Production parameters for Döhne Merino sheep under an accelerated, intensive lambing system

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Data of lambing records from 1984 to 1989, which comprised 914 ewe lambing years and 1 522 lambing opportunities, were used to investigate overall productive performance of Döhne Merino ewes under an accelerated lambing system. Ewes were exposed to three fixed 30-day mating periods per year to lamb during February/March (first season), June/July (second season) and October/November (third season). The number of ewes lambed/ewes mated/year (E_L/E_M/year) was 0,80 and the number of lambs born/ewe mated/year (L_B/E_M/year) was 1,25. Fecundity (L_B/lambing) was 1,32. The average interlambing period was 11,09 ± 3,66 months while the number of lambings recorded/lambing opportunity was 0,61 ± 0,24. Average survival rate from birth to 100 days was 0,83 and was influenced by both year and season of birth. Average weaning mass was 16,73 ± 2,72 kg at 56,3 ± 8,6 days on average, and average 100-day mass was 24,99 ± 5,17 kg. Body mass of lambs at 100 days was significantly ($P < 0,001$) influenced by year of birth, season of birth, sex of lamb and birth status. Lambs born in winter were 16,2% heavier than those born in spring and 20,9% heavier than those born in summer/autumn. Management practice should take these effects into account.

Data van lamrekords vanaf 1984 tot 1989, bestaande uit 914 ooijare en 1 522 lamgeleenthede, is gebruik om die totale produksie van Döhne Merino-ooie in 'n versnelde paringstelsel te ondersoek. Ooie is vir drie vaste periodes van 30 dae elk by die ramme geplaas om gedurende Februarie/Maart (eerste seisoen), Junie/Julie (tweede seisoen) en Oktober/November (derde seisoen) te lam. Aantal ooie gelam/ooi/jaar gepaar (E_L/E_M/jaar) was 0,80 en aantal lammers gebore/ooi/jaar gepaar (L_B/E_M/jaar) was 1,25. Die fekunditeit (L_B/lamming) was 1,32. Die gemiddelde interlamperiode was 11,09 ± 3,66 maande terwyl die aantal lammings per lamgeleentheid aangeteken, 0,61 ± 0,24 was. Die gemiddelde oorlewingstempo vanaf geboorte tot 100 dae was 0,83 en is deur beide jaar en seisoen van geboorte beïnvloed. Gemiddelde speenmassa was 16,73 ± 2,72 kg op 'n gemiddelde ouderdom van 56,3 ± 8,6 dae en die gemiddelde 100-dae-massa was 24,99 ± 5,17 kg. Lammassa op 100 dae is betekenisvol ($P < 0,001$) deur jaar van geboorte, seisoen van geboorte, geslag van die lam en geboortestatus beïnvloed. Lammers wat in die winter gebore is het op 100 dae 16,2% swaarder as dié in die lente en 20,9% swaarder as dié in die somer gebore, geweeg. In die toepassing van bestuurspraktyke behoort hierdie effekte in ag geneem te word.

Keywords: Accelerated lambing, Döhne Merino, lamb production.

The efficiency of lamb production in sheep flocks could most effectively be improved by increasing the number of lambs marketed per ewe per year (Dickerson, 1970). For example, increasing the number of lambs born and weaned per ewe per year, may be achieved by increasing the frequency of lambing in sheep. Implementing such accelerated lambing systems usually increase the overall probability of conception (Iniquez, Quaas & Van Vleck, 1986), the number of lambs born and weaned per ewe (Karberg, Fourie & Barnard, 1985; Rawlings, Jeffcoate & Howell, 1987), and the total ewe output per year (Rawlings *et al.*, 1987).

Methods for increasing the reproductive rate in an accelerated lambing system have been based on using more prolific breeds (Dzakuma, Stritzke & Whiteman, 1982) together with, or instead of breeds with an extended breeding season. Sheep breeds normally used in South Africa are, however, neither prolific nor have a long breeding season (Boshoff, Gouws & Nel, 1975).

The application of an accelerated lambing system requires a high level of management. Such a system would not normally be applied on commercial farms under normal management. However, under intensive sheep production, it is likely that the extra managerial input will result in an additional output of lambs.

