# THE EFFECT OF FEED SUPPLEMENTATION ON THE PRODUCTIVITY OF REPLACEMENT EWE LAMBS UNDER NATURAL VELD CONDITIONS

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## INTRODUCTION

Season of birth, age, nutrition, weight, breed and environment have an effect on the growth and development of ewe lambs (Chappell, 1993). The sheep producer can exert the most immediate effect through nutritional programs that encourage optimal growth and development, as nutrition is one of the few factors over which the producer has significant control. Nutrition of the female from the fetal stage until she reaches maturity may influence the reproductive performance by firstly affecting the time or age of the first estrus, secondly by affecting the fertility and fecundity at this first estrus, and thirdly by residual effects on reproductive performance during the remainder of the reproductive life (Gunn, 1983).

Weaned ewe lambs are one of the most important assets of the small stock producer. There is therefore no better investment than to allow replacement ewes to grow out and develop optimally, as this will determine the animal's lifetime production and reproduction potential. To ensure a high lifetime reproduction rate, ewe lambs have to maintain a high growth rate until weaning and at least a moderate growth rate from weaning until 12 months of age. After 12 months of age, young ewes still have to increase their body weight and should at no stage have a decrease in body weight before the first mating (Meat Livestock Commission, 1988). Several researchers indicated that for every 1 kg increase in body weight at mating, the lambing percentage would increase with approximately 1.5 to 2.0% (Coetzee, 2004).

Ewe lambs that were under nutritional stress conditions for the first few months of their life, had a lower ovulation rate and produced less lambs over their lifetime than ewe lambs under good nutritional conditions (Williams, 1984). Weaned ewe lambs under poor nutritional conditions from six to 12 months of age with the same body weight at 18 months of age as ewe lambs under good nutritional conditions from six to 12 months of age, had a lower lambing percentage at two-year age (Coetzee, 2004). Reardon & Lambourne (1966) reported that moderate undernutrition before 12-month age decrease the lifetime reproduction potential of young ewes permanently and irreversibly. Young ewes under good nutritional conditions for the first 12 months of their life did not only have a higher ovulation rate at the first mating, but also an increase in their lifetime reproduction potential. Good nutritional conditions during the mature stage of the ewe's life also did not compensate for poor nutritional conditions before 12 months of age (Gunn, 1977). Poor nutritional conditions six months prior to mating can often be the reason for a poor conception and lower fecundity rate, despite the animals been in excellent condition at mating (Gunn et al., 1984).

The aim of this study was therefore to determine the effect of supplementation of replacement ewe lambs from weaning until first mating on their production under natural veld conditions.

**MATERIALS AND METHODS**

The project was conducted with wool sheep on two farms in the Trompsburg and Graaff-Reinet districts. The farm in the Trompsburg district (De Put) is in a semi-arid grassland (Dry Cymbopogon-Themeda veld; Grassland Biome), while the farm in the Graaff-Reinet district (Tandjies View) is in a grassy dwarf shrubland (False Karroid Broken veld; Karoo Biome) (Acocks, 1988). The project started in September 2007 on the Trompsburg farm and in September 2009 on the Graaff-Reinet farm. At both localities the participants' own animals were used. For Phase 1, the April/May 2007-born ewe lambs (300), weaned in September 2007, were used at the Trompsburg locality, while the April/May 2009-born ewe lambs (200), weaned in September 2009, were used at the Graaff-Reinet locality. For Phase 2, the September/October 2009-born ewe lambs (200 at Trompsburg; 110 at Graaff-Reinet), weaned in April 2010, were used at both localities. The animals were kept on natural veld throughout the year. The existing management practices with regard to animal health (dipping, dosing and inoculations), supplementary feeding, etc., were maintained.

At each locality and for each phase, a group of ewe lambs was divided into two equal groups (Control and Treatment) after weaning. The animals of the two groups grazed separate camps, comparable in size and veld quantity and quality. The Control groups received supplementary feeding according to the existing management program on the farm, while the Treatment groups received a commercial, pelleted supplement [250 g/kg crude protein, 42 g/kg urea (52% protein from NPN), 8.1 MJ ME/kg, 10 g/kg Ca (max), 4 g/kg P (min)] on a continuous basis from weaning until first mating.

