A comparison between female lambs of the Dorper and two synthetic composites with respect to feed intake, growth and efficiency

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Growth-related parameters, such as feed intake, growth rate and feed efficiency were investigated in ewe lambs of two genetically related synthetic lines and the Dorper. Ten ewe lambs in each of the three groups were individually fed in metabolic cages and individual intake and mass gain were recorded weekly over a period of 34 weeks, starting at approximately 100 days of age. Intake levels (53%) and mass gain (45.5%) were significantly ($P \leq 0.05$) higher in the Dorper as compared to the combined Synthetic group. Both intercept ($SL = 0.000$) and slope ($SL = 0.033$) differed between the two groups. After adjusting for differences in mature body mass at equal degrees of maturity, there was still a tendency ($SL = 0.060$) in the Dorpers to have a higher intake (13.7%) relative to metabolic size and to be less efficient (9.7%) than the Synthetic group ($SL = 0.098$). No differences in growth rate/$M^{0.75}$ on equal degrees of maturity were evident, which indicate that differences in growth rate were only related to differences in mature size.

Groeiverwante maatstawwe, soos voerinname, groeitempo en voerdoeltreffendheid is in ooilammers van twee geneties-verwante sintetiese lyne en die Dorper ondersoek. Tien ooilammers in elk van die drie groepe is individueel in metaboliese kratte gevoer en individuele innames en groeitempo's is weekliks oor 'n tydperk van 34 weke, beginnende op ongeveer 100-dae-ouderdom, aangeteken. Inname-peile (53%) en groeitempo (45.5%) was betekenisvol ($P \leq 0.05$) hoër in die Dorper vergeleke met die saamgevoegde Sintetiese groep. Beide afsnit ($BP = 0.000$) en helling ($BP = 0.033$) het tussen die twee groepe verskil. Na korrigering van verskille in volwasse massa by dieselfde graad van volwassenheid, was daar steeds 'n neiging ($BP = 0.060$) by die Dorper om 'n hoër inname (13.7%) relatief tot metaboliese massa en laer doeltreffendheid (9.7%) as die Sintetiese groep ($BP = 0.098$) te hê. Geen verskille is in groeitempo/$M^{0.75}$ by dieselfde graad van volwassenheid aangetoon nie, wat aandui dat verskille in groeitempo slegs in verband met volwasse massaverskille staan.

Keywords: Dorper, efficiency, ewes, feed intake, growth rate, synthetics.

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Introduction

The primary aim of increasing growth rate is to increase overall efficiency at flock level. Biological efficiency in meat producing animals can be expressed as a ratio of output (i.e. body mass) to input (i.e. food consumed). It is well-known that large variation exists between animals in levels of feed intake, growth rate and feed conversion efficiency. These parameters are, however, often highly correlated so that genetic change in output, via increased growth rate and feed conversion efficiency, often results in a corresponding change in input (i.e. feed intake), and there may be little net change in the efficiency ratio (Thompson, 1987).

Larger animals normally grow faster, but will take longer to reach the same stage of maturity than smaller animals, and will consume more food than will smaller animals (Taylor, 1980a). These growth-related variables are therefore strongly associated with the proportion of mature body mass that has been achieved (Taylor & Murray, 1987). Much of this variation in growth-related parameters among animals of different mature sizes can be reduced when applying genetic size-scaling rules (Taylor, 1980a; 1980b; Roux & Meissner, 1984). When mature size differences are adjusted for in this way, there usually are small differences in growth rate and efficiency at the same stage of maturity (Thonney *et al.*, 1987). It makes them relatively independent of mature size. This relationship is, however, not perfect, in that some of the variation is still independent of mature size (Thompson, 1987).

Two genetically related synthetic lines were developed for lamb production in both extensive and intensive production areas and to act as dam lines in terminal crossbreeding programmes. Emphasis was placed on small size, earlier sexual maturity and high fertility in the development of these two composites.

The objectives of this study therefore were to investigate patterns of feed intake, growth and gross feed conversion efficiency in these lines under a restricted feeding period, which is more closely related to natural conditions as compared to an *ad libitum* situation. Growth, feed intake and efficiency equations were fitted and used to assess whether these two genotypes, as compared to the Dorper, differed in their patterns of feed intake, growth and efficiency before and after adjusting for differences in mature body mass.

Procedure

Experimental material

Growth and feed intake data were obtained from three genetic groups of 10 single-born ewe lambs each. Owing to restricted facilities, only 30 animals could be accommodated. The three groups were:

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

Group 2: A 3/8 Finn 1/4 Blackhead 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 first group.

No ewe selection was applied on ewes of these two groups, except for the culling of ewe lambs showing conformational abnormalities. Ram replacements were subjectively selected on conformational soundness and on 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 being weaned at approximately 90 days of age.

Group 3: Ten Dorper lambs taken from the Dorper flock of the University of Pretoria.

