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# A genetic approach to footrot control

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## ABSTRACT

Glenbrae and Broomfield strains of Corriedale sheep were developed over a period of 19 years by selectively breeding from animals that remained free from clinical footrot when deliberately exposed to natural infection.

Recent studies have demonstrated relative advantages in these bloodlines during footrot outbreaks in terms of significantly reduced incidence and severity of infection compared to unselected Corriedales. Similar benefits have also occurred in commercial flocks when first cross offspring of Glenbrae and Broomfield rams were compared to offspring of traditional rams.

Introduction to the industry of these apparent genetic gains in footrot resistance has been through 2 approaches. Firstly the Broomfield Corriedale Group Breeding Scheme was established in 1982 with 1420 Sheepplan ewes recorded in 5 flocks screened from an estimated 28,000 ewes. The objective is to breed rams for commercial use utilizing performance records and a footrot challenge prior to selection as 2-tooths. Secondly the Corriedale Sheep Society initiated a top-crossing programme mating 3 Glenbrae footrot resistant rams to 81 registered Corriedale ewes in 1986. Details of these 2 approaches are given.

**Keywords** Ovine footrot; disease resistance; breeding.

## INTRODUCTION

Increasing costs and the temporary nature of benefits from traditional methods of ovine footrot control have recently focused attention on the feasibility of enhancing resistance to the disease by selection and breeding in order to produce low maintenance flocks. In the U.S.A., an experiment with Targhee merino sheep indicated that resistance to footrot infection by natural challenge was responsive to selection on a within-flock basis (Parker *et al.*, 1985). This was substantiated in a study of genetic and phenotypic parameters in New Zealand Romney sheep from which finite genetic gains in terms of reduced prevalence rates per generation were predicted from the application of certain selection strategies (Skerman, 1986; Skerman *et al.*, 1988).

Recently we described a sheep breeding programme carried out in a Corriedale flock by E.C. and M. Orr, Amberley, North Canterbury, in which improved resistance to footrot has been a major objective for over 15 years (Skerman and Moorhouse, 1987). Results were also reported of trials which indicated that animals from this source were generally less prone to virulent footrot by both experimental and natural challenge when compared with other Corriedale lines bred without any special regard to disease resistance.

This paper presents additional evidence for enhanced resistance to footrot in the strain of Corriedales developed by E.C. and M. Orr and

describes programmes currently being undertaken to distribute this apparently desirable trait more widely within the Corriedale breed.

## DEVELOPMENT OF FOOTROT-RESISTANT CORRIEDALES

The historical background of E.C. and M. Orr's Corriedale flock and the selection procedures followed have been outlined previously (Skerman and Moorhouse, 1987). Since 1971, the flock has consisted of non-registered (Broomfield) and registered (Glenbrae) components. Foundation registered animals included 11 mixed-age Corriedale ewes selected from the Conniston stud (R. Robinson, Ashburton) as well as ram AE 305/67, subsequently used extensively to mate both registered and unregistered ewes. This ram remained free from footrot throughout his 13 year life-span.

According to the Corriedale Society Flockbooks from 1971, 1973, 1978 and 1981, additional registered animals entering the Glenbrae section of the flock have included:

- 1970 — 1 Conniston ram, CG 112/69, used for only part of a mating season.
- 1972 — 10 mixed-age Conniston ewes selected on visually sound feet.
- 1972 — 9 mixed-age ewes from Est. H.T. Little, Flock 5 (Hui-hui).
- 1977 — 8 mixed-age ewes from W.M. Kinaston, Flock 199.

1980 — 14 Conniston ewe hoggets, sired by A 49/76, a son of AE 305/67.

The Glenbrae flock has remained closed since 1971 for males, and since 1980 for females. The majority of registered sires used within the flock have been from the AE 305/67 bloodline. Glenbrae sires were also mated with Broomfield ewes until 1984. Each autumn, all Broomfield and Glenbrae progeny are subjected to natural footrot challenge on irrigated pasture (Skerman and Moorhouse, 1987). The flock has been recorded since its establishment on the National Flock Recording Scheme and subsequently on Sheeplan (Clarke and Rae, 1977).

### COMPARISON OF FOOTROT PREVALENCE AND SEVERITY IN BROOMFIELD/GLENBRAE AND 3 OTHER SIRE PROGENY GROUPS

A natural challenge trial was established in 1986-87 at Mt. Palm, Rotherham, North Canterbury, to compare the performance of Broomfield/Glenbrae-sired progeny with that of the offspring sired by rams from a wider range of Corriedale control strains (unselected) than used in the previous study (Skerman and Moorhouse, 1987).

#### Methods

Groups of 3 rams were obtained from 4 breeders providing a Broomfield/Glenbrae *resistant* group and 3 control groups designated 1, 2 and 3. Each group of rams were assigned to a randomly selected line of 300 mixed-age ewes to form a sire mating group identifiable by different coloured plastic ear tags. The 4 sire groups were separated for mating over a 2 cycle (6 week) period after which rams were withdrawn and the groups of ewes combined for winter grazing.

Ewes were separated into sire groups shortly before lambing until tailing, when lambs were identified by sire grouping using individually numbered plastic ear tags. After tailing, all lambs were combined and grazed together until foot-scored the following autumn. Foot lesions were scored subjectively and each animal assigned a foot infection rating on a 0-9 scale (Skerman *et al.*, 1988).

