cattle following vaccination with a bivalent BTV-2/BTV-9 modified-live vaccine

Discussion and conclusions

This study demonstrates that vaccination using a bivalent BTV-2/BTV-9 modified-live vaccine did not interfere with milk production in dairy cows; the results were consistent with those observed elsewhere (3). However, they differed from those observed in sheep when the same vaccine combination was used; in sheep, a drop in milk production was observed shortly after peak BTV-9 virus titres were attained. The decrease in production commenced one week pv and lasted for seven days. In this study, the BTV-9 virus titre was similar to that observed in sheep but no losses in milk production were recorded (Fig. 3).

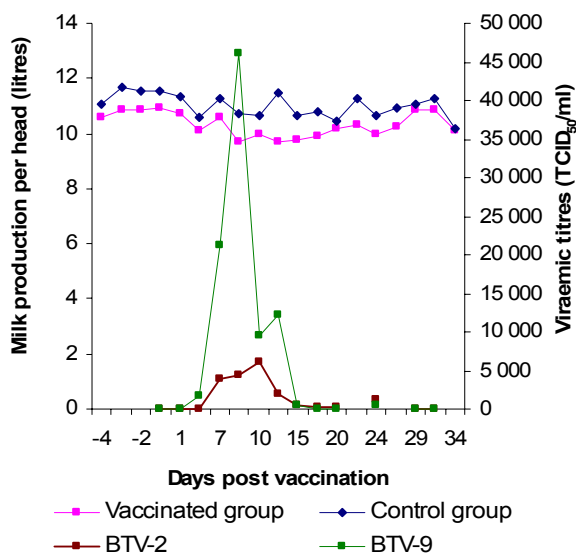


Figure 3
Comparison of viral titres and milk production in cattle following vaccination with a bivalent BTV-2/BTV-9 modified-live vaccine

A possible explanation for this discrepancy is that sheep developed clinical signs and so BT disease may have caused the drop in milk production. The vaccinated cattle exhibited no disease and no loss in milk production.

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