The wintering of young ewes on *Digitaria eriantha* Steud. pasture in the North West Province

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The object of this study was to determine the influence of different stocking rates (viz. 2, 4, 6 & 8 sheep/ha for a six-month period) on the performance of Dohne merino ewes grazing *Digitaria eriantha* (Smuts finger grass) pasture during winter (middle of May to middle of November). The trial was run from 1983 to 1986. Data from 1984 were excluded owing to insufficient rain which severely limited forage production. Each year the pasture was rested for the full preceding growing season (November to April). During Years 1 and 3 ('83 and '86 seasons) the animals could only stay on the pastures for limited periods. During these seasons approximately 75% (± 440 mm) of the total rainfall occurred during the active growing season (October to April) compared to 87% (485 mm) for the second season (1985). The generally recommended practice to rest pasture from January/February with the aim of utilising it as foggage seems, therefore, to be risky. The three lowest stocking rates (viz: 2, 4, & 6 sheep/ha for a six-month period) were only suitable for maintenance (1.7, 1.8 and 2.8 kg/ha respectively). These results can be seen as a norm for years with similar rainfall. Unpredictability of rainfall prevents the recommendation of higher stocking rates during the winter (May to September) in this area. The live mass gain of the animals during the fourth grazing cycle (October/November) was disappointing and Smuts finger grass pasture should not be utilised during early spring.

Die oorwintering van woldraende skape op *Digitaria eriantha* Steud. weiding. Die doel van hierdie ondersoek was om die invloed van veelading (2, 4, 6 en 8 skape/ha vir 'n periode van ses maande) op die prestasie van Dohnemerino-ooie op *Digitaria eriantha* (Smutsvingergras) weiding gedurende die winter (middel Mei–middel November) te bepaal. Die ondersoek het vanaf 1983 tot 1986 geduur. Data van die 1984-seisoen was onbruikbaar as gevolg van lae reënval wat voerproduksie ernstig benadeel het. Die weiding is gedurende elke jaar vir die volle voorafgaande groeiseisoen (November–April) gerus. Tydens Jare 1 en 3 ('83 en '86-seisoene) kon die ooie slegs vir beperkte periodes op die proefkampies wei. Gedurende hierdie twee seisoene het slegs ongeveer 75% (± 440 mm) van die totale reënval gedurende die aktiewe groeiseisoen voorgekom in vergelyking met 87% (485 mm) vir die tweede seisoen (1985). Die algemene aanbevole praktyk dat weiding vanaf Januarie/Februarie gerus word indien dit as staande hooi benut word, blyk dus riskant te wees. Dit wil dus voorkom asof reënval, beide ten opsigte van hoeveelheid en verspreiding, die mees kritieke faktor is. Die lewende massatoename van die skape op die drie ligste veeladings (2, 4 en 6 skape/ha vir 'n periode van ses maande) was onderskeidelik 1.7, 1.8 en 2.8 kg/ha. Hierdie resultate moet dus gesien word as 'n norm vir soortgelyke seisoene. Hiervolgens is hierdie veeladings slegs voldoende vir onderhoud van skape. Onvoorspelbaarheid van reënval verhoed die aanbeveling van hoër veeladings gedurende die winter (Mei tot September) in hierdie gebied. Massatoenames wat gedurende die vierde weisiklus (Oktober/November) verkry is, was teleurstellend en benutting van Smutsvingergrasweiding gedurende die lentemaande word nie aanbeveel nie.

Keywords: Smuts finger grass, wintering, foggage, stocking rate

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Introduction

The poor quality of winter veld in the sour veld areas, as well as its detrimental effect on extensive sheep farming, is well documented (Jacobsz, Cronje, Baard & Skea, 1971; Henning & Barnard, 1982; Verbeek 1982). Coetzee, Nel & Joubert (1968) also stressed the adverse effects on wool production and reproduction.