The lambs were individually kept in metabolic cages from approximately 100 days of age for a period of 37 weeks (October 1988 to June 1989). Data of the first three weeks were discarded to allow for adaptation of the animals to the diet and environment.

The lambs were individually fed a pelleted balanced commercial diet with a ME value of 10.5 MJ/kg DM and a crude protein content of 10%. The lambs were fed daily at *ad libitum* and leftovers were removed from the feeding troughs every Tuesday when weekly feed intake and body mass were recorded. Weighing took place after overnight fasting. The animals were kept in the metabolic cages from 15:00 until 07:00 the next day and were then moved to a large pen where only water and a dicalcium phosphate lick were freely available. They were also exercised daily by running approximately 800 m. The lambs were weighed on four occasions between October 1990 and April 1991 and the average was taken as mature body mass (Table 1).

Table 1 Age and final and approximate mature mass of two Synthetic groups and one Dorper group of ewe lambs

	Synthetic I	Synthetic II	Dorper
Number of lambs	10	10	10
Average date of birth	1988-06-18	1988-06-18	1988-06-28
Average mass (kg) after adaptation (1988-11-01)	21.2 ± 2.7[a]	20.3 ± 2.0[a]	28.6 ± 2.9[b]
Final mass (kg) (1988-06-26)	46.0 ± 3.4[a]	43.1 ± 4.8[a]	67.9 ± 4.7[b]
Approx. mature mass (kg)	56.8 ± 6.6[a]	58.9 ± 6.4[a]	77.5 ± 8.4[b]

[a,b] $P \leq 0.05$.

Statistical analysis

During an initial analysis both means and variances of the two synthetic groups were tested for equality (Steel & Torrie, 1980). As both means and variances for mass at any age during the trial did not differ significantly ($P < 0.05$) (see Table 1), it was decided to pool the data of the two synthetic groups. It was subsequently compared to the Dorper as one single group (Synthetic).

Individual as well as average relationships between ln (cumulative feed intake) and ln (body mass) were also estimated (Roux, 1976; Meissner, 1977), where

$$\ln y = \ln a + b \ln x$$

where y = body mass,
x = cumulative feed intake,
b = slope,
a = intercept.

This procedure treats the physical process as an input-output system in which the output is an increase in mass and input is the cumulative feed intake. It is simple to use and it fits the data extremely accurately. Feed intake during the period prior to the experiment was not known and, although it could have been estimated, it was, however, ignored.

By applying this procedure, growth period was divided into two phases, each described by a straight line in terms of slope and intercept. As will be discussed later, approximate break-points between the two phases were obtained after 12 weeks for both the Synthetic and Dorper groups. These phases were:

Phase 1: From the start (approximately 100 days of age) to approximately 200 days of age.

Phase 2: From approximately 200 days of age up to the end of the experiment (approximately 360 days of age).

Student's *t* test was used to test for differences in mass gain, average daily gain, cumulative feed intake and efficiency between the Synthetic and Dorper groups within each phase (see Table 2).

Weekly patterns of feed intake, growth rate and efficiency were subsequently fitted on data. Differences in feed efficiency between the two groups were obtained for each animal from the first derivative (dy/dx) of the individual body mass-cumulative feed intake equations and then fitted on both weeks and degree of maturity. Regression equations were fitted for each animal by using the simple regression procedure of the STATGRAPHICS computer program (1986). Differences between intercepts (*a* values) and slopes (*b* values) were tested by means of analysis of variance.

Results and Discussion

Feed intake

When animals are fed *ad libitum*, large differences in feed intake and feed efficiency are observed (Malik, 1984). Differences in feed intake arise from differences in maintenance requirements (size), feed efficiency, basal metabolism, activity, growth (rate of tissue deposition) as well as the processes of thermoregulatory thermogenesis. Of these, maintenance requirements, growth and efficiency are the most important to the animal breeder, as they are related to efficiency of the entire flock (Roux, 1992).

Differences in cumulative feed intake between the Synthetic and Dorper groups are presented in Table 2. Cumulative feed intake of the Dorper was significantly ($P \leq 0.05$) higher than that of the Synthetic group for both phases. The total cumulative intake of the Dorpers was 54.3% more than that of the Synthetic group and the average weekly intake differed with 53% between the two groups.

The pattern of feed intake (kg/week) for the two groups is illustrated in Figure 1.