The body weights of the ewe lambs were recorded at the start of the project (after weaning) and at monthly intervals thereafter until first mating. The greasy fleece weights of the animals were recorded at first shearing and midrib samples were taken for the determination of the wool characteristics. Greasy fleece weights of all the ewes were also recorded at the next two shearing opportunities. Conception, lambing and weaning percentages of the ewes at the first two lambing opportunities, as well as the weaning weights of their progeny, were also recorded.

The PROC GLM-procedure of SAS was used to evaluate the effect of supplementation on the body weights, fleece weights and wool characteristics of the ewes and the weaning weights of their progeny (SAS, 2009). Weaning weight of the replacement ewes was included as a co-variable in the final models for the mating weight and body weight change traits, while locality was included as a fixed effect in the final models for all the traits.

## RESULTS

### Phase 1: Trompsburg (Autumn-born lambs)

The body weights and body weight change of the autumn-born ewe lambs are presented in Table 1, the fleece weights and fleece characteristics in Table 2 and the reproduction data of the ewes and the weaning weight of their progeny in Table 3.

Table 1. The body weights and body weight change (± s.e.) of the autumn-born ewe lambs

| Trait | Control (kg) | Treatment (kg) |
|---|---|---|
| Weaning weight (5-month age) | $23.91^{a} \pm 0.23$ | $26.03^{b} \pm 0.24$ |
| Mating weight (12-month age | $40.85^{a} \pm 0.28$ | $44.05^{b} \pm 0.28$ |
| Body weight change | $15.79^{a} \pm 0.28$ | $18.99^{b} \pm 0.28$ |

[ab] Values with different superscripts in rows, differ significantly (P<0.05)

Table 2. The fleece weights and fleece characteristics (± s.e.) of the ewes

| Trait | Control | Treatment |
|---|---|---|
| Greasy fleece weight - 1st shearing (kg) | $3.01^{a} \pm 0.04$ | $3.15^{b} \pm 0.04$ |
| Greasy fleece weight - 2nd shearing (kg) | $3.03^{a} \pm 0.04$ | $3.21^{b} \pm 0.04$ |
| Greasy fleece weight - 3rd shearing (kg) | 3.09 ± 0.04 | 3.19 ± 0.04 |
| Fleece characteristics - 1st shearing: | | |

| | | |
|---|---|---|
| Staple length (mm) | 67.12[a] ± 0.77 | 69.43[b] ± 0.78 |
| Fibre diameter (µm) | 19.97 ± 0.12 | 20.24 ± 0.13 |
| Coefficient of variation of fibre diameter (%) | 18.82[a] ± 0.20 | 18.19[b] ± 0.20 |
| Staple strength (N/Ktex) | 43.87 ± 0.67 | 42.95 ± 0.68 |

[ab] Values with different superscripts in rows, differ significantly (P<0.05)

Table 3. Reproduction data of the ewes and weaning weight (± s.e.) of their progeny (1st and 2nd mating)

| **Trait** | **2008** | | **2009** | |
|---|---|---|---|---|
| | **Control** | **Treatment** | **Control** | **Treatment** |
| Conception percentage (%) | 87.3 | 94.3 | 91.5 | 91.6 |
| Lambing percentage (%) | 76.1 | 82.9 | 98.3 | 103.6 |
| Weaning percentage (%) | 56.3 | 69.3 | 71.2 | 91.6 |
| Weaning weight (kg) | 23.96[a] ± 0.54 | 26.69[b] ± 0.49 | 26.21 ± 0.58 | 26.86 ± 0.43 |

[ab] Values with different superscripts in rows, differ significantly (P<0.05)

**Phase 2: Trompsburg (Spring-born lambs)**

The body weights and body weight change of the spring-born ewe lambs are presented in Table 4, the fleece weights and fleece characteristics in Table 5 and the reproduction data of the ewes and the weaning weight of their progeny in Table 6.