The implementation of accelerated lambings has for some years been advocated in South Africa, based on successful application thereof in countries like the United States, France and Britain. However, mainly due to the high level of management required, these systems have not been widely adopted in South Africa. Systems in which ewes lamb three times in two years have shown more promise overseas, but few reports have provided production parameters in South Africa.

The objectives of this study were to evaluate reproduction and production parameters in a Döhne Merino flock under an accelerated lambing system, and to examine the effects of environmental variables on reproduction and growth traits of individual lambs and on lamb production per ewe.

Procedure

Experimental material

Data were collected at the Experimental Farm of the University of Pretoria from Döhne Merino ewes which lambed from 1984 to 1989. The data included 127 to 181 ewes mated annually and comprised 914 ewe breeding year records (see Table 1).

All ewes were exposed to rams at four-month intervals, so as to lamb in eight month intervals from 15 February to 15 March (first season), 15 June to 15 July (second season) and from 15 October to 15 November (third season) – sometimes referred to as 'clean-up breeding'. Ewes which did not conceive during the first possible mating season, were re-exposed four months later. Mating and lambing therefore took place every four months. Although some ewes had

Table 1 Reproductive performance and lamb survival rate under an accelerated lambing system (LS Means)

	Years						
	1984	1985	1986	1987	1988	1989	Total / Average
Reproductive performance							
Number of ewes mated (E_M)	148	181	174	127	141	143	914
Average ewe age (years)	4,25	5,09	4,25	3,52	3,39	3,34	4,04
E_L/E_M/year	0,86^b	0,62^c	0,70^c	0,84^b	0,90^b	0,99^a	0,80
N_L/ewe/year	1,19^a	0,60^b	0,72^b	0,91^a	1,07^a	1,31^c	0,95
L_B/E_M/year	1,16	0,78	0,90	1,25	1,48	1,68	1,25
L_B/lambing	1,35^a	1,27^b	1,24^b	1,38^a	1,38^a	1,28^b	1,32
Interlambing period (months) (Average ± *SD*)							11,09 ± 3,66
N_L/lambing opportunity (Average ± *SD*)							0,61 ± 0,24
Lamb survival rate							
Lambs alive at birth	0,93	0,95	0,94	0,97	0,97	0,97	0,95
Survival rate birth to weaning	0,91	0,93	0,90	0,86	0,86	0,86	0,88
Survival rate weaning to 100-days	0,99	0,99	1,00	0,98	0,96	0,98	0,99
Total survival rate	0,83^b	0,88^a	0,85^a	0,82^b	0,80^b	0,81^b	0,83

E_L: number of ewes lambing; N_L: number of lambings; L_B: number of lambs born.
$^{a-c}$ Means with different superscripts differ significantly ($P < 0,01$).

measurements in more than one year and were treated as different ewes for each year, it was believed that this practice did not affect the results. Lambing performance of an ewe in one year was furthermore influenced by her performance during the previous year, e.g. if she lambed twice in the first year (first and third seasons), she could only lamb once in the following year (second or third season).

Ewes were not subjected to hormone treatment. Two to four rams were used per season, depending on the number of ewes that were possibly not already pregnant. Ewes were randomly divided into single sire breeding groups varying from approximately 25 to 45 per ram. Rams were also evaluated for reproductive soundness before the start of each breeding season. This included semen, libido, and mating performance tests.

Ewes were culled on the grounds of abnormalities, failure to lamb in two consecutive years and on age (six or seven years). During the course of the experiment, only 24 ewes were culled as a result of failure to lamb. Culling took place at the end of each year to enable ewes to complete a full reproductive cycle of one calender year. Ewes which died during a calender year before the third lambing season, were excluded from the analysis for that year. Only 36 ewes died over the period of six years. Maiden ewes were first mated at 11 months of age, provided that they had reached a body mass of 40 kg, and were then added to the flock.