Table 2 Mass gain, average daily gain, cumulative feed intake and efficiency (± *SD*) of Synthetic and Dorper ewe lambs for two phases and total respectively

	Synthetics	Dorpers
Number of lambs	20	10
Phase 1		
Mass gain (kg)	11.22 ± 1.93^a	14.15 ± 1.66^b
Average daily gain (kg/d)	0.15 ± 0.03	0.18 ± 0.02
Cumulative feed intake (kg)	81.18 ± 8.34^a	115.77 ± 7.42^b
Efficiency		
[(kg gain/kg feed) × 100]	13.84 ± 1.17	12.21 ± 1.05
Phase 2		
Mass gain (kg)	16.56 ± 3.46^a	24.44 ± 3.52^b
Average daily gain (kg/d)	0.10 ± 0.02^a	0.16 ± 0.02^b
Cumulative feed intake (kg)	189.05 ± 13.33^a	300.17 ± 18.12^b
Efficiency		
[(kg gain/kg feed) × 100]	8.74 ± 1.29	8.14 ± 1.02
Total		
Mass gain (kg)	27.62 ± 4.17^a	38.63 ± 3.89^b
Average daily gain (kg/d)	0.11 ± 0.02^a	0.16 ± 0.02^b
Cumulative feed intake (kg)	269.82 ± 18.55^a	416.27 ± 20.28^b
Efficiency		
[(kg gain/kg feed) × 100]	10.21 ± 1.21	9.28 ± 1.00

^{a,b} $P \leq 0.05$.

Regression equations and model parameters as well as the analysis of variance between intercepts and slopes, are presented in Table 3.

Feed intake increased over weeks, while differences in both intercept (*SL* = 0.000) and slope (*SL* = 0.033) were evident between the Synthetic and Dorper groups. Despite large week-to-week variation in feed intake, a sharp decline was evident in the Synthetic group from approximately week 23 to week 26, followed by a sharp increase. This decline was associated with the first observed oestrus. The same applied to the Dorper but in a less accentuated degree and at a later age. More ewes of the Synthetic group (18) started their cycles between weeks 20 and 32 as compared to the Dorpers (6).

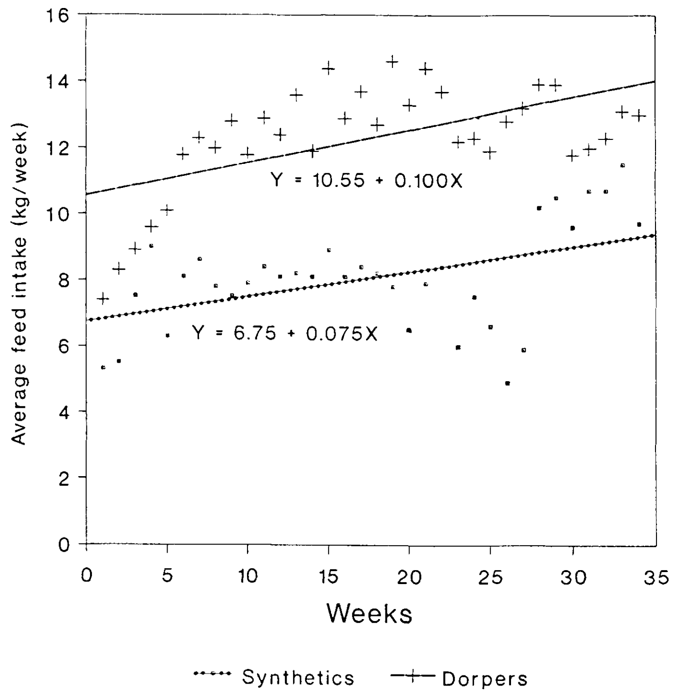

Figure 1 Differences in weekly feed intake levels between Dorper and Synthetic ewe lambs over equal ages.

Large breeds usually eat more, grow faster and reach a higher mature body mass at a later age than smaller breeds. Estimated average limit mass ($dy = 0$) for the Synthetic and Dorper groups was 51.96 and 65.83 kg respectively, which correspond to an estimated average age of 12.8 and 14.2 months respectively. Large breeds therefore take longer to mature. Comparing larger and smaller breeds at the same age, simply implies that the larger breed is less mature than the smaller breed. Similarly, comparing large and small breeds at the same mass simply reflects that the larger breed is less mature than the smaller breed (Thompson, 1988). To overcome this problem, the application of mathematical scaling procedures is proposed to provide a more logical basis for comparison (Taylor, 1980a; 1987; Roux & Meissner, 1984.). The differences in cumulative feed intake/$M^{0.75}$ on equivalent degrees of maturity (mass/mature mass) in Dorper and Synthetic ewe lambs are presented in Figure 2 and the model parameters and analysis of variance are presented in Table 4.