Table 4. The body weights and body weight change (± s.e.) of the spring-born ewe lambs

| **Trait** | **Control (kg)** | **Treatment (kg)** |
|---|---|---|
| Weaning weight (6-month age) | 35.10 ± 0.36 | 35.20 ± 0.36 |
| Mating weight (18-month age) | 45.71 ± 0.34 | 46.27 ± 0.35 |
| Body weight change | 10.61 ± 0.33 | 11.18 ± 0.35 |

[ab] Values with different superscripts in rows, differ significantly (P<0.05)

Table 5. The fleece weights and fleece characteristics (± s.e.) of the ewes

| **Trait** | **Control** | **Treatment** |
|---|---|---|
| Greasy fleece weight - 1st shearing (kg) | 2.46 ± 0.04 | 2.48 ± 0.04 |
| Greasy fleece weight - 2nd shearing (kg) | 2.89 ± 0.04 | 2.96 ± 0.04 |
| Greasy fleece weight - 3rd shearing (kg) | 2.95 ± 0.05 | 3.04 ± 0.05 |

| Fleece characteristics - 1st shearing: | | |
|---|---|---|
| Staple length (mm) | 58.06 ± 0.68 | 57.34 ± 0.66 |
| Fibre diameter (µm) | 17.30 ± 0.14 | 17.41 ± 0.14 |
| Coefficient of variation of fibre diameter (%) | 20.33 ± 0.24 | 20.17 ± 0.23 |
| Staple strength (N/Ktex) | $39.87^{a}$ ± 0.92 | $43.21^{b}$ ± 0.90 |

[ab] Values with different superscripts in rows, differ significantly (P<0.05)

Table 6. Reproduction data of the ewes and weaning weight (± s.e.) of their progeny (1st and 2nd mating)

| Trait | 2011 | | 2012 | |
|---|---|---|---|---|
| | **Control** | **Treatment** | **Control** | **Treatment** |
| Lambing percentage (%) | 95.5 | 97.6 | 95.0 | 96.2 |
| Weaning percentage (%) | 86.5 | 104.9 | 91.4 | 101.3 |
| Weaning weight (kg) | 25.70 ± 0.45 | 26.14 ± 0.47 | 23.62 ± 0.39 | 24.17 ± 0.40 |

**Phase 1: Graaff-Reinet (Autumn-born lambs)**

The body weights and body weight change of the autumn-born ewe lambs are presented in Table 7, while the fleece weights and fleece characteristics are presented in Table 8.

Table 7. The body weights and body weight change (± s.e.) of the ewes

| Trait | Control (kg) | Treatment (kg) |
|---|---|---|
| Weaning weight (6-month age) | 19.40 ± 0.32 | 19.49 ± 0.32 |
| Mating weight (18-month age) | $35.57^{a}$ ± 0.31 | $38.93^{b}$ ± 0.31 |
| Body weight change | $15.82^{a}$ ± 0.31 | $19.11^{b}$ ± 0.31 |

[ab] Values with different superscripts in rows, differ significantly (P<0.05)

Table 8. The fleece weights and fleece characteristics (± s.e.) of the ewes

| Trait | Control | Treatment |
|---|---|---|
| Greasy fleece weight - 1st shearing (kg) | $2.86^{a}$ ± 0.06 | $3.22^{b}$ ± 0.06 |
| Greasy fleece weight - 2nd shearing (kg) | $2.98^{a}$ ± 0.07 | $3.25^{b}$ ± 0.07 |

| | | |
|---|---|---|
| Greasy fleece weight – 3rd shearing (kg) | $3.02^a \pm 0.07$ | $3.34^b \pm 0.07$ |
| Fleece characteristics - 1st shearing: | | |
| Staple length (mm) | 77.42 ± 0.97 | 79.49 ± 0.98 |
| Fibre diameter (µm) | $18.67^a \pm 0.13$ | $19.20^b \pm 0.13$ |
| Coefficient of variation of fibre diameter (%) | 18.23 ± 0.19 | 18.02 ± 0.19 |

[ab] Values with different superscripts in rows, differ significantly (P<0.05)

**Phase 2: Graaff-Reinet (Spring-born lambs)**

The body weights and body weight change of the spring-born ewe lambs are presented in Table 9, while the fleece weights and fleece characteristics are presented in Table 10.

