Assessment of the reproductive and growth performance of two sheep composites, developed from the Finnish Landrace, compared to the Dorper

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Genes were introduced from the prolific Finnish Landrace sheep breed by crossbreeding with indigenous breeds to produce several composites. In this study, two of these composites were compared to the Dorper in terms of reproductive characteristics and growth. Mean ovulation rate of Composites 1 and 2 was 1.93 and 1.67, respectively, compared to 1.13 of the Dorper. Composites were subsequently also mated to Dorper rams. Prolificacy was 1.35, 1.48, and 1.08 lambs born per lambing to Composites 1 and 2 and Dorpers, respectively. Birth mass differed between the Dorper and composites. Neither weaning mass (at 62.6 days) nor 100-day mass differed between composites and the Dorper. There was a higher fat content in the milk of the composites. Although the preliminary assessment is based on relatively low numbers, there is, however, some potential in these dam lines for future crossbreeding purposes.

Die Finse Landras is gebruik om gene van dié hoë vrugbare ras deur kruisteling met inheemse rasse in verskeie komposiete te benut. Twee van dié sintetiese kuddes is in hierdie studie met die Dorper ten opsigte reproduksie-eienskappe en groei vergelyk. Die gemiddelde ovulasietempo van Komposiete 1 en 2 was onderskeidelik 1.93 en 1.67 vergeleke met 1.13 van die Dorpers. Die komposiete is daarna ook met Dorperramme gepaar. Meerlinggeboortes was 1.35, 1.48 en 1.08 vir die Komposiete 1 en 2 en Dorpers, onderskeidelik. Geboortemassa van Dorpers en komposiete het verskil. Speenmassa (op 62.6 dae) sowel as 100dae-massa het nie betekenisvol tussen die komposiete en Dorpers verskil nie. Die melk van die komposiete het 'n hoër vetinhoud as dié van die Dorpers gehad. Alhoewel die voorlopige vergelyking slegs op 'n relatief klein getal gebaseer is, toon die genotipes egter tog potensiaal as moederlyne vir toekomstige kruisteeltdoeleindes.

Keywords: Crossbreeding, Finnsheep, mass, ovulation rate, puberty, reproductive performance.

Both economic and biological efficiency in sheep flocks depend mainly on reproductive and growth performance (Large, 1970). Low reproductive rate and high maintenance requirements of the breeding female contribute largely to a low efficiency (Dickerson, 1978).

Sheep breeds normally differ in age of sexual maturity, ovulation rate, prolificacy and length of the natural breeding season. The limited scope for increased reproduction through selection, owing to the low heritabilities of these traits, directed the attention of sheep breeders to the large differences that exist in several reproductive components between breeds (Maijala, 1984).

The highly prolific Finnish Landrace (Finn) sheep breed has been used extensively in many countries (Maijala, 1984; Young *et al*, 1985), in both traditional crossbreeding and in the development of new specialized dam lines, to balance some of the deficiencies (e.g. growth performance) of the Finn with outstanding characteristics of other breeds. In an attempt to develop such a prolific sheep population with a long breeding season, Finnsheep were crossed with several indigenous sheep breeds, including the Van Rooy, the Afrikaner and the Blackhead Persian (Terblanche, 1979). Two of these crosses were regarded as being suitable for extensive farming as well as dam lines for crossbreeding purposes in more intensive systems. These two composite groups were:

Composite 1: A 1/2 Finn 1/2 Blackhead Persian composite. Finn rams were mated to Blackhead Persian ewes. *Inter se* matings followed between the F_1 progeny.

Composite 2: A 3/8 Finn 1/4 Persian 1/4 Van Rooy 1/8 Afrikaner composite. Van Rooy ewes were first mated to Finn × Afrikaner crossbred rams. Ewes born from this cross (1/2 Van Rooy 1/4 Finn 1/4 Afrikaner) were subsequently mated to 1/2 Finn 1/2 Blackhead Persian rams from the Composite 1 group.

Despite culling lambs which showed conformational abnormalities, no ewe selection was practised within these two groups. Ram replacements were subjectively selected on conformational soundness and weaning mass. The two groups were bred in the Fraserburg District (Karoo) and the ewe lambs were moved to the Experimental Farm of the University of Pretoria after weaning, at approximately 90 days of age.

The third group consisted of the experimental Dorper flock of the University of Pretoria. Sheep in the three groups were of the same age, and 10 single-born lambs were selected from each group for this study, in which some reproductive performance and growth characteristics were investigated. Owing to restricted facilities and availability, only 30 animals could be accommodated. The reproduction efficiency parameters included age and mass at puberty, ovulation rate and the number of lambs born per lambing and per lambing opportunity. The mass of each lamb at birth, weaning and 100 days was also recorded.