Table 3 Regression equations, model parameters and analysis of variance between intercepts and slopes for feed intake on weeks

Equations (± *SE*)	*SL* (b)	R^2 (%)
Synthetic: Y = 6.75 + 0.075 X		
(± 0.507) (± 0.0253)	0.005	21.80
Dorpers : Y = 10.55 + 0.100 X		
(± 0.487) (± 0.0243)	0.000	34.58

		Intercept			Slope		
Source of variation	*df*	*MS*	*F*	*SL*	*MS*	*F*	*SL*
Between groups	1	95.66	199.50	0.000	0.413 × 10^{-2}	5.02	0.033
Within groups	28	0.480			0.082 × 10^{-2}		

No difference in intercepts (SL = 0.506) between the Synthetic and Dorper groups was evident, while the Dorper still showed a tendency (SL = 0.060) towards a faster increase in feed intake relative to metabolic size. Average weekly values per metabolic size were only 13.7% higher in the Dorper (6.67) than in the Synthetic group (5.87). However, when intercept was included as a covariate into the analysis of variance, there was strong evidence (SL = 0.001) of a faster increase in intake in the Dorper compared to the Synthetic group.

Thonney *et al.* (1987) showed that sheep breeds were still observably different in feed intake after genetic size-scaling, which agrees with the results of this study. According to Brien (1987) there is some genetic variation in feed intake in excess of maintenance requirements, with only a low correlation between these two traits. Thonney *et al.* (1987) also indicated that large breeds tend to have an above-average appetite at earlier stages.

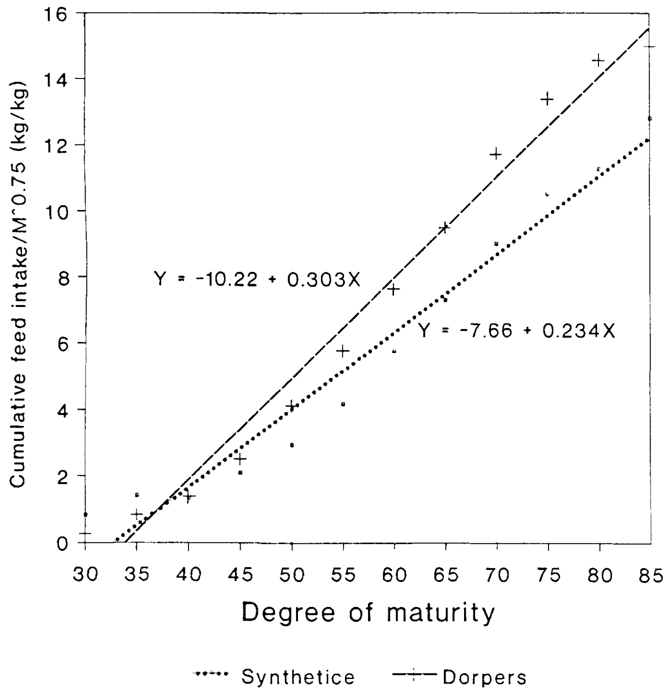

Figure 2 Differences in cumulative feed intake/$M^{0.75}$ on equivalent degrees of maturity in Dorper and Synthetic ewe lambs.

Growth rate

Differences in growth rate between the two phases are presented in Table 2.

A significantly ($P \leq 0.05$) faster (45.5%) growth rate was obtained in the Dorper lambs (0.16 ± 0.02 kg/d) as compared to the Synthetic lambs (0.11 ± 0.02 kg/d). Dorper lambs were also significantly ($P \leq 0.05$) heavier than those of the Synthetic group at all ages (37.2%).

Average daily gain for the Synthetic group was 0.15 kg/d during the first phase and 0.10 kg/d during the second phase. Corresponding values for the Dorpers were 0.18 and 0.16 kg/d respectively, which also indicate a decrease in daily gain with increasing age. Daily gain for the Synthetic group was 0.83 and 0.63 kg/d for Phases 1 and 2 respectively, which indicate faster relative growth in the this group at earlier stages. Average daily gain did not differ during the first phase between the Synthetic and Dorper groups. Average mature body mass of the Synthetic group was also only 74.6% of that of the Dorpers.

The regressions of growth rate per week on weeks are presented in Figure 3 and the model parameters and analysis of variance in Table 5.

Large differences in week-to-week growth rates were evident. Despite these differences, growth rate was also of a cyclic nature with a first peak at about 6—7 weeks. The reason for this is not clear. However, cyclical growth patterns associated with changes in maximum daily temperature were also observed by Thompson *et al.* (1985). Average growth rate declined in the Synthetic group (SL = 0.034) with increasing age, which is consistent with most literature. Although growth rate in sheep depends on the diet, it normally increases from birth to a maximum at about 20 weeks of age, whereupon it begins to decline with increasing age (Thompson, 1988).

Slopes did not differ between the Synthetic and Dorper groups, whereas a difference in intercepts was evident (SL = 0.000). Intercept and slope of growth rate on weeks were negatively correlated (r = −0.47) so that, when intercept was included as a covariate into the analysis of variance, a difference between slopes (SL = 0.002) was evident. Consequently, growth rate (b values) was related to body size (intercept) so that, when adjusted for these differences, relative growth rate was higher in the Synthetic group.

