

The use of an autogenous *Dichelobacter nodosus* vaccine to eliminate clinical signs of virulent footrot in a sheep flock in Bhutan

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Abstract

An outbreak of virulent footrot was investigated in a flock of 605 Merino cross-bred sheep in Bhutan. Conventional control methods in the preceding eight years had reduced its prevalence from 36–79% in different components of the flock to about 15% overall. Only one serogroup (B) of *Dichelobacter nodosus* was identified among 40 isolates cultured from affected sheep. A vaccine prepared from this strain was used in a pilot trial to compare the response of 14 treated and 14 untreated sheep. All affected, vaccinated animals in this trial healed quickly and were protected against re-infection while additional cases developed among untreated sheep during a period favourable for the spread of footrot.

The serogroup B vaccine was administered to the whole flock for two successive years. No other footrot treatment was given during these or subsequent years. The whole flock was examined three times, foot by foot, for two years and twice yearly for another two years. When vaccination began there were 88 affected sheep in the flock, an affected sheep being defined as an animal with a foot-score of 2 or greater in one or more feet. There were neither affected sheep in the flock 30 days after the first dose of vaccine nor were any identified in later inspections. Virulent footrot, originating from the farm under investigation, persisted in neighbouring village flocks during this period. It was concluded that whole flock specific *D. nodosus* vaccination made a major contribution to the elimination of all clinical signs of footrot from the flock of 605 sheep where the condition had previously persisted for 10 years.

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1. Introduction

Footrot is a contagious disease of ruminants transmitted by *Dichelobacter nodosus*. The occurrence and persistence of the condition are favoured by warm, wet environments (Egerton, 2000). Before 1989, there was no evidence of footrot in sheep in Bhutan. During 1989, the Royal Government of Bhutan imported 420 Merino Comeback sheep (20 rams and 400 ewes) from Victoria, Australia to its National Sheep Breeding Centre (NSBC). Shortly afterwards lameness appeared in

both imported sheep and in others at NSBC. This lameness was diagnosed as virulent footrot (Kelly, 1990). Kelly also confirmed the presence of footrot in three village flocks close to NSBC.

The environment at NSBC, Bumthang is favourable for footrot. The centre has improved pasture, which during the summer months especially provides a lush green sward of grasses, which is considered to retain moisture, and leads to maceration and hydration of interdigital skin (Graham and Egerton, 1968). Thus, conditions during the monsoon season (June–September) are ideal for predisposing animals to infection if it is present, and for spread to susceptible animals. However, the winter temperatures are low enough to inhibit transfer of infection. Kelly (1990) recommended control methods based on

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foot bathing in zinc sulphate and the use of antibiotics for this flock. Before this, copper sulphate and formalin had been used in footbaths and lame sheep had received injections of penicillin–streptomycin. Furthermore in 1990 and 1991 the whole flock had been treated with a commercial, multivalent footrot vaccine.

Early experiments with footrot vaccines demonstrated that they could be both prophylactic and therapeutic (Egerton and Burrell, 1970). Immunity to *D. nodosus* was shown to be serogroup specific and later nine major serogroups of the organism were identified (Claxton et al., 1983). In countries where footrot is endemic there is considerable antigenic diversity among isolates of *D. nodosus* (Chetwin et al., 1991; Claxton et al., 1983; Ghimire, 1997; Ghimire et al., 1996; Gradin et al., 1993; Hindmarsh and Fraser, 1985; Kingsley et al., 1986).

Many of these serogroups may be present in the same flock (Claxton, 1989) and thus commercial vaccines needed to have antigens of all serogroups represented. It was discovered subsequently that this multiplicity of antigens interfered with the immune response of sheep to each of the antigens. Multivalent vaccines were thus less potent and immunity following their use was of shorter duration (Hunt et al., 1994; Raadsma et al., 1993, 1994; Schwartzkoff et al., 1993).

Vaccines based on the virulent strains involved were tested in the management of footrot in sheep and goats in Nepal where a specific, bivalent vaccine was superior to a commercial, multivalent vaccine in protecting animals during a seasonal migration (Egerton et al., 2002). It was decided, therefore, to re-examine footrot at NSBC and assess the potential of using specific vaccination to control footrot in that flock. This paper, describes that investigation which had three phases: isolation and identification of the strain(s) of *D. nodosus* present at NSBC; the test of specific vaccine in a pilot trial, and treatment of the whole flock with specific vaccine and subsequent surveillance.

2. Materials and methods

2.1. Study area and flock

The NSBC is at Dechenpelrithang in Bumthang District in the central region of Bhutan and is 10 km from Bumthang, the district headquarters where the Regional Veterinary Laboratory is located. Bumthang (27° 15 min N–28° 10 min N and 90° 25 min E–91° 10 min E) has a generally temperate climate. NSBC is at an altitude of 2650 m ASL, so the temperature may fall as low as –1 °C in winter whereas summer maximum temperatures reach 26 °C (Fig. 1). Most rainfall occurs from May–September. In each of these monsoon months >1 m of rain falls. Mean monthly rainfall for the period 1999–2001 was 703 cm. NSBC has developed pastures extensively with different grasses. The main grasses are clover (*Trifolium species*), Italian rye grass (*Lolium multiflorum*), tall fescue (*Festuca arundinacea*) and cocksfoot (*Dactylis glomerata*).

All 605 sheep at NSBC were included in this study. They were managed in three mobs: rams, ewes and weaners. Animals were grazed in the pasture during day and were housed or yarded at night. This was practiced to protect animals from cold weather and predators including bears and leopards. Lambing was in March–April. The lambs were weaned at 10 weeks and were managed separately. There were routine procedures for the control of internal and external parasites. The most common and persistent ectoparasite infestation in sheep at NSBC was *Oestrus ovis*. Annual vaccination was undertaken against *Clostridial* species and foot and mouth disease.

2.2. Footrot control

Initially (1989–1990), during the monsoon, whole flock foot bathing was done twice weekly with a 10% solution of commercial formalin containing 37.4%

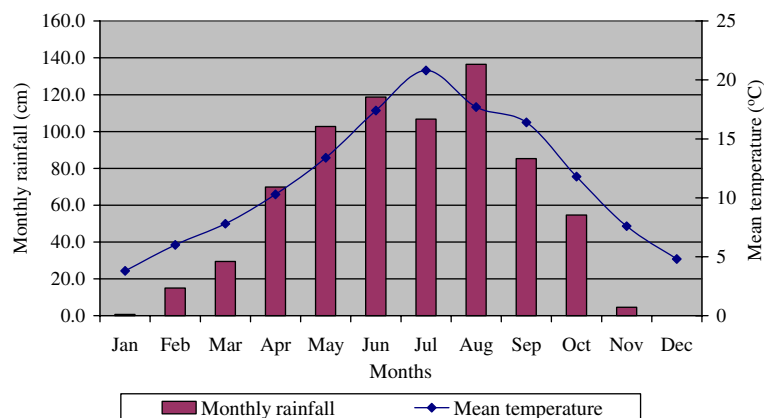


Fig. 1. Mean temperature and rainfall for the year 1999 at NSBC.

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