The ewes were fed a pelleted balanced commercial diet (10.5 MJ ME/kg DM; 10% CP DM) at 0.6 kg per day for the Dorpers and 0.4 kg per day for the composites per animal. This corresponds to approximately 2% of body mass at the beginning of the experiment (approximately 1.1% of body mass at puberty). The ewes also received a poor quality hay *ad libitum*. The animals were weighed weekly, on each occasion after an overnight fast.

From approximately five months of age (December 1988), the lambs were teased twice daily, using three teaser rams, to determine age of puberty. The first observable oestrus was taken as the onset of puberty. At approximately two days after the last noticeable signs of oestrus, ovulation rate was determined through laparoscopy (Oldham & Lindsay, 1980), carried out at either the third or fourth estrous cycle after onset of puberty.

The ewes were subsequently mated for three cycles to obtain lambing performances. The same Dorper rams were used in all three groups during each cycle. These cycles were:

15 April to 31 May 1989;

15 December 1989 to 31 January 1990; and

15 August to 30 September 1990.

Body masses at the beginning of the experiment, at puberty, at the beginning of each mating cycle, and at the end of the experiment are presented in Table 1. The combined Composite:Dorper body mass ratio is also presented, and indicates a ratio of approximately 40:60 which corresponds to the 40:60 ratio in pellets presented to the Composites and Dorper, respectively.

Least-squares procedures (SAS, 1990) were used to analyse the data. Least-squares means for age and mass at puberty, ovulation rate and subsequent reproductive performances of the ewes are presented in Table 2.

An analysis of variance for the reproductive traits with contrasts between the Dorper and combined composites and between the Composite 1 and Composite 2 groups, is presented in Table 3.

The Dorpers attained puberty at a higher (*ca.* 40%) body mass than the two composite groups. However, there was no difference in age at puberty between the groups ($P = 0.586$). Ovulation rate was higher in the two composite groups than in the Dorper ($P = 0.093$), which resulted from the high genetic contribution of the prolific Finnish Landrace in the two groups.

The number of lambings per lambing opportunity (N_L/L_O) tended to be higher in the composites compared to the Dorper ($P = 0.101$). The mean litter size (or L_B/N_L) was 1.42 for the composites compared to 1.08 for the Dorpers ($P = 0.016$). A

Table 1 Body mass of Composites 1, 2 and Dorper ewes, and Composite:Dorper body mass ratio at different stages of the experiment

		Body mass ± *SD* at					
				Start of mating cycles			
Group	*n*	Start of experiment	Puberty	1st	2nd	3rd	End of experiment
Composite 1	10	19.5 ± 2.30	35.8 ± 2.84	40.7 ± 3.52	53.8 ± 4.09	55.1 ± 7.57	51.1 ± 3.64
Composite 2	10	19.8 ± 4.50	36.3 ± 3.75	41.1 ± 3.08	55.4 ± 2.50	56.4 ± 5.34	52.9 ± 5.16
Dorper	10	28.8 ± 3.79	50.9 ± 6.97	57.9 ± 4.53	73.8 ± 3.95	79.4 ± 8.78	74.0 ± 8.92
Composite : Dorper ratio	30	40.5 : 59.5	41.5 : 58.5	41.5 : 58.5	42.5 : 57.5	41.2 : 58.8	41.1 : 58.6

Table 2 Least-squares means ± *SE* for reproductive performance of the two Composite and Dorper ewes

Group	*n*	Age at puberty (months)	Mass at puberty (kg)	Ovulation rate (n)	Number of L_O	N_L	L_B	Reproductive performance N_L/L_O	L_B/N_L	L_B/L_O
Composite 1	9	8.03 ± 0.362	37.1 ± 0.71^a	1.93 ± 0.251^a	24	21	29	0.88 ± 0.066	1.35 ± 0.105^{ab}	1.20 ± 0.131^{ab}
Composite 2	10	7.64 ± 0.261	34.9 ± 0.54^a	1.67 ± 0.226^{ab}	30	27	40	0.93 ± 0.048	1.48 ± 0.098^a	1.34 ± 0.123^a
Dorper	9	8.14 ± 0.292	50.8 ± 1.82^b	1.13 ± 0.201^b	25	18	21	0.75 ± 0.086	1.08 ± 0.090^b	0.83 ± 0.125^b

^{a,b} Means with different superscripts in the same column differ significantly ($P \leq 0.05$).

L_O = number of lambing opportunities; N_L = number of lambings; L_B = number of lambs born.