As possible solutions to this problem the following have been suggested: rumen stimulating licks (Louw, 1979), protein supplementation during the winter months (Bekker & Stoltz, 1983), utilisation of crop residues (Schoonraad, Schoeman, Laas & Beukes, 1988), silage feeding (Coetzee & Vermenlen, 1967), veld fertilisation (Booysen, 1980; Rethman, 1984), introduction of legumes (Graven, Birch & Muzzel, 1968), a fodder bank (hay) (Jones, 1983; Dannhauser, van Rensburg & Opperman, 1986) and foggage (I'Ons, 1968; Rethman & Gouws, 1973).

Le Riche (1982) alleged that the role of cultivated pastures to bridge the dry periods of the year with their accompanying feed shortages, has not been well exploited. The cultivation of pastures, especially on low potential soils, for utilisation during these periods is important and this aspect deserves much more attention.

Research done regarding the utilisation of foggage by woolled sheep, especially in the lower rainfall areas, is limited. Dannhauser (1988) suggested that *Digitaria eriantha*

(Smuts finger grass) as foggage can play an important role in the wintering of livestock. Rethman (1984) stressed the fact that foggage must be seen as a low cost feed for the wintering of ruminants.

The object of this study was to determine the potential of *Digitaria eriantha* (Smuts finger grass) as foggage for woolled sheep at different stocking rates. Dannhauser (1988) dealt with the pasture aspects of this study (dry matter production, chemical analysis, etc.).

Procedure

The trial was carried out with young Döhne merino ewes under dryland conditions on a low potential Avalon 3100 soil type (Soil Classification Working Group, 1991) on the experimental farm Noyjons of the North West Agricultural Development Institute, Potchefstroom. The long-term average (lta) rainfall for this region is approximately 640 mm/year (Institute for Soil, Climate and Water, 1989).

Although the trial was originally planned to start during 1982 and continue for three consecutive seasons, the low rainfall during some seasons resulted in an insufficient quantity of grazing material. Data were not collected during 1982 and 1984, but only during the seasons of 1983, 1985 and 1986. At the beginning of each season twenty year-old Dohne merino ewes were randomly allocated to four groups (five animals/treatment).

In an attempt to determine the stocking rate of Smuts finger grass that can be applied at different stages of the winter period, the total duration of the trial (180 days) was divided into four grazing cycles of 45 days each:

Grazing cycle 1: 15th May - 30th June
Grazing cycle 2: 1st July - 15th August
Grazing cycle 3: 16th August - 30th September
Grazing cycle 4: 1st October - 15th November

During each of the different grazing cycles (45 days) four different stocking rates were applied. Camp sizes differed in order to obtain these stocking rates. The stocking rates were the following (camp sizes are given in parenthesis):

Stocking rate 1: 8.3 sheep/ha (0.6 ha)
Stocking rate 2: 16.6 sheep/ha (0.3 ha)
Stocking rate 3: 25.0 sheep/ha (0.2 ha)
Stocking rate 4: 33.3 sheep/ha (0.15 ha)

The trial was thus divided into 16 camps for utilisation during each season. If extrapolated to a grazable period of 180 days (winter) the respective stocking rates were 2, 4, 6 & 8 sheep/ha for a six-month period.

Approximately seven days after the commencement of each grazing cycle during the various seasons, oesophageal fistula samples of the pasture were collected. Three samples for each stocking rate were collected. Samples were analysed for *in vitro* dry matter digestibility (IVDMD) according to the method of Tilley & Terry, (1963) as modified by Engels & van der Merwe, (1967) and nitrogen (Clare & Stevenson, 1964) for the calculation of crude protein (CP). These results are presented by Dannhauser (1988).

Fertiliser was applied annually (during August) at a level of 120 kg N + 20 kg P/ha. The fertilisers used were limestone ammonium nitrate (LAN) (28% N) and superphosphate (11.3% P).

The results for each of the three different seasons ('83, '85 and '86) were analysed separately as a 4 × 4 factorial design with four stocking rates, as well as four grazing cycles (Steel & Torrie, 1960).