Pre-joining body mass of all ewes were recorded one to two days prior to the start of the mating season (average 56,3 ± 7,1 kg). At lambing, all lambs were identified with their dams within 24 h after birth, and birth mass was recorded. Ewes with single or twin lambs were grouped accordingly for the first few days after birth for easier care and management. Thereafter, all ewes were grouped together. Lambs were weighed weekly on a fixed day and it was attempted to wean them at approximately 45 days, provided that their weaning mass exceeded 15 kg. In practice, however, lambs were weaned at an average (± *SD*) age of 56,3 ± 8,6 days and an average (± *SD*) mass of 16,7 ± 3,1 kg. Lambs born as twins but reared as singles, were considered as singles for weaning mass and 100-day body mass. Artificially reared twin born lambs were considered as twins because of a non-significant ($P > 0,05$) difference between twins reared as twins and artificially reared twin born lambs for weaning mass and 100-day body mass. Only 27 (2,5%) of lambs born alive were artificially reared.

Ewes were maintained on both irrigated and cultivated dryland pasture as well as natural pasture during the day and were penned from approximately 15h00 to 07h00, receiving grass hay and a standard lick. Ewes were only supplemented with concentrates when average body condition was reduced to scores of approximately 2—2,5 (Russel, Doney & Gunn, 1969). Lambs were offered creep (pellets) from approximately 14 days of age.

Statistical analysis

Components of performance included in the analysis were lambing performance, lamb survival, birth mass, weaning mass and 100-day body mass. A ratio number of lambings (N_L) per lambing opportunity was also calculated. The first lambing opportunity of every ewe was taken at 16 months of age, provided that she weighed at least 40 kg at mating. Ensuing lambing opportunities were taken after 8 months, following the previous lambing or lambing opportunity. Summed over years and seasons, 1522 potential lambing opportunities were recorded of which 922 resulted in lambings (Table 1). An average inter-lambing period, which gives expression to the average number of months that ewes were kept in the flock for one lambing, was also calculated. The month of first mating (approximately 11—15 months of age) was taken as the time of entry into the flock.

For analysis of both ewe reproductive performance and lamb mass at different ages, the model included fixed effects of year, season of birth, age of dam, pre-mating mass of the ewe, sex of lamb and birth status as main effects, and all possible two-way interactions. For weaning mass, weaning age was included as a covariate into the model, both as linear and quadratic equations. The influence of year, age of ewe and pre-joining body mass and possible two-way interactions on total 100-day mass/ewe mated/year (ewe productivity) was also investigated. By means of a step-down procedure, all non-significant ($P > 0,05$) interactions were removed from the models.

The General Linear Models of the Statistical Analysis System (SAS, 1985) were used in the analyses of the data to determine the importance of each fixed effect on reproductive performance and birth mass, weaning mass and 100-day body mass.

Results and Discussion

Reproduction

The reproductive potential of a flock is primarily determined by the number of ewes lambed per ewe mated (E_L/E_M), the number of lambs born per lambing (L_B/lambing), and the mortality rate of the lambs. E_L/E_M was significantly influenced by year, age of the ewe and pre-joining body mass, while L_B/lambing was significantly influenced by year, season, pre-joining body mass and a year × season interaction.

The influence of year on reproductive performance and its components is presented in Table 1. Average E_L/E_M was 0,80 and varied from 0,62—0,99 between years. The lower values for 1985 and 1986 (0,62 and 0,70, respectively) may have resulted from an exceptionally dry period, the lambing distribution of the previous year (e.g. in 1984, 33,8% of all ewes lambed in both first and third seasons), or an abnormal age structure during 1985 and 1986. During this latter period, 42% of all ewes were six to seven years of age and 46% two years and younger, a distribution caused by bringing in two- and three-year-old ewes during 1982. On a year basis, L_B/E_M averaged 1,25, with a considerable variation between years (0,78—1,68).

