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PRODUCTION PERFORMANCE OF MERINO AND DOHNE MERINO EWES AND LAMBS IN PURE OR CROSSBREEDING SYSTEMS

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SUMMARY

This study details the performance of Merino and Dohne Merino ewes and lambs over eight years in either a pure or a crossbreeding regime. Ewes were mated either to rams of their own breed or to Dormer or Suffolk rams as terminal sires. Dam breed affected birth weight and lamb survival, with lambs borne by Dohne ewes being heavier and having greater survival to weaning than those borne by Merinos. Progeny of Dohne ewes and progeny sired by terminal rams were heavier at weaning. Dohne Merino ewes were heavier at mating than Merinos, but produced less clean wool at a slightly lower fibre diameter. No ewe breed or breeding regime differences were found for number of lambs born or weaned per ewe lambed. Total weight of lamb weaned was higher in Dohne Merino ewes and in ewes mated to terminal rams. Crossbreeding may have a relative advantage to pure breeding in terms of lamb output per unit ewe body weight maintained. Further studies on breed differences and crossbreeding of the South African ovine genetic resource are warranted.

INTRODUCTION

Research on South African sheep has so far not focused on the comparison of those breeds constituting the available ovine genetic resource. The option of crossbreeding as a means to achieve commercial gains through heterosis and the exploitation of sexual dimorphism has also not been researched in great detail. In fact, published studies on these topics are very scarce.

The paucity of published research is not only relevant for the South African sheep industry, as South African ovine germplasm has been exported to several overseas countries, including Australia and New Zealand. Among the breeds that were exported to Australia is the Dohne Merino. This breed presently contributes the most weaning weight records to the South African national database and shows sustained growth in weaning weight records during the recent decade (Cloete *et al*. 2014). In Australia, the Sheep Genetics Database already includes more than 100,000 Dohne Merino records for most key traits and the breed is regarded as adaptable, with easy-care properties and an ability to adapt to varying conditions (Li *et al*. 2013).

Against this background, we assessed the performance of the Dohne Merino in comparison with the internationally known Merino breed. The breeds were compared under regimes involving pure breeding and crossbreeding with terminal sires under commercial conditions.

MATERIALS AND METHODS

The study took place from 2007 to 2014 on the Langgewens research farm near Malmesbury in the Swartland region of South Africa, a mixed farming region (grain-growing and sheep farming) described in Cloete *et al*. (2003; 2004). The Merinos used in the study included some animals used in previous crossbreeding studies (Cloete *et al*. 2003; 2004) and ewes originating from the “Wet and dry” line at Tygerhoek (Cloete *et al*. 2007). Although Merino ewes originated from experimental flocks, previous results were consistent with other reports on other industry flocks (Cloete *et al*. 2003) while some ewes born from 2007 were sired by industry rams. The Dohne ewes were also transferred from the previous experiment, but were complemented with ewes donated by local breeders and purchased ewes, primarily from the University of Stellenbosch Dohne Merino stud (Cloete *et al*. 1999). The ewes were mated in single sire groups in January, either to rams of their own breed (n=7 for Dohne Merinos; n=12 for Merinos), or at random to rams of the terminal sire breeds Dormer or Suffolk (Cloete *et al*. 2003; 2004). The ewes were maintained as a single flock afterwards. Selection of most rams considered their representation as sires in several industry flocks so as to create links of the experimental population with the national database. As well, about half of the selected Merino rams originated from the High line of a divergent selection experiment for number of lambs weaned per mating (Cloete *et al*. 2009). The ewes lambed in June-July. Birth weight, dam identity and pedigree were recorded at birth as reported by Cloete *et al*. (2003). Weaning weights were recorded at 97 (s.d.=19) days and birth and weaning records were combined to derive complete reproduction records. Ewes were shorn in May during late pregnancy and individual greasy fleece weights were recorded. Individual wool samples were taken to measure clean yield, staple length, staple strength, fibre diameter and the coefficient of variation (CV) of fibre diameter. Clean fleece weight was derived from the product of greasy fleece weight and clean yield. Wool records were available from 2008 to 2014.