Fasting mass (16 h without food or water) was determined at the start and end of each grazing cycle, while the animals were also weighed every fortnight.

Owing to the fact that these animals were utilizing winter grazing, a protein lick (42% crude protein) with the following composition was supplied to the animals:

Groundnut oilcake meal	40%
Salt	30%
Dicalcium phosphate	15%
Urea	10%
Molasses	5%

The average lick intake was determined fortnightly.

Results and Discussion

Rainfall

The average monthly rainfall for the different seasons and the preceding summer months, as well as the long-term average (lta) for 74 years (1913–1986), are shown in Figure 1.

Grobler (1956) recommends a minimum of 600 mm of rain per year for optimal animal production from Smuts finger grass. The distribution during the season also plays an important role. From Figure 1 it is evident that a lower rainfall occurred during all the seasons compared to the quantity needed for optimum animal production. This was in contrast with the lta, which was even higher than the recommended minimum per year. During the season prior to the trial (1982) the pasture was hayed during January, as is recommended to produce high quality foggage. The season was, however, very dry which resulted in insufficient regrowth and, therefore, grazing material. Subsequently the pastures were not hayed during the remainder of the trial.

During the 1983 season (Year 1) the rainfall was approximately 100 mm lower than the lta. Owing to the limited amount of grazing available, the animals could only stay on the foggage for limited periods that varied between 26 and 37 days during the different grazing cycles of this season (as specified later).

Although the total rainfall during the 1985 season (Year 2) was much lower than the lta, it was almost similar to the lta during the active growing season of the grass. During this season 87% (485 mm) of the total rainfall occurred from October to April compared to approximately 75% (± 440 mm) for the other two seasons. This was the only season in which there was enough grazing available for all the animals to stay in the camps for the duration of the trial. In this instance followers had to be used for all stocking rates to clean up excess grass.

The lower rainfall (± 100 mm less than the lta) of the 1986 season occurred during the growing season and this had the result that the sheep of the highest stocking rate (33.3 sheep/ha) could not graze the pasture for the duration of the different grazing cycles.