Table 3 Analysis of variance for reproductive traits with contrasts for Dorper vs. composites and Composite 1 vs. Composite 2

		Traits														
		Age at puberty			Ovulation rate			N_L/L_O*			L_B/N_L*			L_B/L_O*		
Source of variation	df	MS	F	P	MS	F	P	MS	F	P	MS	F	P	MS	F	P
Between groups	2	1.672	0.55	0.586	5.866	1.60	0.225	0.069	1.53	0.238	0.330	3.74	0.040	0.546	3.11	0.065
Dorper vs. Comp.	1	3.272	1.12	0.301	10.901	3.07	0.093	0.127	2.93	0.101	0.590	6.74	0.016	1.019	5.95	0.023
Comp. 1 vs. Comp. 2	1	0.072	0.02	0.894	0.830	0.16	0.695	0.011	0.43	0.521	0.119	0.59	0.453	0.073	0.40	0.537
Within groups	22	3.050			3.673			0.045			0.088			0.176		

* L_O = number of lambing opportunities; N_L = number of lambings; L_B = number of lambs born.

difference was also evident for L_B/L_O, which is the product of N_L/L_O and L_B/N_L, between the composites and the Dorper (P = 0.023). Composite 1 produced 45% and Composite 2 produced 61% more lambs per lambing opportunity than the Dorper. The number of twin lambings were 38, 48 and 17% for the three groups, respectively. No differences were evident between Composites 1 and 2 for any trait.

Earlier sexual maturity, increased conception rates, higher ovulation rates and higher fecundity in Finn and Finn crosses were also illustrated in many overseas studies (Maijala & Österberg, 1977; Oltenau & Boylan, 1981; Young *et al.*, 1985; Fahmy & Dufour, 1988; Aboul-Naga *et al.*, 1989), where the Finn was crossed with local breeds.

Lambs born during the three cycles were weighed at birth and weekly thereafter. Weaning took place after they reached 50 days of age (62.6 days on average), provided that they weighed at least 15 kg. Lambs were also offered creep feed (pellets) from one week of age. Birth, weaning and 100-day mass were recorded. These were also analysed by means of least-squares procedures (SAS, 1990). Genetic group, lambing cycle, birth type (single or twin) and sex were included into the models for the birth and 100-day body mass. For weaning mass, the age of weaning was additionally included as a covariable. Since the least-squares means given by the SAS programme were not all estimable when first-order interactions were included in the model equation, a model equation which describes main effects only was used to obtain such means for the mass of lambs at birth, weaning and 100 days. These are presented in Table 4.

Birth mass of lambs of the two composites were less than birth mass of Dorper lambs ($P \leq 0.05$). No differences were evident for either weaning or 100-day mass between the three groups. A faster pre-weaning growth rate in the crossbred lambs of the composite ewes, was therefore evident. This could only be brought about by either a higher milk production in the composites, or a difference in milk composition.

Table 4 Least-squares means ± *SE* for birth, weaning, and 100-day mass of lambs of the two Composites and Dorper

Group	n	Body mass (kg) at Birth	Weaning	100 days
Composite 1	26	3.5 ± 0.08^a	16.7 ± 0.29	26.9 ± 1.32
Composite 2	35	3.3 ± 0.09^a	16.9 ± 0.33	26.3 ± 1.53
Dorper	17	5.0 ± 0.13^b	17.3 ± 0.54	26.7 ± 2.15

^{a,b} Means with the same superscript in the same column differ significantly ($P \leq 0.05$).

Milk samples were taken at 10, 20, 30 and 40 days *post partum* from ewes which lambed during the second cycle. These samples were tested for fat content (Gerber test) only. Mean values are presented in Table 5.

There was no evidence of any difference in either intercept (P = 0.547) or slope (P = 0.496) when individual slopes and intercepts were subjected to an analysis of variance. However, when slope was included as a covariate into the analysis of variance, a difference in intercept between the composites and the Dorper became evident (P = 0.006), which indicates a higher fat percentage in the milk of the composites which may have been responsible for the faster preweaning growth rate in these lambs. Significant differences in fat content between breeds were also reported by Rhind *et al.* (1992), whereas Boujenane & Lairini (1992) and Sakul & Boylan (1992) failed to do so.

On the basis of these initial results, it may be concluded that the two composite groups show promise for use in future breeding schemes. The lower body mass, improved reproductive performance and faster preweaning growth rate confirm the possibility of increased efficiency in sheep flocks through crossbreeding. The results allow one to predict that the composite lines would be ideal genetic material as dam lines in crossbreeding systems.

Table 5 Means ± *SE* for milk fat content (%) at 10, 20, 30 and 40 days *post partum* and regressions of fat percentage on days for composites and Dorper ewes

		Days *post partum*				
Groups	n	10	20	30	40	Regressions
Composites	13	8.4 ± 0.44	8.8 ± 0.42	7.9 ± 0.53	7.9 ± 0.33	$Y = 8.79 - 0.021\,X$
Dorper	4	7.2 ± 0.78	7.1 ± 0.35	7.1 ± 0.17	5.5 ± 0.26	$Y = 8.01 - 0.051\,X$

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