Table 9. The body weights and body weight change (± s.e.) of the ewes

| Trait | Control (kg) | Treatment (kg) |
|---|---|---|
| Weaning weight (6-month age) | 27.11 ± 0.42 | 27.87 ± 0.42 |
| Mating weight (18-month age) | $34.51^a \pm 0.45$ | $36.99^b \pm 0.48$ |
| Body weight change | $7.53^a \pm 0.29$ | $9.09^b \pm 0.31$ |

[ab] Values with different superscripts in rows, differ significantly (P<0.05)

Table 10. The fleece weights and fleece characteristics (± s.e.) of the ewes

| Trait | Control | Treatment |
|---|---|---|
| Greasy fleece weight - 1st shearing (kg) | 2.65 ± 0.05 | 2.62 ± 0.06 |
| Greasy fleece weight - 2nd shearing (kg) | 2.89 ± 0.08 | 2.93 ± 0.08 |
| Greasy fleece weight - 3rd shearing (kg) | 2.96 ± 0.08 | 3.01 ± 0.08 |
| Fleece characteristics - 1st shearing: | | |
| Staple length (mm) | 80.44 ± 1.22 | 82.75 ± 1.30 |
| Fibre diameter (µm) | $17.28^a \pm 0.16$ | $17.78^b \pm 0.17$ |
| Coefficient of variation of fibre diameter (%) | 16.49 ± 0.25 | 16.50 ± 0.27 |

[ab] Values with different superscripts in rows, differ significantly (P<0.05)

The combined reproduction data of the Phase 1 and Phase 2 ewes and the weaning weight of their progeny are summarised in Table 11. The occurrence of Rift Valley Fever in 2010/11 and the subsequent very low reproduction rate (10 to 20%) of the Phase 1 animals at first mating, necessitated the mating of the Phase 1 and Phase 2 ewes as one group in April/May 2011 and April/May 2012.

Table 11. Reproduction data of the ewes and the weaning weight (± s.e.) of their progeny (1st and 2nd mating)

| Trait | 2011 | | 2012 | |
|---|---|---|---|---|
| | **Control** | **Treatment** | **Control** | **Treatment** |
| Lambing percentage (%) | 82.2 | 85.1 | --- | --- |
| Weaning percentage (%) | 78.1 | 81.1 | 81.5 | 83.9 |
| Weaning weight (kg) | 22.25 ± 0.27 | 22.81 ± 0.27 | 24.32 ± 0.31 | 25.06 ± 0.32 |

**Phase 1 combined: Trompsburg and Graaff-Reinet (Autumn-born lambs)**

The combined data of the autumn-born ewe lambs at the Trompsburg and Graaff-Reinet localities are presented in Tables 12 and 13.

Table 12. The body weights and body weight change (± s.e.) of the autumn-born ewe lambs

| Trait | Control (kg) | Treatment (kg) |
|---|---|---|
| Weaning weight | $21.57^a \pm 0.20$ | $22.84^b \pm 0.20$ |
| Mating weight | $37.63^a \pm 0.25$ | $41.97^b \pm 0.25$ |
| Body weight change | $15.90^a \pm 0.20$ | $19.02^b \pm 0.20$ |

$^{ab}$ Values with different superscripts in rows, differ significantly (P<0.05)

Table 13. The fleece weights and fleece characteristics (± s.e.) of the ewes

| Trait | Control | Treatment |
|---|---|---|
| Greasy fleece weight - 1st shearing (kg) | $2.96^a \pm 0.03$ | $3.18^b \pm 0.03$ |
| Greasy fleece weight - 2nd shearing (kg) | $3.01^a \pm 0.03$ | $3.23^b \pm 0.03$ |
| Greasy fleece weight - 3rd shearing (kg) | $3.06^a \pm 0.03$ | $3.26^b \pm 0.03$ |
| Fleece characteristics - 1st shearing: | | |
| Staple length (mm) | $72.26^a \pm 0.61$ | $74.47^b \pm 0.62$ |
| Fibre diameter (µm) | $19.33^a \pm 0.09$ | $19.71^b \pm 0.09$ |
| Coefficient of variation of fibre diameter (%) | $18.55^a \pm 0.14$ | $18.09^b \pm 0.15$ |

$^{ab}$ Values with different superscripts in rows, differ significantly (P<0.05)

**Phase 2 combined: Trompsburg and Graaff-Reinet (Spring-born lambs)**

The combined data of the spring-born ewe lambs at the Trompsburg and Graaff-Reinet localities are presented in Tables 14 and 15.