Fecundity (L_B/lambing) averaged 1,32, which is 9% higher than the results obtained by Karberg *et al.* (1985). Fecundity was significantly ($P < 0,001$) affected by both year (Table 1) and season (Table 2). A significant ($P < 0,001$) year × season interaction on L_B/lambing was also evident. For the first season, it varied between years from 1,11 (1987) to 1,42 (1989), for the second season from 1,25 (1986) to 1,63 (1984), and for the third season from 1,14 (1989) to 1,40 (1984), without any definite pattern. On average, L_B/lambing was highest in the second lambing season (1,35) and lowest in the first lambing season (1,29) (Table 2). Differences between seasons were all significant ($P < 0,001$); a finding which agrees with results reported by Fogarty, Dickerson & Young (1984). Overall, 26% of all lambings were in the first and 37% in both the second and third lambing seasons (Table 2). The higher fertility rate during the third lambing season might have resulted from the seasonal nature of the breeding season. Month of peak fertility in the breeding season is, however, not exactly known under present circumstances, as peak of fertility normally varies with breeds and environment (Lax, French, Chapman, Pope & Casida, 1979).

Total number of lambings (N_L) per ewe per year averaged 0,95, which is lower than the 1,23 in the Bathurst flock (Karberg *et al.*, 1985) as well as in several overseas studies (Notter & Copenhaver, 1980a; Robinson, 1980). However, when the data of 1985 and 1986 were excluded due to the exceptional dry period, an average value of 1,13 was obtained. This value is higher than the theoretical maximum for traditional once-a-year breeding systems, which underlines the possible advantage of an accelerated system.

From Figure 1, it is also clear that E_L/E_M increased with increasing age of dam. Maximum values were obtained at 4—5 years of age, which is consistent with the results obtained by Karberg *et al.* (1985). Contrary to the results of

Table 2 The influence of lambing season on reproductive performance and lamb survival rate under an accelerated lambing system (LS Means ± *SE*)

	Seasons		
	First	Second	Third
Reproductive performance			
Number of lambings	239	344	339
Frequency of lambings	0,26	0,37	0,37
Number of lambs born	287	435	422
L_B/lambing	1,29 ± 0,04^a	1,35 ± 0,04^b	1,33 ± 0,05^b
Lamb survival rate			
Lambs alive at birth	0,96 ± 0,07	0,97 ± 0,06	0,94 ± 0,06
Survival rate birth to weaning	0,87 ± 0,06	0,89 ± 0,06	0,88 ± 0,07
Survival rate weaning to 100 days	0,98 ± 0,04	0,99 ± 0,04	0,98 ± 0,05
Total survival rate	0,81 ± 0,09^b	0,86 ± 0,09^a	0,81 ± 0,10^b

^{a,b} Means with different superscripts differ significantly ($P < 0,01$).

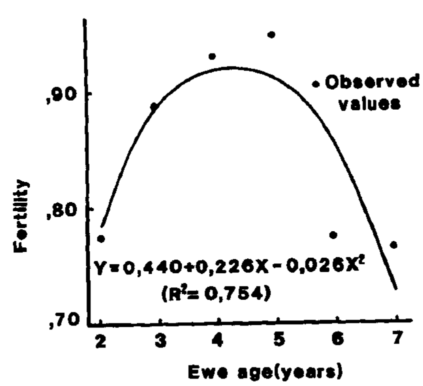

Figure 1 The influence of ewe age on the number of ewes lambed per ewes mated per year (E_L/E_M/year).

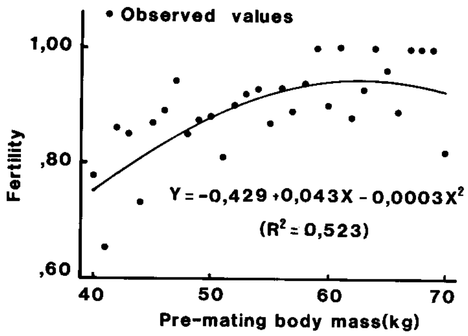

Figure 2 The influence of pre-mating body mass of ewes on the number of ewes lambed/ewes mated/year (E_L/E_M/year).

these authors and several others (Turner, Brown & Ford, 1968; Heydenrych, 1975; Fourie & Heydenrych, 1983), L_B/lambing was not significantly influenced by age of the ewe. This may have resulted from the higher nutritional level applied in the accelerated intensive system.