When mature size differences were allowed for by regressing growth rate/$M^{0.75}$ on equal degrees of maturity, there was

Table 4 Regression equations, model parameters and analysis of variance between intercepts and slopes for cumulative feed intake/$M^{0.75}$ on degree of maturity

Equations (± SE)	SL (b)	R^2 (%)
Synthetic: Y = −7.66 + 0.234 X		
(± 0.853) (± 0.0142)	0.000	96.43
Dorpers : Y = −10.22 + 0.303 X		
(± 0.793) (± 0.0132)	0.000	98.14

		Intercept			Slope		
Source of variation	df	MS	F	SL	MS	F	SL
Between groups	1	8.22	0.47	0.506	0.017	3.84	0.060
Within groups	28	17.53			0.004		

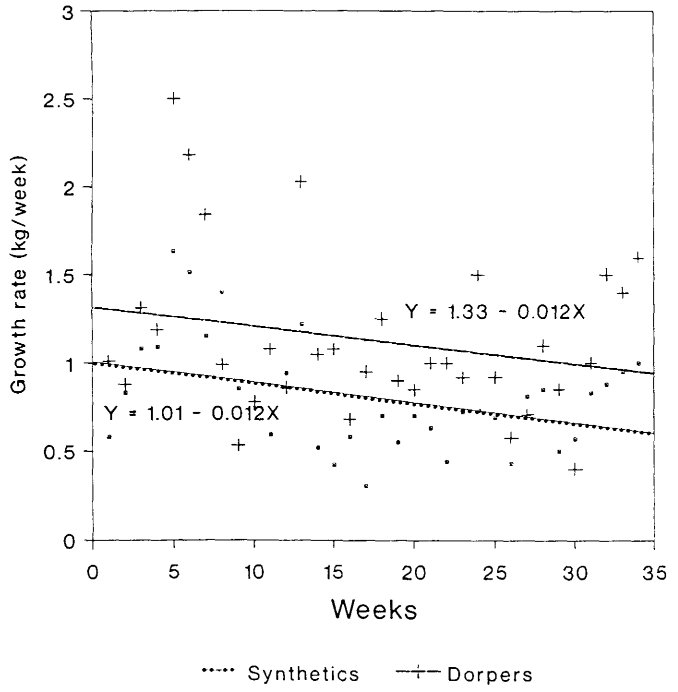

Figure 3 Differences in weekly growth rate between Dorper and Synthetic ewe lambs over equal ages.

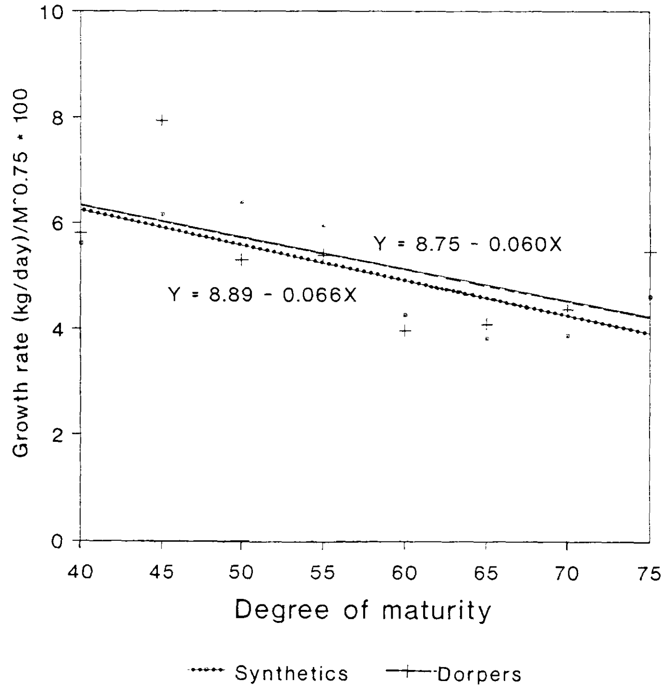

Figure 4 Differences in growth rate/$M^{0.75}$ on equal degrees of maturity between Dorper and Synthetic ewe lambs.

Table 5 Regression equations, model parameters and analysis of variance between intercepts and slopes for growth rate on weeks

Equations (± *SE*)	*SL* (b)	R^2 (%)
Synthetic: Y = 1.01 – 0.012 X		
(± 0.104) (± 0.0052)	0.034	13.32
Dorpers : Y = 1.33 – 0.012 X		
(± 0.169) (± 0.0084)	0.163	5.98

		Intercept			Slope		
Source of variation	*df*	*MS*	*F*	*SL*	*MS*	*F*	*SL*
Between groups	1	0.652	17.12	0.000	4.32×10^{-6}	0.04	0.843
Within groups	28	0.038			1.05×10^{-4}		

Table 6 Regression equations, model parameters and analysis of variance between intercepts and slopes for (growth rate/$M^{0.75}$) × 100 on degree of maturity

