

MEASURES OF TEMPERAMENT ARE HIGHLY REPEATABLE IN MERINO SHEEP AND SOME ARE RELATED TO MATERNAL BEHAVIOUR

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SUMMARY

Measures of animal temperament have been shown to be related to production in several domesticated livestock species. In this study we aimed to test whether components of temperament of Merino sheep, as measured in arena and box tests, were repeatable across ages, and whether they were related to the maternal behaviour of ewes at lambing. The components of temperament were highly repeatable when assessed at weaning, hogget age and 2.5 years. In general the relationships between measures of temperament and maternal behaviour were not strong in this preliminary study of 39 ewes. However, the behaviour of ewes in the box test was moderately correlated to components of maternal behaviour and this test shows promise as an indicator of maternal rearing ability.

Keywords: Merino sheep, temperament, repeatability, maternal behaviour.

INTRODUCTION

Animal temperament may affect production in domestic species of cattle and pigs. Animals of quiet temperament grow faster and are better producers than animals that are restless, nervous or aggressive (Tulloh 1961; Beilharz and Cox 1967; Fraser 1974; Kilgour 1975; Kovalcikova and Kovalcik 1983).

Maternal behaviour is an activity that is also likely to depend on the emotivity and temperament of the animal. If this is so, it should be possible to predict the maternal ability of an animal by measuring its temperament. The key is to find simple tests to measure it. Temperament can be assessed by exposing animals to unfamiliar environments and strange events.

Putu (1988) showed that there was a significant correlation ($r = 0.65$) between temperament in primiparous Merino ewes (assessed in an "open field" test) and subsequent maternal behaviour. Ewe temperament and the time that the ewe spent at the birthsite were also correlated ($r = 0.60$), with ewes that were less active in the temperament tests spending more time on the birthsite. The time spent by the ewe at the birthsite has been strongly related to low incidence of ewe-lamb separations and therefore increased lamb survival rates (Alexander *et al.* 1983; Putu 1988). The incidence of separations between ewes and lambs within 48 hours after parturition was also correlated to the temperament of the ewe ($r = 0.30$). Alexander *et al.* (1983) reported strain and breed differences in maternal behaviour and mothering ability that may be available for exploitation by selection, although rearing performance has been reported to be both lowly heritable (0.10) and lowly repeatable (0.09) (Piper *et al.* 1982).

The results reported in this paper are the early findings from a selection experiment that has as its aim the estimation of the extent to which measures of temperament in Merino sheep are heritable and the extent to which these measures are phenotypically and genetically correlated with maternal rearing ability and lamb survival.

MATERIAL AND METHODS

Animals and management

This study was carried out at Allandale Research Farm, at Wundowie, Western Australia. The animals in this study were born in July/August 1990 ($n = 111$) and 1991 ($n = 153$), and were the female progeny resulting from the mating of commercial Merino ewes of mixed age and strain and mixed aged rams of the AMS strain. Lambs were tailed at 4 weeks and weaned at 3 months, and then run in a larger group of ewe weaners until shearing at 15 months after which they were run with mature ewes. The ewe weaners born in 1990 were mated in January 1992 with rams from the same flock and age group, and lambed in a paddock with mature aged ewes. Only animals with complete records were included in this analysis.

The ewes born in 1990 were tested for temperament using the procedures described below at the following times: one week after weaning in October 1990; at age 15 months in 1991; and in October 1992

when 2.5 years old (after lambing in July/August of 1992) . The ewes born in 1991 were tested in the same series of tests in 1991 and 1992 as those born in 1990.

Testing procedures

Temperament arena tests The temperament test arena is illustrated in Figure 1.