Both E_L/E_M and L_B/lambing were significantly ($P <$ 0,001) influenced by pre-joining body mass of the ewe. Curvilinear regressions for E_L/E_M (Figure 2) and L_b/lambing (Figure 3) respectively, were fitted on pre-mating body mass. This regression emphasizes the importance of body mass in intensive production systems, and indicates that there should be aimed to achieve an optimum body mass for maximum output. Rattray, Jagusch, Smith, Winn & MacClean (1981) also obtained such a curvilinear relationship between pre-mating
tions. This curvilinear relationships do, however, not correspond to the linear regressions reported by Atkins (1980b) and Cloete & Heydenrych (1986). The curvilinear relationships in the present study may be related to differences between age specific linear regressions as found by Cloete & Heydenrych (1986).

A 0,61 ± 0,24 (Table 1) ratio number of lambings per lambing opportunity was obtained in the present study, compared to a value of 0,74 obtained by Notter & Copenhaver (1980a) with Finnish Landrace crossbred ewes in an eight-month breeding cycle, when ewes were exposed to rams for a 45-day breeding period. The average inter-lambing period was found to be 11,09 ± 3,66 months (Table 1), whereas a value of 9,2 months was reported by Schindler & Amir (1985) for Merino × Finn and Finn × Awassi crosses.

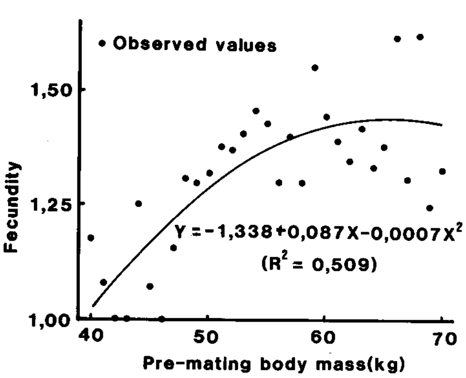

Figure 3 The influence of pre-mating body mass of ewes on the number of lambs born per lambing (L_B/lambing).

An average lamb survival of 0,83 from birth to 100 days (Table 1) compares with values obtained by Hohenboken, Corum & Bogart (1976a) and Atkins (1980a). This value was significantly ($P <$ 0,01) affected by both year (Table 1) and season of birth (Table 2), with winter born lambs having a higher survival rate than either summer/autumn or spring born lambs. Mortality rate was highest from birth to weaning (Tables 1 & 2).

Hohenboken *et al.* (1976a) obtained a significantly lower survival rate when comparing an intensive to an extensive system (0,82 *vs* 0,92), which may have been the result of less exposure to respiratory and other infections of the lambs in the extensive system. The same reasoning may be applied to the locally hotter and more humid summer conditions.

Survival rate was also significantly ($P <$ 0,001) affected by birth type, with a higher survival rate in singles (0,88) as compared to twins (0,78). However, the overall effect of litter size on mortality became, in accordance with Notter & Copenhaver (1980b), non-significant when the data were

Table 3 The influence of fixed effects on birth mass, weaning mass and 100-day mass of Döhne Merino lambs (LS Means ± standard error)