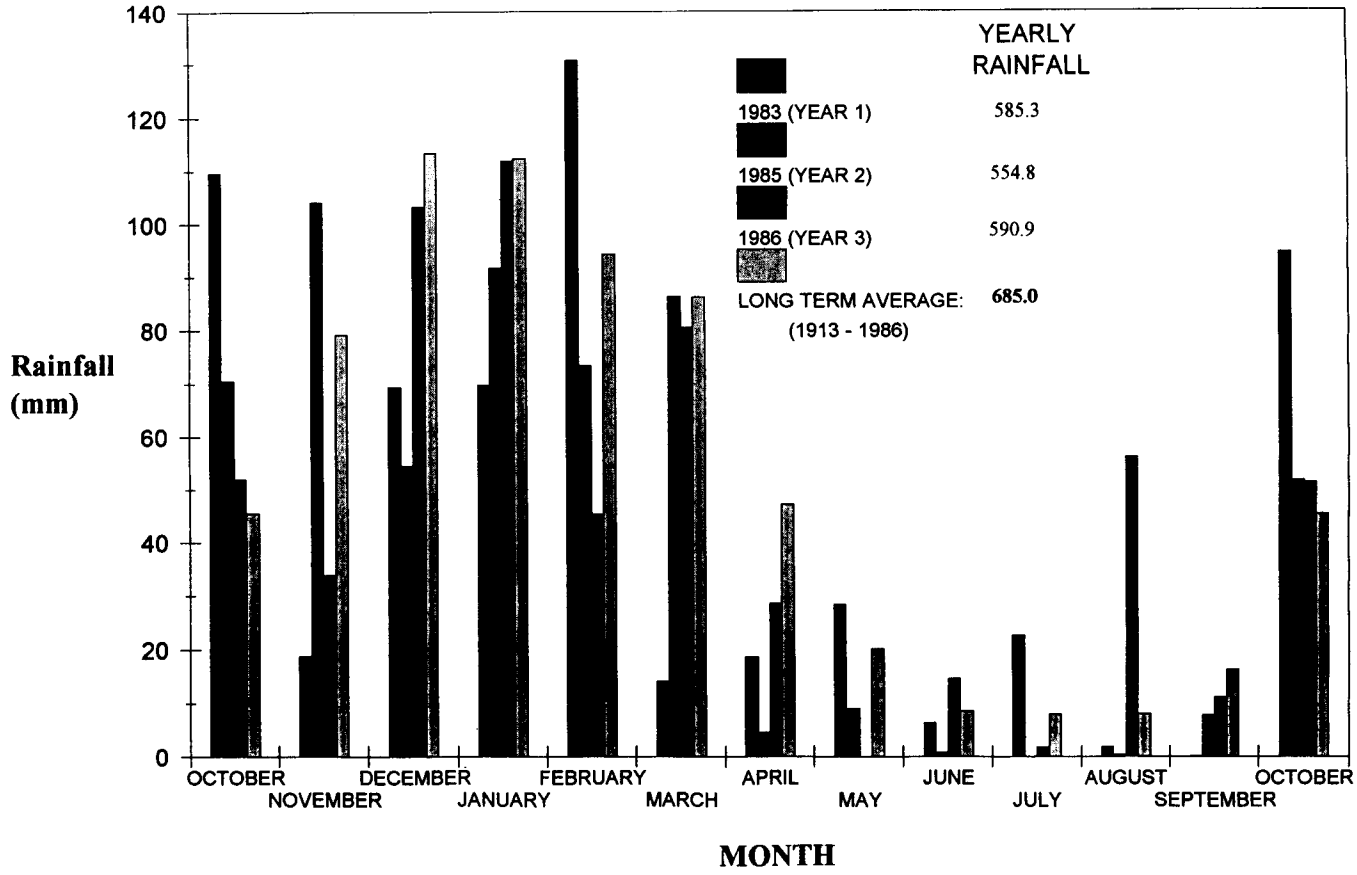

Figure 1 Average monthly rainfall (mm) during the various seasons.

Dry matter digestibility and crude protein content

The mean *in vitro* dry matter digestibility and the crude protein content of the pasture samples obtained from oesophageally fistulated animals for Grazing cycles 1 to 4 over the various seasons were: 52.2, 9.4; 46.9, 9.3; 51.0, 10.7 and 60.4 and 14.7 respectively (Dannhauser, 1988). Although it appears from these results as if the quality of the pasture during the different seasons was adequate for maintenance and that a salt-phosphate lick would have been sufficient, it must be kept in mind that these are mean values. During certain cycles of some seasons, especially those with relatively high rainfall, the digestibility of the pasture was low which necessitated supplementation with a rumen-stimulating lick. Despite this, animal performance was disappointing — mainly because of the limited quantity of grazing (as discussed later). The animals were removed from the trial when the available grazing was insufficient and a mass loss occurred. Rethman (1984) reported disappointing results with Smuts finger grass foggage that had been rested since January/February. The mass gain of the sheep was, however, satisfactory (50–60 g/day) when the grass was cut during March but the grazing capacity of the foggage was lower owing to the fact that only 50% of the potential production of the grass was available.

Mass change

Period of grazing

Owing to the below average rainfall and the poor distribution, the planned grazing periods (45 days) could not always be realised (Table 1). Therefore, an analysis between grazing cycles within a specific year was not possible. However, with the exception of the first grazing cycle of Year 1, the grazing periods within a specific year were comparable and consequently the effect of grazing cycle on animal performance for the three different seasons could be compared statistically.

The average daily gains (ADG) of the animals during the different grazing cycles of the three trial seasons (with the number of grazing days in parenthesis) are shown in Table 1.