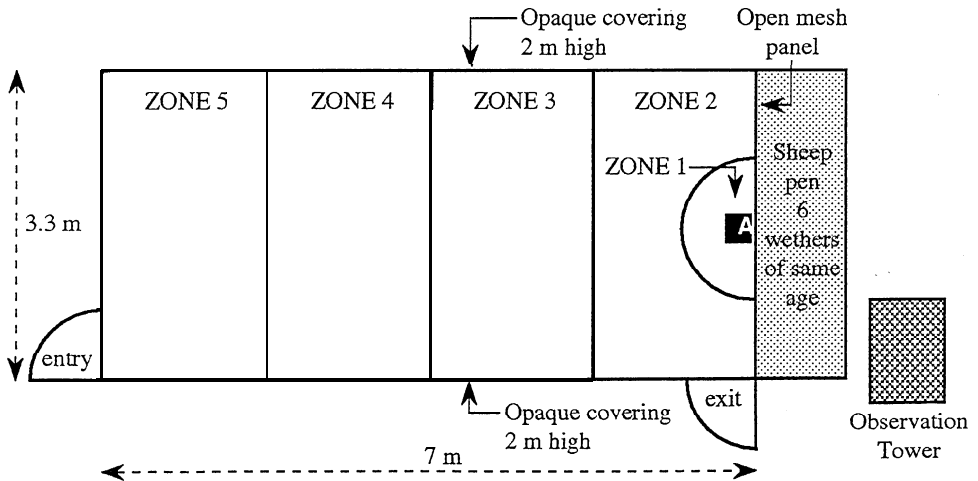


Figure 1. Plan of the temperament test arena

The zones were numbered progressively from the position of the person in position A. A second handler gently ushered each individual sheep into the arena. Timing started when the animal entered the arena. The animals were tested for 4 minutes in 1990 and 3 minutes in 1991 and 1992. The following measurements were made on each animal: the total time spent in each zone multiplied by the number of the zone (TIME); the total number of zone boundaries crossed during the test (CROSS); the number of high pitched bleats (HPB); the number of sniffs of the tester (SNF); and a subjective score of temperament by the observer in the tower (SCORE). These ranged from 1 (calm, quiet temperament) through to 10 (extremely nervous, agitated).

Box tests From 1991 onwards, at the completion of the temperament arena test animals were evaluated for their response to being completely enclosed in a plywood box measuring 1.5 m x 1.5 m x 1.5 m high. Movements and vocalisations were measured by an electronic device and the output recorded as arbitrary numeric values (BOX).

Maternal behaviour and lamb survival

Of the 111 ewe lambs born in 1990 that were present at all tests, 39 lambed in July/August 1992 and maternal behaviour was recorded after parturition. The ewes were under constant surveillance during the period of lambing with night observations carried out in a flood lit paddock. Lambs were tagged at birth and the distance the ewe retreated from the lamb during this operation was recorded (EDIST). During the first hour after birth the ewe and lamb(s) were monitored at close range and the number of ewe bleats and the time that the ewe spent licking the lamb (TOTLIK) were recorded. The time that the ewe remained on the birthsite was also recorded. Mortality data was assessed 48 hours after birth (48MORT), at lamb tailing at 4 weeks (TLMORT) and again at weaning at 3 months of age (WNMORT).

Statistical methods

The data were analysed by least squares ANOVA procedures. The effects of age at testing, year of birth (where appropriate), date of birth, human tester and animal were included in the model. Where the age at testing and individual tester were confounded, data were pre-adjusted within year of test for the effects of tester. Repeatability was estimated from the intra-class correlation.

RESULTS

Repeatabilities and correlations between measures of temperament

Repeatabilities of temperament test arena and box scores at different ages are presented in Table 1.

All measures of temperament from the test arena and the box test were highly repeatable ($t > 0.55$) when assessed at weaning and again at hogget age. Similarly, temperament measures at hogget age were highly repeatable at 2.5 years. Between weaning age and 2.5 years the repeatabilities of the measures were lower, but still highly significant.

Between the measures of temperament themselves the correlations were mostly low. There was no correlation between TIME and CROSS, nor between TIME and BOX ($r = -0.02$), nor BOX and SCORE ($r = 0.09$). By contrast there was a high positive correlation between TIME and SCORE ($r = 0.66$) and a moderate correlation between CROSS and BOX ($r = 0.41$).