	Birth mass (kg)	Weaning mass (kg)	100-day mass (kg)
Year	**	***	***
1984	3,9 ± $0,1^{b}$	15,3 ± $0,5^{b}$	27,4 ± $0,7^{a}$
1985	4,4 ± $0,1^{ac}$	18,4 ± $0,6^{a}$	29,4 ± $0,7^{a}$
1986	4,2 ± $0,1^{bc}$	15,9 ± $0,5^{b}$	24,2 ± $0,7^{b}$
1987	4,0 ± $0,1^{bc}$	13,8 ± $0,4^{c}$	18,9 ± $0,7^{c}$
1988	4,0 ± $0,1^{bc}$	16,2 ± $0,4^{b}$	22,2 ± $0,6^{d}$
1989	3,9 ± $0,1^{bc}$	15,9 ± $0,4^{b}$	24,0 ± $0,5^{b}$
Season	***	***	***
First	3,8 ± $0,1^{a}$	15,2 ± $0,4^{b}$	22,5 ± $0,5^{b}$
Second	3,9 ± $0,1^{a}$	16,8 ± $0,3^{ac}$	27,2 ± $0,5^{a}$
Third	4,4 ± $0,1^{b}$	15,8 ± $0,3^{bc}$	23,4 ± $0,5^{b}$
Age of dam	***	***	NS
2	3,7 ± $0,1^{c}$	14,7 ± $0,4^{b}$	–
3	4,0 ± $0,1^{b}$	16,0 ± $0,47^{ac}$	–
4	4,2 ± $0,1^{bd}$	15,7 ± $0,4^{bc}$	–
5	4,4 ± $0,1^{ad}$	16,4 ± $0,4^{ac}$	–
6	4,0 ± $0,1^{bd}$	16,4 ± $0,6^{ac}$	–
7	4,0 ± $0,1^{bd}$	16,1 ± $0,6^{bc}$	–
Sex	***	*	***
Ram	4,2 ± $0,1^{a}$	16,2 ± $0,3^{a}$	25,2 ± $0,4^{a}$
Ewe	3,9 ± $0,1^{b}$	15,6 ± $0,3^{a}$	23,5 ± $0,5^{b}$
Type of birth	***	***	***
Single	4,6 ± $0,1^{a}$	17,7 ± $0,3^{a}$	26,4 ± $0,4^{a}$
Twin	3,6 ± $0,1^{b}$	14,0 ± $0,3^{b}$	22,3 ± $0,5^{b}$
Average (± *SD*)	4,11 (± 0,80)	16,3 (± 2,72)	24,99 (± 5,17)
R^2-model (%)	38,09	25,10	27,90
n	852	807	844

* $P <$ 0,05; ** $P <$ 0,01; *** $P <$ 0,001.

a—c Means with different superscripts differ significantly ($P <$ 0,01).

adjusted to a common birth mass. This suggests that differences in mortality rates between singles and twins were primarily determined by differences in birth mass *per se*.

There were no significant differences in survival rate between lambs born to ewes of different ages or ewes different in pre-mating body mass. Survival rate was also not influenced by sex of lamb. These results accord with those found by Atkins (1980a) and Notter & Copenhaver (1980b). No significant interactions were recorded.

Body mass traits

Body mass is an important trait in mutton and dual purpose sheep breeds. Influences of all fixed effects with significant ($P < 0,05$) influence on birth mass, weaning mass and 100-day body mass are presented in Table 3. The influence of pre-mating body mass as predictor was not significant in either of the three traits. The total variance accounted for by the original full model ranged from 25,0% for weaning mass to 38,1% for birth mass. The proportion of the total variance accounted for by the investigated individual main effects was, however, relatively low.

Birth mass, weaning mass and 100-day body mass were all significantly affected by year of birth (Table 3). The lowest weaning as well as 100-day masses were recorded in 1987 (13,8 and 18,9 kg) and the highest in 1985 (18,4 and 29,4 kg) respectively (Table 3). No time trend due to years was, however, evident.

Season of birth also significantly ($P < 0,001$) affected birth, weaning and 100-day body mass (Table 3). Although lambs born in the third season were the heaviest at birth, they weighed less at weaning and 100 days. The highest average 100-day mass was recorded in the second and the lowest in the first seasons respectively (Table 3). Lambs born in winter (June/July) were therefore 16,2% heavier than those born in spring (October/November) and 20,9% heavier than those born in summer/autumn (February/March). These differences may have resulted from a higher possibility of infections, internal parasite infestation and coccidioses due to favourable climatic conditions, and reflect a probable lower ewe milk production and lamb creep intake during the hotter summer months. Lower weaning masses for lambs born in summer were also obtained by Fogarty *et al.* (1984).

Birth mass and weaning mass were significantly influenced by age of dam (Table 3). The age-of-dam effect on weaning mass was, however, unimportant. Birth mass was highest in those lambs born from 5-year-old ewes (4,4 kg). This finding did not agree with results of Fourie & Heydenrych (1982) who found that maximum birth mass was obtained from 7-year-old ewes and maximum 100-day body mass for lambs from 6-year-old ewes.