Equations (± *SE*)	*SL* (b)	R^2 (%)
Synthetic: Y = 8.89 – 0.066 X		
(± 1.330) (± 0.0227)	0.023	58.65
Dorpers : Y = 8.75 – 0.60 X		
(± 2.026) (± 0.0346)	0.133	33.50

		Intercept			Slope		
Source of variation	*df*	*MS*	*F*	*SL*	*MS*	*F*	*SL*
Between groups	1	34.38	2.13	0.155	0.997×10^{-2}	2.73	0.110
Within groups	28	16.11			0.365×10^{-2}		

on average only a 1.2% faster growth rate in the Dorpers compared to the Synthetic group at the same stage of maturity. These differences are illustrated in Figure 4 and the model parameters and analysis of variance are presented in Table 6.

There was no evidence of any difference in either intercept (*SL* = 0.155) or slope (*SL* = 0.110) between the Synthetic and Dorper groups. Maximum relative growth rate was attained at 45—55% of maturity and declined rapidly thereafter.

Growth is sometimes expressed as a cumulative measure of output, characterized by the well-known sigmoidal growth curve. It can, however, also be expressed in terms of both input and output. Regressions of body mass (output) on cumulative feed intake (input) are:

Synthetic:
$Y = 21.21 + 0.134\,X - 0.143 \times 10^{-3}X^2$ (R^2 = 99.16%)

Dorper:
$Y = 29.05 + 0.110\,X - 0.062 \times 10^{-3}X^2$ (R^2 = 99.15%)

The allometric-autoregressive growth model (Roux, 1976) with ln (cumulative body mass) on ln (cumulative feed intake) as a function of both input and output, is presented in Figure 5 and the model parameters and analysis of variance are shown in Table 7.

Approximate breakpoints were in both cases observed after 12 weeks. Evidence from the literature (Scholtz & Roux,

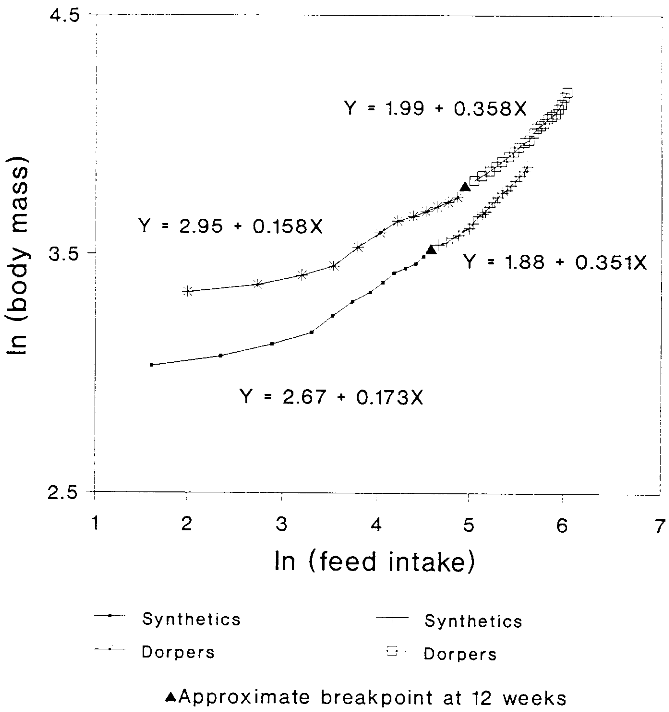

Figure 5 Average values for ln (body mass) on ln (cumulative feed intake) for Synthetic and Dorper ewe lambs respectively.

Table 7 Regression equations, model parameters and analysis of variance for slope and intercept of the allometric-autoregressive growth model

Phase 1

Equations (± *SE*)	*SL* (b)	R^2 (%)
Synthetic: Y = 2.67 + 0.173 X		
(± 0.055) (± 0.0151)	0.000	92.91
Dorpers : Y = 2.95 + 0.158 X		
(± 0.049) (± 0.0124)	0.000	94.23

		Intercept			Slope		
Source of variation	*df*	*MS*	*F*	*SL*	*MS*	*F*	*SL*
Between groups	1	0.525	7.01	0.013	0.127×10^{-2}	0.71	0.415
Within groups	28	0.075			0.178×10^{-2}		

Phase 2

Equations (± *SE*)	*SL* (b)	R^2 (%)
Synthetic: Y = 1.88 + 0.351 X		
(± 0.054) (± 0.014)	0.000	98.27
Dorpers : Y = 1.99 + 0.358 X		
(± 0.057) (± 0.0102)	0.000	98.41

		Intercept			Slope		
Source of variation	*df*	*MS*	*F*	*SL*	*MS*	*F*	*SL*
Between groups	1	0.055	0.238	0.635	0.799×10^{-3}	0.108	0.748
Within groups	28	0.230			0.741×10^{-2}		

1981) suggested physiological reasons (i.e. sexual maturity) associated with breakpoints between individual animals. Thompson (1988) was, however, of the opinion that such an inflection point is simply a mathematical function of the underlying feed intake and feed efficiency curves, rather than a function of physiological changes in the development of the animal. Average age at puberty was approximately two weeks earlier in the Synthetic group as compared to the Dorpers (Schoeman *et al.*, 1992), which supports the idea of Thompson (1988), as age of puberty was not associated with the breakpoints in this case.