Table 1. Repeatability estimates for measures of temperament from arena and box tests conducted at weaning, hogget age and 2.5 years

Trait	Age at which measurements were taken		
	Weaning - hogget	Wean - 2.5 yrs	Hogget - 2.5 yrs
TIME	0.71 (n = 264)	0.52	0.63
CROSS	0.62 (n = 264)	0.57	0.65
HPB	0.69 (n = 264)	0.73	0.72
BOX	0.73 (n = 153)	n/a	0.77
SCORE	0.67 (n = 153)	n/a (n = 111)	0.59 (n = 111)
TIME = total time spent in each zone x zone no.; CROSS = the total number of zone boundaries crossed during the test; HPB = the number of high pitched bleats; BOX = box score; SCORE = a subjective score of temperament (1 to 10) by the observer in the tower.			

Table 2. Correlation coefficients between measures of temperament^a, maternal behaviour^b and mortality at 48 hours (48MORT), tailing (TLMORT) and weaning (WNMORT)

Trait	EDIST	TIMEBS	TOTLIK	48MORT	TLMORT	WNMORT
TIME ^a	-0.35	0.44	0.11	0.15	0.15	0.17
CROSS ^a	-0.04	-0.10	0.12	-0.01	0.01	0.02
HPB ^a	0.10	-0.13	0.14	-0.09	-0.08	-0.07
BOX ^a	0.30	-0.03	-0.39	-0.06	-0.05	-0.05
SCORE ^a	-0.04	0.09	0.10	-0.04	-0.02	-0.01
EDIST ^b		-0.43	-0.12	-0.11	-0.12	-0.11
TIMEBS ^b			-0.24	0.21	0.21	0.21
TOTLIK ^b				-0.51	-0.52	-0.49
TIME = total time spent in each zone x zone no.; CROSS = the total number of zone boundaries crossed during the test; HPB = the number of high pitched bleats; BOX = box score; SCORE = a subjective score of temperament (1 to 10) by the observer in the tower. EDIST = Distance the ewe moved away from person tagging the lamb; TIMEBS = time spent by the ewe on the birthsite; TOTLIK = total time spent by the ewe licking her lamb(s) during the first hour after birth.						

Correlations with maternal behaviour and lamb survival

The relationships between measures of temperament assessed using the arena and box tests at hogget age and maternal behaviour at lambing at 2.5 years are presented in Table 2. In general, the relationships between measures of temperament and maternal behaviour were low. However, there was a significant negative relationship between TIME and EDIST and between BOX and TOTLIK; significant positive

correlations between TIME and TIMEBS, and between BOX and EDIST. Lamb mortality was only related significantly but negatively with the time spent by the ewe licking the lamb in the first hour after birth (TOTLIK).

DISCUSSION

In this study the performance of ewes in temperament arena tests and enclosed box tests was highly repeatable. More importantly, high predictability of performance extended from immediately after weaning to 2.5 years of age. This indicates that all of the tests successfully measured a real and constantly present component of temperament. However, the absence of a significant relationship between the measure of the animal's aversion to man (TIME) and the measure of its degree of agitation (CROSS) suggests that some of these variables may be measuring different components of temperament. By contrast, the box test appeared to measure similar components of behaviour to the variable CROSS.

The objective of this work now is to determine those measured components of temperament that are related to maternal behaviour. The preliminary study presented here was based on the lambing data of only 39 ewes and suggested that there may be no relationship with maternal behaviour at all. Nonetheless, the box test and maternal behaviour associated with flight from a threat (EDIST) and grooming (TOTLIK) are sufficiently well correlated to suggest that the box test is a promising indicator of maternal behaviour. The box test is a very simple and practical technique and could be very easily incorporated into existing liveweight measurement systems.

ACKNOWLEDGMENTS

This project was conducted with the financial assistance of the Wool Research and Development Corporation.

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