The effect of frequency of supplementation on the production of South African Mutton Merino ewes grazing wheat stubble

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Abstract

A trial was conducted to determine to what extent the frequency of supplementary feeding would affect the production of sheep while grazing wheat stubble in the winter rainfall region of South Africa. One hundred and sixty SA Mutton Merino ewes were randomly divided into two groups that consisted of four camps each. They grazed eight camps of wheat stubble for a period of 138 days during which parturition occurred. One hundred ewes (four groups of 25 each) grazed a 17 ha camp at a stocking density of 5.8 sheep/ha and 60 ewes (four groups of 15 each) grazed a 12 ha camp at a stocking density of 5.0 sheep/ha. A weekly rotation within each of the two camps was followed to eliminate the camp effect. An energy and protein combination supplement was made available to the ewes as a lick. Two groups received no supplementary feed, two groups received 200 g/ewe/day, two groups received 400 g/ewe every second day, and two groups received 600 g/ewe every third day. During the feeding period, the smallest decrease in the weight of the ewes was observed in the groups that received supplementary feed every day as well as every second day, while no significant differences were observed between these two groups. Over the total feeding period, the smallest decrease in weight was observed in the groups that received supplementary feed in comparison with the control groups. Lambing percentage, weaning percentage, birth weight, 42-day weight and survival rate of the lambs were not affected significantly. This implies that supplying this type of supplementary feed to ewes only every third day or at least every second day is a viable option, whereby production is not harmed, and a reduction in labour and transport costs may be established.

Keywords: Bodyweight, SA Mutton Merino ewes, supplementation frequency, wheat stubble
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Introduction

Straw and other grain residues comprise more than 50% of the total dry matter production of a cereal crop and are a significant proportion of the material available for grazing. During the dry summer months in the winter rainfall region of South Africa supplementation on wheat stubble lands grazed by producing sheep is essential. Wheat stubble is characterized by low levels of nitrogen and available carbohydrates, poor digestibility and a high cell wall content (Dann &Coombe, 1987). Wheat stubble cannot supply sufficient nutrients to fulfil the high protein and energy needs of the reproducing ewe (Aitchison, 1988; Brand *et al*., 2000), and this necessitates the provision of supplementary feeding for ewes grazing wheat stubble so as to provide additional energy and protein (Aitchison, 1988; Brand *et al*., 1997a). Due to the low digestibility of wheat stubble, there is a reduced intake of the available stubble (Mulholland *et al*., 1976), which results in a larger decrease in the nutrient intake by the ewe.

Mature Merino wethers that grazed wheat stubble for 95 days, for example lost weight at a mean rate of 90 g/d (Messenger *et al.*, 1971). Supplemental feeding is a means to promote productivity by supplying limiting nutrients during deficient periods (Huston *et al*., 1999). The energy supply can be successfully supplemented with a rapidly fermentable carbohydrate, such as maize meal to improve the utilization of the wheat stubble (Gomes *et al*., 1994), while non-protein nitrogen (NPN) sources may improve the digestibility and intake of low quality grain residues (Perdok *et al*., 1988). Undegradable protein is normally necessary to improve milk production of the ewe as well as birth weight and early growth rate of lambs (Brand *et al*., 1997b).

Protein and energy supplements are normally provided daily (Thomas *et al.*, 1992). The daily provision of supplementary feed, however, requires large management inputs that may not always be

feasible. It entails increased transport expenditure, especially where large areas of land are used, and is labour intensive (Kartchner & Adams, 1982). It is attractive to reduce the frequency of feeding supplements (Allden, 1981; Beaty *et al.*, 1994), due to lower labour costs and the potential for all the animals in the flock to get an opportunity to feed. Several studies have shown no detrimental effects on animal performance when protein supplements are fed at 48 h (Hunt *et al*., 1989), 72 h (McIlvain & Shoop, 1962) or 96 h (Coleman & Wyatt, 1982) intervals. Utilization of the grazing may also be improved, since the animals would spend less time at the feeding troughs. A stampede to the feeding troughs which could lead to ewes becoming separated from their lambs may also be avoided by less frequent feeding periods. With less frequent feeding a more uniform feed intake is established the weaker sheep also have the opportunity to feed at the troughs and therefore sheep losses are lower and wool production higher (Van Niekerk *et al.*, 1967). Most day-of-supplementation research has been conducted on cattle. No significant difference on cattle performance when fed a supplement composed of cottonseed cake on alternate days was recorded (McIlvain & Shoop, 1962; Melton & Riggs, 1964). However, Kartchner & Adams (1982) found that feeding grain on alternate days decreased cow weight change relative to daily feeding. They suggested that the decreased performance might be a result of a decreased ruminal pH due to the feeding of grain every second day, which reduced forage intake and digestion.