Data were analysed by ASREML (Gilmour *et al*. 2006) to predict means for selected fixed effects. Fixed effects assessed for lamb records were ewe breed (Dohne Merino or Merino), breeding regime (pure or terminal cross), sex (male or female), birth year (2007-2014), dam age (2-7+years) and birth type (single or multiple). Apart from ewe breed and breeding regime, ewe age (2-7+years) and year (2007-2014) were fitted to ewe records. No distinction was made between the two terminal sire breeds, as they were earlier shown to perform alike (Cloete *et al*. 2003; 2004). The ewe breed x breeding regime interaction was fitted where appropriate (i.e. lamb traits and ewe reproduction) but not for ewe wool traits. The random effects of animal and dam permanent environment were fitted to lamb records, while animal permanent environment (and service sire for reproduction records) were fitted to ewe traits. Where proportions needed to be analysed, the online tool of Preacher (2001) was used.

RESULTS AND DISCUSSION

Ewe breed exerted a marked effect on lamb birth weight, lambs borne by Dohne Merino ewes being 9.6% heavier (P<0.01) than the progeny of Merino ewes (5.36±0.09 vs. 4.89±0.08 kg respectively; Table 1), when expressed relative to Merino progeny. Birth weight was independent of crossbreeding system and the interaction between ewe breed and crossbreeding regime. In a previous study, when only terminal crossbreeding was practiced, progeny of Dohne Merino ewes were 5.5% heavier than lambs borne by Merino ewes (Cloete *et al*. 2003).

Table 1. Predicted means (±s.e.) for ewe breed (Merino or Dohne Merino) with mating system (pure breeding of terminal cross) combinations for lamb birth weight, weaning weight and lamb survival. The logit transformation was applied to binomial survival records, but only backtransformed means and approximate s.e.'s are given.

Ewe breed (EB)	Merino		Dohne Merino		EB	CS	EB x CS
Crossing system (CS)	Pure	Cross	Pure	Cross			
Lambs born (n)	608	395	366	312			
Birth weight (kg)	4.79±0.11	4.99±0.09	5.32±0.13	5.40±0.10	**	0.13	0.41
Weaning weight (kg)	29.1±0.5	31.9±0.5	34.4±0.6	35.5±0.5	**	**	*
Lamb survival	0.78±0.02	0.76±0.03	0.81±0.03	0.83±0.03	*	0.81	0.40

* P<0.05; ** P<0.01; Actual significance level for P>0.05

Weaning weight was affected by ewe breed, crossbreeding regime and their interaction. Terminal crossbred progeny of Merino ewes were 9.6% heavier at weaning than purebred lambs

(P<0.05; Table 1). This difference was smaller for Dohne Merino ewes, the advantage of terminal crossbred progeny only amounting to 3.2%. Overall, crossbred progeny of Dohne Merino ewes were 11.2% heavier than crossbred lambs produced by Merino ewes (Table 1). Cloete *et al*. (2003) previously reported a comparable breed difference of 10.5%. Van Deem *et al*. (2008) also found that F1 Dohne Merino x Merino lambs outgrew purebred Australian Merino lambs. Only ewe breed affected lamb survival, being improved by 6.5% in the progeny of Dohne Merinos compared to Merinos (0.82±0.02 vs. 0.77±0.02 respectively), when expressed relative to the mean for lambs borne by Merinos. A previous study reported respective lamb mortality rates of 0.18 to 0.23 for Merinos, compared to 0.16 for Dohne Merinos (Cloete *et al*. 2003). Cloete *et al*. (1999) reported that the advantage in lamb survival of purebred Dohne Merino lambs relative to Merinos was primarily for the survival of twins (respectively 0.87 vs. 0.81).

Ewe mating weight and reproduction were independent of crossing regime and the interaction of ewe breed with crossing regime (Table 2). Overall, Dohne Merino ewes were 19.6% heavier than Merinos at mating (72.6±0.6 vs. 60.7±0.4 kg respectively), when expressed relative to means for the Merino. Previous studies also reported that mature Dohne Merino ewes were approximately 20% heavier than Merinos (Cloete *et al*. 2003; 2004). The number of lambs born per ewe lambed ranged from 1.56 to 1.63 and number of lambs weaned per ewe lambed from 1.19 to 1.29 (both P>0.05). Overall, lamb output per ewe lambed of Dohne ewes exceeded the mean performance of Merinos by 18.5% (48.0±1.2 vs. 40.5±1.0 kg respectively; Table 2). The corresponding advantage of ewes mated to terminal sire rams amounted to 15.6% (47.5±1.2 vs. 41.1±1.0 kg respectively). Reproduction was not expressed per ewe mated, as higher lambing rates were seen in ewes mated to a terminal sire. In total, 395 of 512 Merino ewes mated to a Merino ram lambed in comparison to 249 of 295 ewes mated to a terminal ram (0.771 vs. 0.844; Chi²=6.12; P=0.013). A total of 237 of 320 Dohne ewes mated to a Dohne ram lambed in comparison with 204 of 232 Dohne ewes mated to a terminal ram (0.741 vs. 0.879; Chi²=16.1; P<0.01). Previous studies also did not report marked advantages in reproduction traits of either breed in comparison to the other in either pure or crossbred situations (Basson *et al*. 1969; Fourie and Cloete 1993; Cloete *et al*. 2003).