The differences ($p < 0.05$) between Grazing cycle 1 (mass loss) and Grazing cycles 2 and 3 (mass gain) during the first

Table 1 Average daily gain per sheep (g) of the animals during the different grazing cycles (number of grazing days in parenthesis)

	Grazing cycle (G)				
Year (Y)	1 (15/5–30/6)	2 (1/7–15/8)	3 (16/8–30/9)	4 (1/10–15/11)	Ave. (Y)
1	-25.3^{a}	28.6^{b}	34.1^{b}	4.6^{ab}	10.01
(1983)	(37)	(27)	(28)	(26)	(30)
2	49.7^{a}_{wx}	52.2^{a}_{w}	15.1^{b}_{xy}	-41.3^{b}_{y}	18.59
(1985)	(45)	(45)	(45)	(45)	(45)
3	2.0^{a}	21.3^{ab}	12.1^{ab}	31.3^{b}	16.54
(1986)	(43)	(41)	(42)	(41)	(42)

$^{a-d}$ Values in the same row with different superscripts differ significantly ($p < 0.05$)

$_{w-z}$ Values in the same row with different subscripts differ highly significantly ($p < 0.01$)

year ('83 season) (Table 1), possibly point to the fact that grazing material was limited for all stocking rates and animals remained on the grazing too long. Meissner & Paulsmeier (1988) found a negative ADG with sheep on Smuts finger grass for the months July to mid-September, whereas the animals had a positive ADG after the first spring rain. The poor growth rate during the fourth grazing cycle of Year 1 is possibly due to the fact that sheep grazed the young growth, of which the quantity was still insufficient, and did not graze enough foggage to satisfy their requirements.

During Year 2 ('85 season) this tendency was repeated when the ADG during Grazing cycle 3 was lower than during Grazing cycles 1 ($p < 0.05$) and 2 ($p < 0.01$). The mass loss during Grazing cycle 4 differed ($p < 0.01$) from the mass gains of Grazing cycles 1 and 2. Rethman (1984) found that animal performance during the spring months (September/October) was disappointing and recommended an alternative feed source for this period, whereas Meissner & Paulsmeier (1988) also recorded a mass loss during October/November.

During the third season (1986) the sheep maintained their mass during all the grazing cycles and even showed a slight mass gain. The limited number of grazing days must, however, be kept in mind since the animals with the highest stocking rate could not stay in the camps for the whole period. The high rainfall that was recorded during August 1986 (Year 3), resulted in early growth of the grass. There was already enough green material available during the fourth grazing cycle with the result that the animals' ADG during this period was significantly higher ($p < 0.05$) than that of the first grazing cycle (Table 1).

Mass gain per hectare

As far as mass gain per hectare is concerned, three factor interactions ($p < 0.01$) between the main effects, as well as interactions ($p < 0.01$) between Year and Grazing cycle, and Grazing cycle and Stocking rate, occurred. This was probably due to the variation in and the below average rainfall (as discussed earlier), which resulted in the fact that the animals could not, for most of the grazing cycles, stay on the pastures for the planned period.

Owing to these interactions the total live mass gain/ha of the animals was only compared statistically within each grazing cycle of the different seasons and is presented in Table 2.

The initial loss of mass during the first grazing cycle of Year 1 (Table 1) resulted in a negative mass change per hectare for all stocking rates (Table 2). Although differences between stocking rates were detectable during Grazing cycles 1 and 2, these differences were not statistically significant ($p > 0.05$), possibly because of larger variation. During the third grazing cycle (16/8–30/9) of Year 1 the total mass gain of the animals on the highest stocking rate (33.3 sheep/ha) was better ($p < 0.01$) than that obtained with 16.6 sheep/ha. In contrast, exactly the opposite occurred during the fourth grazing cycle (1/10–15/11). This was possibly due to the relatively high rainfall during October (± 50 mm above the lta) resulting in the sprouting of grass and the consequent lack of sufficient foggage utilisation.