Less frequent feeding may have disadvantages like the excessive intake of urea, acidosis caused by excessive starch intake, as well as suboptimal urea utilization which is caused by inconsistent ammonia levels in the rumen (Leng, 1990). Collins & Pritchard (1992) reported that alternate day supplementation with plant protein concentrates can be used when ruminants are consuming low crude protein forages like wheat straw (*ca*. 30 g CP/kg). Huston *et al.* (1997) also found that the most variable data were observed in the daily-fed group of cows due to aggressive competition during short consumption periods. Cows fed less frequently showed a reduced variation in production. On the other hand, certain evidence indicates that frequent feeding is more favourable than intermittent feeding for weight gain in sheep and cattle (Mochrie *et al*., 1956), except in drought conditions (Franklin *et al.*, 1955; Briggs, 1956; 1968; Rakes *et al*., 1961; Robards, 1970). These studies also indicated that frequent feeding might be more important to young animals than to mature animals.

The objective of this study was to quantify the effect of the frequency of feeding a supplementary energy and protein lick on the production of South African Mutton Merino ewes during late pregnancy and early lactation while grazing wheat stubble.

Materials and Methods

A total of 160 ewes were randomly divided into two groups consisting of four camps each. Four groups (of 25 each) consisting of 100 ewes grazed a 17 ha camp at 5.8 sheep/ha and four groups (of 15 each) consisting of 60 ewes grazed a 12 ha camp at 5.0 sheep/ha from 7 December 1995 until the second week in May 1996. The two camps were adjoining each other. To eliminate the effect of the camps, weekly rotation of sheep within each of the two camps was practised. The supplementary energy and protein loose lick (Table 1) was supplied in the morning as follows: Two groups of ewes received 200 g/ewe daily, two groups received 400 g/ewe on alternate days, two groups 600 g/ewe every third day and two control groups received none. The ewes receiving supplementation on alternate days or every third day, was given free access for the whole period. The composition of the supplementation was determined according to previous experiments with sheep grazing wheat stubble where nutrient intake (Brand *et al*., 1997b) and the response to different types of supplementary feed (Brand *et al*., 1997a) was determined. The ewes were weighed every 14 days, while the lambs were weighed at birth, as well as every fortnight thereafter. The supplementary feed was supplied from eight weeks pre-partum to six weeks post-partum. Lambing took place from the second week in April 1996 until the second week in May 1996.

All treatment means were compared by the Least significant difference (LSD) method. In line with recommendations by Snedecor & Cochran (1980), the LSD test was only used when it was protected by a significant F-value in the analysis of variance table. Statistical analysis was performed on groups of animals and not individual animals, and every group was regarded as an experimental unit. In the analysis of final bodyweight, initial bodyweight was included as a covariant. Ewe and lamb data were corrected for multiple births by linear model procedures.

Table 1 Components and chemical composition (on a dry matter basis) of the supplement supplied to SA Mutton Merino ewes at different feeding frequencies while grazing wheat stubble

Item	Content
Components (%)	
Barley meal	57.1
Fish meal	14.3
Sweet lupins	7.8
Urea	3.7
Feed lime	1.4
Molasses meal	1.1
Mineral-vitamin premix[a]	0.3
Sulphur	0.15
Taurotec[b]	0.15
Salt	14.0
Chemical composition (g/kg dry matter)	
Dry matter	854
Crude protein	216
Crude fibre	46
Ether extract	26
Ash	67
Total digestible nutrients	651
Metabolisable energy (MJ/kg)	113
Calcium	157
Phosphorus	8.1
Magnesium	1.5
Sulphur	3.0

[a] Mineral-vitamin premix/2 kg pack:Vitamin A, 6 000 000 I.U.;Vitamin D_3, 500 000 I.U.;Vitamin E, 5000 I.U.; Vitamin B_1, 2800 mg; Fe, 50 g; Mn, 40 g; Zn, 50 g; I, 1 g; Co, 1 g; Se,100 mg
[b] a growth promoter

Results and Discussion

Production results of ewes subjected to different feeding frequencies are presented in Table 2. During the feeding period, the smallest decrease in weight ($P \leq 0.01$) was observed in the groups that received supplementary feed daily as well as every second day. During the total period, the smallest decrease in weight ($P < 0.1$) was observed in the groups that received supplementary feed daily as well as every second or third day. Huston et al. (1999) observed that ewes fed at 7-day intervals lost more ($P < 0.05$) weight than the 1 day and 4 day-interval groups. In the present study the lambing percentage, weaning percentage, birth weight, 42-day weight and survival rate of the lambs were not affected significantly ($P \geq 0.18$) by the frequency of supplementary feeding. However, according to the data, the lambing and weaning percentage of the ewes that received supplementation every day and every third day tended to be higher than the ewes receiving supplementation every second day. Ewes that were supplemented every third day had the highest bodyweight loss of all supplemented groups during the feeding period ($P \leq 0.01$). All supplemented groups performed significantly better than the unsupplemented control group in terms of the live weight change over the feeding as well as the total period. The lack of significant differences in the lambing and weaning percentage of the ewes in groups that received supplementation daily as well as every third day, indicate that from an economical point of view, supplementation could be provided every third day. Faichney (1968) reported a significant improvement in bodyweight gain in sheep due to an increased frequency of feeding (100 g lucerne pellets was fed to sheep at 3 hr intervals for 24 hrs), whereas Kartchner & Adams (1982) reported a gain of 64.4 kg with dry pregnant crossbred cows fed daily and a decrease of 31.3 kg with cows fed on alternate days when grazing autumn winter veld. McIlvain & Shoop (1962) concluded that the weight gains of steers tended to decrease as feeding interval increased, when steers were fed cottonseed cake (410 g

CP/kg) while grazing on winter veld. In contrast, studies on cattle have shown that a supplement of cottonseed cake can be fed on alternate days, every third day or even weekly without decreasing animal performance compared to a daily feeding schedule (McIlvain & Shoop, 1962; Melton & Riggs, 1964).