Table 14. The body weights and body weight change (± s.e.) of the spring-born ewe lambs

| Trait | Control (kg) | Treatment (kg) |
|---|---|---|
| Weaning weight | 31.16 ± 0.29 | 31.48 ± 0.29 |
| Mating weight | $40.27^{a}$ ± 0.34 | $41.44^{b}$ ± 0.35 |
| Body weight change | $9.26^{a}$ ± 0.24 | $10.10^{b}$ ± 0.25 |

$^{ab}$ Values with different superscripts in rows, differ significantly (P<0.05)

Table 15. The fleece weights and fleece characteristics (± s.e.) of the ewes

| Trait | Control | Treatment |
|---|---|---|
| Greasy fleece weight - 1st shearing (kg) | 2.55 ± 0.03 | 2.55 ± 0.03 |
| Greasy fleece weight - 2nd shearing (kg) | 2.89 ± 0.03 | 2.95 ± 0.03 |
| Greasy fleece weight - 3rd shearing (kg) | 2.95 ± 0.03 | 3.03 ± 0.03 |
| Fleece traits - 1st shearing: | | |
| Staple length (mm) | 69.08 ± 0.62 | 70.26 ± 0.64 |
| Fibre diameter (µm) | 17.40 ± 0.11 | 17.48 ± 0.11 |
| Coefficient of variation of fibre diameter (%) | 18.32 ± 0.18 | 18.43 ± 0.19 |

The reproduction data of the ewes and the weaning weights of the progeny could not be combined for the Phase 1 and Phase 2 animals at the two localities as the data were not available separately at the Graaff-Reinet locality.

**DISCUSSION**

Supplementary feeding from weaning until first mating increased the body weights and growth rates of the ewe lambs of the Treatment group, compared to the animals of the Control group at Trompsburg (autumn-born lambs) and Graaff-Reinet (autumn- and spring-born lambs). The combined data of the autumn-born and the spring-born animals at the two localities indicate that supplementary feeding from weaning until first mating increased the body weights and growth rates of the ewe lambs of the Treatment group, compared to the animals of the Control group, for both the autumn- and spring-born lambs.

With regard to wool production, the ewes of the Treatment group produced more wool than the ewes of the Control group at the first and second shearing at Trompsburg and the first, second and third shearing at Graaff-Reinet for the autumn-born lambs. The combined data also indicate that the autumn-born ewes of the Treatment groups produced more wool than the ewes of the Control groups at the first, second and third shearing. However, no differences in wool production were observed in the spring-born animals.

The combined data indicate that supplementary feeding increased fibre diameter and staple length and decreased coefficient of variation of fibre diameter in the autumn-born animals, but no differences in these wool characteristics were observed in the spring-born animals. The ewes of the Treatment groups at the two localities in general had higher conception, lambing and weaning percentages than the ewes of the Control groups at the first and second lambing opportunities.

It would therefore appear that the effect of supplementation on growth rate, wool growth and wool characteristics was more pronounced for the autumn-born replacement ewe lambs than for the spring-born lambs. The period preceding the weaning of the autumn-born ewe lambs at both Trompsburg and Graaff-Reinet was characterised by low rainfall and subsequent poor grazing conditions, which is reflected in the low weaning weights of the lambs at both localities. On the other hand, the higher weaning weights of the spring-born ewe lambs at both localities can largely be attributed to high rainfall and good grazing conditions in the months prior to weaning.

The results of this study are in accordance with the results reported by Vosloo (1967), Gunn, (1977), Gunn et al. (1984), Williams (1984) and Coetzee (2004), indicating higher production and reproduction rates for ewes that received sufficient supplementation before first mating.

**CONCLUSIONS**

The results of this study indicate that the supply of higher levels of supplementation to replacement ewe lambs from weaning until first mating had a positive effect on their production and reproduction under natural veld conditions, especially for autumn-born lambs, weaned at a relatively low body weight. It would therefore appear that supplementation of replacement ewe lambs weaned at a lower body weight will have a greater beneficial effect on their lifetime production and reproduction, compared to lambs weaned at a higher body weight. It was, however, not possible to do an accurate economic analysis of the impact of supplementation on lifetime production and reproduction of the ewes, mainly due to the lack of complete reproduction data sets.

The prevailing environmental conditions (rainfall, veld condition, etc.) before and after weaning, and its subsequent effect on weaning weights, should always be taken into account when considering a suitable supplementary feeding program for replacement ewe lambs.

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