#### Results

The number of animals by sire progeny group and the prevalence and severity of foot infections are shown in Table 1.

These results agree with those from earlier work and indicate that when animals were effectively challenged, Broomfield/Glenbrae first-cross progeny

were generally less affected by footrot than those chosen as controls.

**TABLE 1** Prevalence and severity rating of footrot infection in ewe lamb progeny of 4 different sire groups.

Sire group	No. sheep	Footrot infection	
		Sheep	Mean infection rating ( $\pm$ SEM)
Resistant	113	44 (39%) <sup>1</sup>	2.9 <sup>2</sup> (0.28)
Control 1	127	75 (59%)	4.0 (0.30)
Control 2	94	67 (71%)	4.8 (0.33)
Control 3	123	69 (56%)	4.0 (0.31)

<sup>1</sup> Prevalence of active footrot cases was significantly lower in the *resistant* group than in other groups ( $P < 0.01$  - $X^2$  test).

<sup>2</sup> Group mean footrot rating of the *resistant* group was significantly lower than those of other groups ( $P < 0.01$  -paired *t*-test).

### INTRODUCTION OF FOOTROT RESISTANCE TO THE SHEEP INDUSTRY

In order to make the genetic gains in footrot resistance more widely available to corriedale sheep owners and to increase the number of breeders producing footrot resistant rams, the Orr's have initiated 2 schemes.

#### 1. The Broomfield Corriedale Group Breeding Scheme (BCGBS).

This large scale scheme was set up in 1981 to supply rams to commercial farmers. The Group utilised the flocks of 4 long-term (<12 years) users of Glenbrae rams and aims to increase the genetic base of footrot resistant Corriedales. The following selection criteria were adopted for breeding rams:

- (i) Strong Corriedale breed type, with open faces, sound back wool and constitutional soundness.
- (ii) Sound feet, determined by foot infection status after natural challenge.
- (iii) Sheeplan production parameters for number of lambs born, liveweight gain, fleece characteristics including clean fleece weight, mean fibre diameter, yield and the Lincoln College predictive colour test (Wilkinson and Aitken, 1985).
- (iv) Low GR leanness score.

Upon joining the BCGBS, each group member established an elite flock after screening rising 2-tooths for size, fleece quality and Corriedale breed type. Progeny from the elite flock are recorded on Sheeplan using the above selection criteria. In 1987, elite flocks of the 5 group members contained a total of 1284 ewes.

The nucleus flock is supervised by E.C. and M. Orr at Waipara. Other group members' flocks are based near Hawarden and Fairlie. All progeny from the elite flocks are sent to the Fairlie property of P.W. Hay each autumn after weaning to be pastured with footrot-infected merino ewes on irrigated paddocks to ensure a footrot challenge. After approximately 7 weeks, all animals are rated for foot infection status (Skerman *et al.*, 1988). Only those clear of infection are eligible to enter the nucleus, the same criterion applying to rams to be used in elite flocks. Infected animals (clinical footscald or footrot) are sent directly for slaughter.

In addition to the above routine, a progeny test programme was commenced in 1985 to allow across-flock comparisons of home-bred sires used within elite flocks. A selection is made of 4 to 6 of the best 2-tooth rams held at the Orr's property. The variation of farm location and mating dates allows sires to be rotated around the contributors' properties. Ewes are selected at random for mating.

## 2. The Corriedale Sheep Society Programme

In 1986, a topcrossing footrot resistance programme was initiated with registered breeders of the Corriedale Sheep Society. The objective is to increase the number of strains of registered Corriedale sheep exhibiting footrot resistance through topcrossing for 4 generations with Glenbrae rams over registered Corriedale ewes belonging to Society members. Numbers of animals involved in this programme are shown in Table 2.

TABLE 2 Participation in the Corriedale Sheep Society footrot resistance programme.

	Year	
	1986	1987
Number of studs	7	16
Number of ewes	81	270
Number of Glenbrae rams	3	5

Each year prior to mating, a group of Glenbrae rams approved by Society inspectors are made available for mating to ewes entered in the programme either at mating centres where ewes are brought to the ram for a 6-week mating period, or by rotating rams around the properties of participants for set mating periods.

Records of all matings and progeny are kept by

M. Orr and are notified to the Corriedale Sheep Society Registrar. The letter R is used to denote the legitimacy of inherited resistance. Animals bearing a double RR ear tattoo are authentic footrot resistant Corriedales having been verified by an approved effective footrot challenge. Progeny are referred to as R 1 ....R4 depending on the number of topcrossing generations involved with Glenbrae rams. Thus:—

Glenbrae RR	X	Participant	= R1 (generation 1)
Glenbrae RR	X	R1	= R1 (generation 2)
Glenbrae RR	X	R2	= R1 (generation 3)
Glenbrae RR	X	R3	= R4 (generation 4)

Only R4 progeny are eligible to enter a central footrot challenge site. If confirmed as resistant, they may have RR included in their ear tattoo as well as being recorded with the Society.

## DISCUSSION

Trial observations of relative advantages among offspring of Broomfield/Glenbrae rams in reduced prevalence, severity of duration of footrot infection are supported anecdotally by farmers claiming that the amount of foot care required in their flocks has diminished following the introduction of sires from this source. Further objective assessment will be necessary to establish the extent to which the genetic gains indicated have been conserved by the 2 expanded breeding schemes described.

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