THE ACCURACY OF CURRENT DAM PEDIGREE RECORDING STRATEGIES EMPLOYED BY STUD MERINO BREEDERS

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SUMMARY

Accurate pedigree information improves the reliability of breeding value estimates in Merino sheep improvement programs. Mismothering of Merino lambs results in incorrect pedigree information. DNA fingerprinting technology is now available to estimate the accuracy of on-farm pedigree recording methods. Dam pedigrees were erroneous for 10.5 % of all lambs genotyped and dam pedigree errors were as high as 15.5 % on one property. DNA pedigreeing could eliminate errors due to mismothering.

Keywords: Merino, mismothering, genotyping, pedigree errors

INTRODUCTION

Accurate pedigree information is necessary for reliable genetic evaluation of animals. The use of erroneous pedigree information in breeding programs reduces potential genetic gain (Long *et al.* 1990). The first Merino study that related mismothering to incorrect pedigree information was by Alexander *et al* (1983a), who observed that pedigree information was likely to be incorrect for 9 % of single born lambs when lambs were monitored constantly but identified once daily. This was due to ewes failing to keep their litters together, lamb desertion and lamb stealing.

A survey established that Merino breeders generally record dam pedigrees in one of two ways, either recording dam pedigrees at the time of, or close to, the time of birth, or else, 2-6 weeks after birth (Barnett 1998). Alexander (1983a) found that a significant proportion of Merino ewes desert their lambs soon after birth. Poindron and Le Neindre (1980) illustrated that the recognition of a lamb by a ewe develops within the first two hours after birth and Alexander *et al* (1986) established that the first hour post-partum was important for the development of exclusive maternal bonding. It has been shown that Merino lambs are more likely to be mismothered than other breeds of sheep (Stevens *et al.* 1984).

Until recently there has been no reliable way of determining the accuracy of on-farm pedigree recording practices. Genotyping using DNA microsatellites (Weber and May 1989) is a new technology that allows the accurate determination of parentage. This technology has been recently applied to Merino sheep to determine pedigrees or to verify pedigrees assigned by the breeder (Parsons *et al.* 1997). Microsatellite markers are well suited to pedigree determination in Merino sheep because they are abundant throughout the ovine genome and exhibit a high degree of polymorphism.

It was the aim of this study to determine the accuracy of current dam pedigree recording methods used by Australian Merino breeders. It was hypothesised that the accuracy of recording full pedigree information at birth would be significantly more accurate than recording pedigree information 2-6 weeks after birth.

MATERIALS AND METHODS

Animals from ten studs were chosen for this study. Five of these studs recorded full pedigree information at birth (Method 1) and five recorded full pedigree information 2-6 weeks after birth (Method 2). A cross-section of the stud Merino industry was included in the study and consequently, the location, wool type and size of studs varied.

At each property, 10 ml of blood was collected from a representative sample of lambs (40-110 lambs). Blood was also collected from the recorded dams and sires of these lambs. The samples were chilled and processed within three days. DNA was extracted from white blood cells using the protocol of Montgomery and Sise (1990).

Animals were genotyped using 12 microsatellite markers as described in Barnett (1998). Data from gels were collected and analysed using PE Applied Biosystems' *GeneScan Analysis 2.1* software. *Genotyper 2.1* software was used to score the gels to estimate the genotypes of the animals. To minimise errors in scoring, gels were scored twice, with the second scoring being three months after the first. Genotyper 2.1 results were run through a pedigree determination computer program. A binomial regression was performed using a logit transformation. Several animals from each stud did not have enough genotypic information to be able to assign parents or offspring to them. These animals were not included in the analysis. A generalised linear model was fitted with pedigree recording method, birth type and flock size as fixed effects. The interactions between flock size, method and birth type were also fitted. Analysis of deviance was used to quantify the difference between the two methods of recording dam pedigree information.

RESULTS

The overall proportion of lambs with incorrect dam pedigree information was 10.5 %. Irrespective of the method employed to record dam pedigrees, all studs involved in this study had animals with incorrect dam pedigree information. Proportions of errors in dam pedigree ranged from 6.8 % to 15.5 % (Table 1, Table 2).

The dam pedigree errors of those studs which recorded dam pedigrees using Method 1 averaged 8.1% and ranged from 6.9 % to 10.8 % pedigree errors (Table 1). Studs that recorded dam pedigree information using Method 2 had dam pedigree errors ranging from 8.7 % to 15.5 %, with the average being 12.6 %. However, the difference between the two methods of recording dam pedigree information was not significant (P=0.08). No other effects or interactions were significant at the 5 % level.

Table 1. Number and percentage (%) of lambs with incorrect dam pedigrees at studs that recorded dam pedigrees using Method 1

Stud	Total number of lambs genotyped	Number of lambs with incorrect dam pedigree	Percentage of lambs with incorrect dam pedigree
1	52	4	7.7
2	37	4	10.8
3	68	5	7.3
4	58	4	6.9
5	56	5	8.9
Total	271	22	8.1

Table 2. Number and percentage (%) of lambs with incorrect dam pedigrees at studs that recorded dam pedigrees using Method 2

Stud	Total number of lambs genotyped	Number of lambs with incorrect dam pedigree	Percentage of lambs with incorrect dam pedigree
6	37	5	13.5
7	58	9	15.5
8	103	11	10.7
9	69	6	8.7
10	79	12	15.2
Total	346	43	12.4

DISCUSSION

Pedigree errors were shown to occur in all Merino breeding flocks represented in this study. The proportion of lambs with dam pedigree errors was higher, but not significantly so, when pedigrees were recorded 2-6 weeks after birth compared to when pedigrees were recorded at birth.

Results presented here are similar to results found in an observational study by Alexander *et al* (1983a). The pedigree errors in the present study are, however, much higher than the pedigree error rates found in a similar study of Romney sheep (Crawford *et al.* 1993). As mismothering in Merinos has been shown previously to be a more common occurrence than in some other breeds of sheep (Alexander *et al.* 1983b), the higher error rates in the present study are not surprising.

The results of this study show that, irrespective of the method used by Merino breeders to record dam pedigree information, some lambs will have incorrect pedigree information.

The errors shown in this study would be largely eliminated if a DNA pedigreeing system were introduced. This system could eliminate problems of mismothering and also problems of operator error. DNA fingerprinting technology is currently expensive for livestock but could be a cost-effective option for breeders if the price of DNA fingerprinting fell as technology improved (Barnett *et al.* 1997).

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