R^2 values for both groups and phases varied from 92.91 to 98.41%, indicating good fit. Slopes for both phases were not different (*SL* = 0.415 for Phase 1 and *SL* = 0.748 for Phase 2) between the two groups, running almost parallel in both phases. The only difference was between the intercepts of the groups (*SL* = 0.013) for Phase 1. Higher *b* values were obtained by Visser (1991) for both Phase 1 (0.29—0.35) and Phase 2 (0.45—0.51) for three breeds. The lower values obtained in this study may be the result of the less concentrated diet and a shorter feeding period.

However, slopes and intercepts were highly correlated in both phases ($r = -0.88$ and -0.97 in Phases 1 and 2 respectively). When intercepts were included as covariates into the analyses of variance, differences between slopes became evident in both phases (*SL* = 0.002 and *SL* = 0.000 for Phases 1 and 2 respectively). Since slopes (*b* values) are positively correlated to both growth rate and efficiency (Scholtz *et al.*, 1990), higher relative growth rate, as was indicated previously, and also higher efficiency would be expected in the Synthetic group, especially at earlier stages.

Efficiency

Feed efficiency is defined as the ratio of mass gain to feed intake, i.e. (kg mass gain/kg feed intake) × 100. The efficiency with which the growing animal converts the food it eats into carcass mass or saleable meat, is important to the animal breeder.

Total efficiency and efficiency between the two phases are presented in Table 2. Efficiency was higher during the first phase compared to the second (58.4 and 50.0% for the Synthetic and Dorper groups respectively). Efficiency was not significantly ($P > 0.05$) different between the Synthetic and Dorper groups. The average feed efficiency factors were 0.009 and 0.008 kg mass gain/MJ of ME intake respectively.

The change in feed efficiency over weeks is presented in Figure 6 and the model parameters and analysis of variance are shown in Table 8. Feed efficiency declined with increasing age in both the Synthetic and Dorper groups (*SL* = 0.000). There was no evidence of any difference between the two groups for either intercept (*SL* = 0.142) or slope (0.377). Slopes were also not different (*SL* = 0.610) when intercept was included as a covariate.

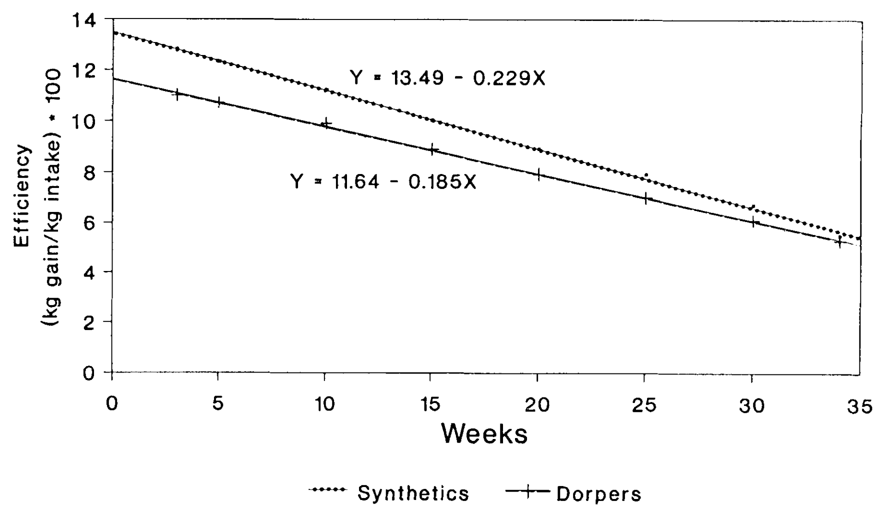

Figure 6 Differences in feed efficiency between Dorper and Synthetic ewe lambs at equal ages.