Table 2 Production results of SA Mutton Merino ewes grazing wheat stubble continuously for 138 days at 5.8 sheep/ha (100 ewes) and 5.0 sheep/ha (60 ewes) respectively and receiving supplementary feed at different frequencies (daily, alternate days, and every third day)

Measurement	Everyday	Every second day	Every third day	Control	s.e.	P
Ewes:						
Initial bodyweight	69.9	70.0	69.6	69.7	1.5	0.99
Final bodyweight	62.7[a]	63.9[a]	62.3[a]	55.2[b]	1.4	0.01
Change in weight:						
Feeding period	-10.9[ab]	-10.0[a]	-12.8[b]	-17.5[c]	0.9	0.01
Change in weight:						
Total period	-7.3	-6.1	-7.4	-14.5	1.9	0.09
Lambing %[+]	161	139	160	139	12.0	0.39
Weaning %[++]	116	103	127	100	11.5	0.29
Lambs:						
Birthweight	4.3	4.5	4.1	4.2	0.1	0.18
42-day weight	7.9	7.1	6.7	6.9	0.5	0.36
Survival rate %[+++]	78	82	82	80	7.0	0.98

[a,b,c] values in rows bearing different superscript letters shows significant ($P \leq 0.05$) differences
[+] prolificacy; [++] lambs weaned per ewes lambing; [+++] lambs weaned per lambs born

Except for birth weight, Hodge *et al*. (1981) also found that frequency of feeding did not significantly affect production or final live weight where sheep were fed oats, lupins or a mixture of oats and lupins. Godfrey *et al*. (1993) observed that with an increasing interval of feeding, there was a decrease in performance (live weight gain and wool growth) irrespective of the source (barley or lupins) of supplement, which indicates that there is some trade-off between the attractive management option of feeding less frequently and the efficiency with which a supplement is utilised. In a study by Thomas *et al*. (1992), with ewes on winter grazing, it was found that ewes which received supplements on alternate days, lost more weight ($P < 0.10$) than ewes that received supplements on a daily basis. The percentage of lambs born per ewe lambing was higher ($P < 0.10$) for ewes receiving no supplements compared to ewes receiving supplements daily or on alternate days. However, no difference ($P > 0.10$) was detected in the percentage of lambs weaned per ewe, which indicates that alternate-day supplementation of pregnant ewes grazing winter veld appears to be a viable management option for sheep producers.

From Table 2 it is evident that under these circumstances, providing supplementary feed every second or even every third day, will not impair production. It will also have the advantage of reducing labour and transport costs. Beaty *et al.* (1994) also concluded that supplementation three times weekly seems to be a viable management option with minimal consequences in terms of cow performance. Huston *et al*. (1997) similarly found that sheep grazing low quality forage can be supplemented as infrequently as once a week with effective results. However, caution must be taken to prevent individual ewes from over-eating or high ingestion levels of starch as well as toxicosis caused by certain ingredients such as urea.

Conclusion

The data show that the highest decrease ($P < 0.1$) in bodyweight of ewes occurred in the control groups, which received no supplementary feed. Supplementary feed provided each day as well as every second day caused the smallest decrease in bodyweight during the feeding period ($P \leq 0.01$). There was no significant difference between weight loss over the total grazing period of ewes that received supplements daily and ewes that received supplements every second or third day. This kind of supplementary feed may be supplied every third or at least every second day, consequently cutting labour and transport costs in half

without affecting animal performance. It is, however, clear that conflicting results occurred in the literature with regard to the frequency of supplementary feeding. The type of supplementary feeding probably plays an important role. Non-protein nitrogen supplementation requires short time intervals (Leng, 1990), while natural protein sources may be provided at longer time intervals (McIlvain & Shoop, 1962; Melton & Riggs, 1964). Previous studies with oesophageally fistulated sheep grazing wheat stubble revealed selection of plant material with a high crude protein content (mean value of 161 ± 40 g/kg for a 5 month grazing period) (Brand *et al*., 2000), which may eliminate the requirement for NPN supplementation on this kind of grazing. Other local studies support these findings where NPN supplementation *per se* had no effect on production of sheep grazing wheat stubble (Brand *et al*., 1997a).

Acknowledgements

This study was funded by the Elsenburg Agricultural Research Centre and financial contributions by the Technology and Human Resources for Industry Program (THRIP) of the National Research Foundation of South Africa.

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