During the first grazing cycle of the second season (1985) the total mass gain/ha of the animals on the heaviest stocking rate (33.3 sheep/ha) was higher ($p < 0.05$) than that of the animals on Stocking rates 1 (8.3 sheep/ha) and 3 (25.0 sheep/ha). The gain/ha of the animals on the different stocking rates during the second grazing cycle of this season did not differ significantly. During the third grazing cycle the animals on the heaviest stocking rate gained significantly ($p > 0.05$) more per hectare than the animals on Stocking rate 2. The mass gains of the animals during the fourth grazing cycle (which were negative for all the stocking rates), clearly show the effect of a rise in stocking rate. Where the available amount of grazing was limited, the higher stocking rates caused a greater ($p > 0.05$) loss of mass. During the third season (1986) there were no significant differences in the mass gain/ha among the different stocking rates during any of the grazing cycles.

Table 2 Total live mass gain (kg/ha) of the animals at the different stocking rates during the three different seasons

	Stocking rate (S) (sheep/ha)					
	1	2	3	4	Avg.	
Grazing cycle (G)	(8.3)	(16.6)	(25.0)	(33.3)	(G)	CV (%)[1]
Year 1 ('83 season)						
1 15 May–30 Jun	-0.5^{a}	-5.7^{a}	-4.5^{a}	-4.7^{a}	−3.83	42.76
2 1 Jul–15 Aug	-0.8^{a}	4.3^{a}	6.0^{a}	-0.7^{a}	2.21	33.15
3 16 Aug–30 Sept	3.5_{wx}	0.0_{w}	5.0_{wx}	10.0_{x}	4.63	17.08
4 1 Oct–15 Nov	2.8^{a}_{w}	-0.7^{a}_{wx}	1.5^{ab}_{wx}	-6.7^{b}_{x}	−0.75	23.58
Avg. (G)	1.25	−0.50	2.00	−0.50	0.56	
Year 2 ('85 season)						
1 15 May–30 Jun	4.4^{b}	7.1^{ab}	5.0^{b}	17.5^{a}	8.26	22.33
2 1 Jul–15 Aug	4.8^{a}	8.0^{a}	12.0^{a}	11.3^{a}	9.04	20.57
3 16 Aug–30 Sept	1.8^{ab}	-1.3^{b}	4.4^{ab}	8.7^{a}	3.33	23.42
4 1 Oct–15 Nov	-3.3^{a}_{w}	-5.7^{a}_{w}	-6.5^{a}_{wx}	-14.0^{b}_{x}	−7.37	34.62
Avg. (G)	1.94	1.75	3.61	5.26	3.12	
Year 3 ('86 season)						
1 15 May–30 Jun	1.5^{a}	3.5^{a}	-2.2^{a}	-5.9^{a}	−0.77	33.94
2 1 Jul–15 Aug	2.0^{a}	3.6^{a}	2.8^{a}	4.4^{a}	3.20	20.16
3 16 Aug–30 Sept	2.5^{a}	-1.1^{a}	0.5^{a}	6.1^{a}	2.09	21.20
4 1 Oct–15 Nov	2.1^{a}	4.0^{a}	6.8^{a}	8.3^{a}	5.21	16.94
Avg. (G)	2.03	2.50	1.78	3.23	2.40	

[a–d] Values in the same row with different superscripts differ significantly ($p < 0.05$)

[w–z] Values in the same row with different subscripts differ highly significantly ($p < 0.01$)

Stocking rate

Despite shorter grazing periods during the first season (Table 1), the animals of the highest stocking rate lost mass (Table 2), whereas the best average gain/ha occurred at this stocking rate during the other two seasons. The poor distribution of the rainfall probably also contributed to this result. In this regard it is evident from Table 2 that the early rainfall during the third season (August, September and October), had the effect that the amount of young growth at this stage was already sufficient for the animals to maintain their mass and even show a slight gain/ha. Consequently these animals, in contrast with the other two seasons, showed the best gains/ha during the

fourth grazing cycle.