Table 8 Regression equations, model parameters and analysis of variance between intercepts and slopes for feed efficiency on weeks

Equations (± *SE*)	*SL* (b)	R^2 (%)
Synthetic: Y = 13.49 – 0.229 X		
(± 0.074) (± 3.55 × 10^{-3})	0.000	99.86
Dorpers : Y = 11.64 – 0.185 X		
(± 0.044) (± 2.12 × 10^{-3})	0.000	99.92

		Intercept			Slope		
Source of variation	*df*	*MS*	*F*	*SL*	*MS*	*F*	*SL*
Between groups	1	22.75	2.29	0.142	0.013	0.84	0.377
Within groups	28	9.95			0.015		

Larger animals usually have a higher efficiency than smaller animals at the same mass, owing to the difference in degree of maturity between them. Between-breed variation which usually exists in feed efficiency is largely a reflection of differences in stages of maturity (Thonney *et al.*, 1981). However, when differences in efficiency are plotted on equal degrees of maturity, these differences usually disappear (Thompson, 1988). The degree of maturity in mass differed from 34 to 82% for the Synthetic group and from 37 to 86% for the Dorpers. Feed efficiency on equal degrees of maturity, is presented in Figure 7 with the related parameters and analysis of variance in Table 9.

The Synthetic group tended to be higher in intercept (*SL* = 0.098) and thus to be more efficient than the Dorpers, while no difference was evident (*SL* = 0.224) in slope. The rate at which feed efficiency declined over equal degrees of maturity, was therefore not different, probably because the stages of maturity of the two groups were not much different. When intercept was included as a covariate, slopes also did not differ (*SL* = 0.261) between the Dorper and Synthetic.

Thonney *et al.* (1987) also compared seven sheep breeds with varying mature sizes over constant maturity intervals for live mass (40—76%) and indicated that the larger breeds were less efficient than the smaller breeds during the earlier growth phases. They then concluded that the larger breeds did not make full use of their above-average feed intake. It also appears to be the case in this study.

Conclusions

Ewe lambs of the Dorper group were at all ages heavier than lambs of the Synthetic group and grew on average 45.5% faster. Mature body mass of the Dorper ewes exceeded that of the Synthetic group by 34.0%.

Average cumulative feed intake was 54.3% higher in the Dorpers than in the Synthetic group, while feed efficiency tended to be superior in the Synthetic group during the early stages of the experiment.

When these growth-related parameters were adjusted to the same degrees of maturity and relative to mature size, only small differences were evident. Growth rates as a function of metabolic age were almost the same between the two groups, indicating that the differences in growth rate are simply a reflection of differences in mature size. The pattern of growth of the two groups was almost identical, as was expressed by the ln (body mass) on ln (cumulative feed intake) model.

The Dorpers tended to consume more (13.7%) food per $M^{0.75}$ than the Synthetic group over equivalent degrees of maturity and to be slightly less efficient (16.6%).

According to these results it is concluded that the two Synthetic groups showed some promising results. Further research is, however, needed for evaluation of reproductive performance, productive efficiency and carcass characteristics to assess their full potential.

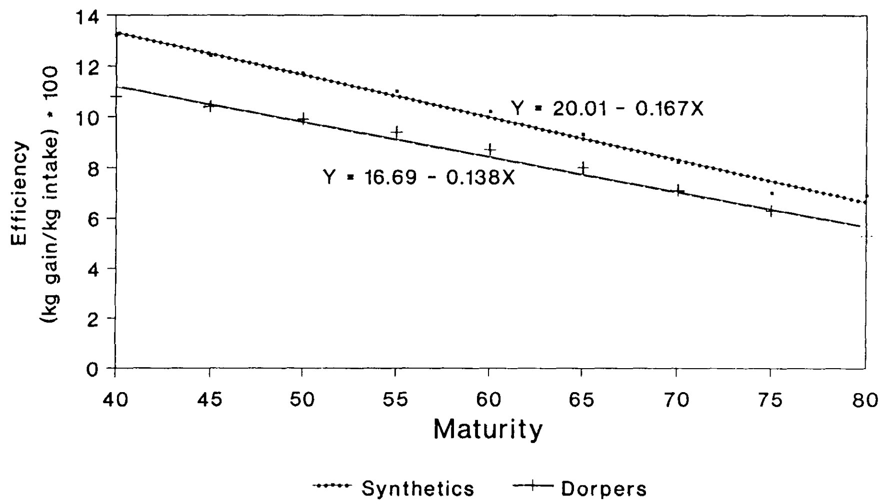

Figure 7 Differences in feed efficiency between Dorper and Synthetic ewe lambs on equivalent degrees of maturity.

Table 9 Regression equations, model parameters and analysis of variance between intercepts and slopes for feed efficiency on degree of maturity

Equations (± *SE*)	*SL* (b)	R^2 (%)
Synthetic: Y = 20.01 – 0.167 X		
(± 0.395) (± 6.44 × 10^{-3})	0.000	98.97
Dorpers : Y = 16.69 – 0.138 X		
(± 0.437) (± 7.12 × 10^{-3})	0.000	98.16

		Intercept			Slope		
Source of variation	*df*	*MS*	*F*	*SL*	*MS*	*F*	*SL*
Between groups	1	101.48	2.93	0.098	0.012	1.55	0.224
Within groups	28	34.68			0.008		

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