Ram lambs were 0,3, 0,6 and 1,7 kg heavier than ewe lambs at birth, weaning and 100-days respectively. Sex is, however, a relatively unimportant source of variation. These differences are of the same magnitude as those found by other authors (Heydenrych, 1975; Hohenboken, Kennick & Bogart, 1976b; Fourie & Heydenrych, 1982).

Single born lambs had a 1 kg (27,8%) higher birth mass, 3,7 kg (26,40%) higher weaning mass and 4,1 kg (18,4%) higher 100-day body mass than twin born lambs (Table 3). The difference seems to decrease from weaning to 100 days of age, which agrees with the results of Dun & Grewal (1963). They found that the handicap of twins is reduced with increasing age.

The only significant interactions recorded were those of year × birth type ($P < 0,001$) and ewe age × season ($P < 0,001$) on weaning mass and season × birth type ($P < 0,05$) on 100-day mass. Since these interactions are not of any practical importance, they are not discussed in any further detail.

Ewe productivity

Ewe productivity was calculated as the sum of 100-day body masses of all lambs per ewe per year. Values for total kilogram of lamb at 100 days per ewe mated and per ewe lambing, averaged 31,1 ± 16,6 and 38,6 ± 15,2 kg respectively.

Total 100-day body mass per ewe mated per year was significantly ($P < 0,001$) affected by pre-joining body mass of the ewe, and the year effect. Years of maximum productivity correspond with years of maximum fertility (Table 1). The influence of age of ewe was not significant.

The influence of pre-mating body mass on ewe productivity is presented in Figure 4, which shows that this parameter increases with premating body mass. This result is contrary to that found by Cochran, Notter & McClaugherty (1984), who suggested that heavier-than-average ewes were not more productive than lighter ewes. The higher productivity amongst heavier ewes is the result of both a higher fertility (Figure 2) and fecundity (Figure 3) and is not due to heavier lambs (Table 3).

Wool production

Wool production is also an important component of overall productive performance of dual purpose sheep such as the Döhne Merino. An average greasy fleece mass of 4,2 ± 0,7 kg per ewe per year was recorded which is higher than the 3,21 kg obtained by Steinhagen & De Wet (1986) for Döhne Merino ewes at the Döhne Research Station. A more detailed

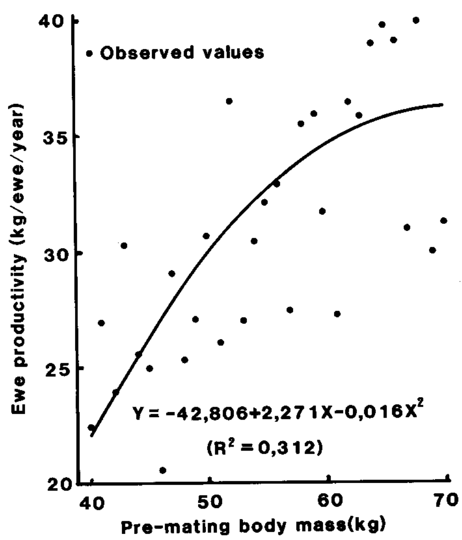

Figure 4 The influence of pre-mating body mass of ewes on ewe productivity (total 100-day body mass of lambs/ewe/year).

investigation into factors affecting wool production under local conditions will follow at a later stage.

Conclusions

The nett result of the implementation of an accelerated lambing system should be evaluated from the total number of lambings per ewe per year, the fecundity, the total mass of lambs weaned as well as the wool production per ewe per year. Evaluation of a particular accelerated lambing system should therefore include examination of all these components, and should also take the effect of environmental factors into account.

Although accelerated lambing systems do have the potential to improve on the traditional once-a-year breeding system, it is likely that extra outputs will require extra inputs. Reasons for the relative low production in this particular system as compared to overseas studies should be further investigated.

Seasonal influences are of particular interest since breeds differ in the length of the breeding season. The choice of the particular mating seasons relative to the season of maximum fertility may, however, affect the success of the implementation of such a system. This phenomenon was illustrated and discussed by Fogarty *et al.* (1984). The restricted length of the mating period of only 30 days may also affect the success of the system and should be increased under local conditions. Relatively favourable, compared to unfavourable seasons for rearing of lambs, should also be taken into consideration.

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