Table 2. Predicted means (±s.e.) for ewe breed (Merino or Dohne Merino) with mating regime (pure breeding of terminal cross) combinations for ewe mating weight and reproduction, with all reproduction traits expressed per ewe lambed

Ewe breed (EB)	Merino		Dohne		EB	CS	EB x CS
Crossing system (CS)	Pure	Cross	Pure	Cross			
Ewes lambed (n)	395	249	237	204			
Mating weight (kg)	60.7±0.5	60.8±0.5	72.5±0.6	72.7±0.6	**	0.83	0.99
Lambs born	1.58±0.03	1.63±0.04	1.56±0.04	1.59±0.04	0.42	0.19	0.51
Lambs weaned	1.19±0.04	1.20±0.05	1.23±0.05	1.29±0.05	0.20	0.46	0.56
Weight weaned (kg)	37.4±1.2	43.5±1.5	44.7±1.5	51.4±1.7	**	**	0.85

* P<0.05; ** P<0.01; Actual significance level for P>0.05

Wool traits of adult Merino and Dohne Merino ewes are provided in Table 3. Clean fleece weights of Dohne Merino ewes were 9.7% lower than in Merinos while the clean yield of Dohne Merino ewes were 7.2% below that of Merinos, when expressed relative to means for the Merino (all P<0.01). Previous studies suggested somewhat higher advantages in clean fleece weight for Merino ewes relative to Dohnes, ranging from 18 to 29% (Cloete *et al*. 1999; 2003; 2004). Van Deem *et al*. (2008) similarly reported that clean wool production was improved in Merino lambs compared to to F1 Dohne x Merino lambs. Clean yield results confirmed previous results that the clean yield of Merino ewes are higher compared to Dohnes (Basson *et al*. 1969; Cloete *et al*. 1999; 2003; Van Beem *et al*. 2008). Staple length was independent of ewe breed, but staple strength tended to be higher in Merinos (P=0.055). Cloete *et al*. (2003) reported a mean staple strength of 37.2 N/ktex for Dohne Merino ewes compared to 41.6 N/ktex for Merino ewes selected for fleece weight. Fibre diameter and the CV of fibre diameter were improved by respectively 3.2 and 7.1% in Dohne ewes (P<0.05). Previous studies on fibre diameter are inconclusive for comparison of Dohnes with Merinos. Cloete *et al*. (2003; 2004) reported that Merino wool was broader than Dohne wool, Cloete *et al*. (1999) reported no breed difference and van Beem *et al*. (2008) reported that F1 Dohne crossbred lambs produced broader wool than Merinos.

Table 3. Predicted means (±s.e.) for ewe breed (Merino or Dohne Merino) for ewe wool traits

Trait	Breed		Significance
	Merino	Dohne	
Ewes shorn (n)	472	291	
Clean fleece weight (kg)	3.91±0.04	3.53±0.05	**
Clean yield (%)	69.9±0.2	64.9±0.3	**
Staple length (mm)	89.9±0.5	90.1±0.6	0.47
Staple strength (N/ktex)	36.2±0.5	35.1±0.6	0.06
Fibre diameter (µm)	21.6±0.1	20.9±0.1	**
Coefficient of variation (%)	19.7±0.1	18.3±0.2	**

* P<0.05; ** P<0.01; Actual significance level for P>0.05

CONCLUSIONS

There were clear advantages of Dohne Merinos for growth, lamb survival and mature size, while Merinos outperformed Dohne Merinos for clean fleece weight and clean yield. No conclusive advantage for either breed was seen in reproduction. The finer fibre diameter of Dohne Merino ewes was unexpected, but consistent with some literature. The experimental outlay did not allow the unbiased estimation of heterosis but the larger crossbred advantage for weaning weight of Merino progeny compared to Dohnes may originate from heterosis. Alternatively, the improved outputs of the crossbreeding regime could simply stem from differences in sexual dimorphism between sire and dam breeds. Further research on input/output performances are warranted.

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