Owing to the fact that the animals at the different stocking rates stayed on the pasture for different periods, as well as the interactions that existed, total mass gains/ha over the three seasons were not compared statistically. The mean mass gains /ha/season of the animals during the trial period for Stocking rates 1 to 4 were: 1.74; 1.77; 2.84 and 3.02 kg/ha.

Although these results indicate that the highest stocking rate (33.3 sheep/ha) had the highest gain/ha, this stocking rate cannot be recommended owing to the uncertainty of the rainfall. During Years 1 and 3 the animals of this stocking rate could only stay on the pastures for 19 and 38 days respectively. The three lowest stocking rates (2, 4, & 6 sheep/ha for a six-month period) seem more appropriate.

Lick intake

Louw (1979) states that on roughage with low digestibility, like winter grass, the live mass gains of animals can, at best, be maintained only if effective rumen-stimulating licks are fed. Meissner & Paulsmeier (1988) also reported that protein supplementation to sheep for the winter period significantly increased their ADG. As the animals in the current trial utilised winter grazing, a nitrogen-containing lick (42% CP) was supplemented.

The average lick intake by the animals is presented in Table 3. As can be seen in Table 3, the average daily lick intake was considerably lower than recommended for this particular lick (70 g/day). This was possibly due to the fact that the pasture, in most cases, supplied adequate protein for the animals' needs. The fact that the average lick intake was notably higher during the first two grazing cycles, in comparison to the third and fourth grazing cycles, can possibly be ascribed to the fact that the young growth was utilised during the last two grazing cycles. The higher lick intake of the animals on the two highest stocking rates probably points to the fact that the amount of grazing was insufficient at the higher stocking rates.

Table 3 Average lick intake (g/day) of the animals during the trial

		Stocking rate (S) (sheep/ha)				
Grazing cycle (G)		1 (8.3)	2 (16.6)	3 (25.0)	4 (33.3)	Avg. (G)
1	15 May–30 Jun	33.6	33.0	50.7	36.5	38.47
2	1 Jul–15 Aug	31.7	32.2	44.0	46.6	38.63
3	16 Aug–30 Sept	17.0	21.8	19.8	33.0	22.89
4	1 Oct–15 Nov	25.6	16.2	29.3	31.2	25.54
	Avg. (G)	26.97	25.78	35.95	36.82	

Conclusions

The results of this investigation show that the utilisation of Smuts finger grass foggage, under these rainfall conditions, at the three lower stocking rates (2, 4, & 6 sheep/ha for a six-month period) was sufficient for the maintenance requirements of the sheep. This implies that over a period of six months a stocking rate of approximately 6 sheep/ha can be applied. Where rainfall was not a limiting factor ('85 season), the animals with the highest stocking rates (33.3 sheep/ha) also had sufficient grazing. During this season 87% (485 mm) of the rainfall occurred from October to April compared to approximately 75% (± 440 mm) for the other two seasons. The best results during this year ('85 season) were obtained at the highest stocking rate. During a year with 'normal' rainfall, the situation may improve to such an extent that it might be possible for all stocking rates to have sufficient grazing material to satisfy maintenance requirements.

The limited mass gains obtained during this trial show that Smuts finger grass foggage, supplemented with a protein lick, is not fit for high producing animals but must rather be used for the wintering of non-productive animals. Because of the disappointing mass gains towards the end of the season (October/November) it appears that the foggage must not be utilised during spring. Alternative feed sources must rather be utilised during this period. The commonly recommended practice that the grass must be cut during January/February and rested afterwards to provide foggage of a high quality, may be risky in the dry western cropping areas owing to the unpredictability of the rainfall.

From these results it appears as if rainfall, in terms of both quantity and distribution, is the most critical factor and that the quantity, rather than the quality, of the grazing is the limiting factor for animal production.

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