SOURVELD FARMER'S DAY'S PROCEEDINGS

The following talks were presented at a series of farmer's day held at Döhne, Kokstad and Amsterdam. Management options for the sustainable use of sour grassland (sourveld) were considered along with the economic implications of various management systems.

A SOURVELD MANAGEMENT SYSTEM IN EAST GRIQUALAND

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"The land produced vegetation: plants bearing seed according to their kinds and trees bearing fruit with seed in it according to their kinds. And God saw that it was good."

I thought I should begin by telling you who I am, where I come from and what I do so that you may understand the background from which I come. Since 1955 I have farmed on Elandskloof in the Kokstad area. This lies in the 4e bioclimatic region and is in extent 1230 ha, with a rainfall average of *c.* 950 mm. My income is derived solely from farming. I bought a small irrigation property in 1986 where I now live and my son-in-law is now running Elandskloof.

Our first move into veld management came in the 1950s with the 4-camp system derived from Professor Scott's work. However, it soon became clear that this was not suited to the very sour veld and, with the late James Rennie, we tried an 8-camp system and he subsequently went to 16 camps. This was to try to get better utilization but was economically unjustifiable.

At about that time Dr Pierre Theron had designed a 5-camp system at Cedara to try to overcome the problem of excessive selective grazing. This was in acknowledgement of the late John Acocks who showed that the desirable grasses were better able to handle periods of heavy grazing. This 5-camp system was later modified and advocated by Dr. Venter as the Venter-Drewes system. We have often been told that we are merely advocating this system. In fact, what happened was that the pasture scientists developed a system from Dr. Theron's work and, at the same time, we were also using the same principles and working to develop a system which was both simple, practical and met our needs. What we have been doing over the last 30 years is to bridge the gap between theory and practice.

Here, I would like to make one very sincere plea to the people involved. The pasture and animal scientists have been pulling in opposite directions for years and our country has been suffering as a result. The animal husbandry people are advocating small single-sire herds and flocks breeding high producing animals with extra growth, extra wool, extra reproduction and all these need extra food. Meanwhile the food value on the veld is retrogressing. To improve this we need larger herds of animals which are better adapted to the environment. If any scheme of veld management is to work, it needs to satisfy the farmer, the veld and the animals.

In the years ahead I feel it particularly important that we produce our meat at lowest cost, particularly up to weaner stage, as we are competing on the world markets now. Also, the new farmers will be unable to come in with high cost production systems.

Diverting slightly at this point, we tried to assess what actually happened in the past before man or modern man arrived on the scene. There is obviously a reasonable amount of speculation here, but some things can be pin-pointed.

- Fire was part of the system.
- For the fire to start naturally there must have been accumulation of dead material.
- There were large herds of animals.
- The animals were adapted to the environment.
- There were no fences.
- Presumably, there were always drought periods.

How could we reconcile this with existing management?

The criteria which we set out for ourselves were:

- to maintain the veld in a healthy vigorous state with the more palatable grasses predominating;
- be cost-effective, i.e. any input must be seen to have financial benefits;
- to cut the winterfeed period which in sourveld is the biggest cost;
- must be easily implemented without too much cost;
- must have sufficient flexibility to allow for droughts; and
- must have a two-year summer rest period and allow for seeding and, in the following year, to allow these seedlings to grow out.

This would also be important for developing hot fires in bush control.

How did we set about meeting these goals?

Step 1

The idea of 5 camps was enlarged to 5 cells or areas, each area having more than one camp. This made the whole system more practical and flexible, particularly in winter when it is more important to split groups of animals because of competition at licks.

Step 2

Breed animals that are adapted to the environment. It is far better to change the type of animal to suit the environment than to try to change the environment to suit our preference of animal type. How much of our veld mismanagement has been due to this factor?

Step 3

We asked ourselves what would happen if we consolidated our herds. This would conform to what actually happened in the past and would alleviate the necessity for any extra fencing costs. Against much opposition from many quarters, we tried this, expecting all sorts of calamities to happen.

This immediately had an enormous influence on the utilization of the veld. Stock that previously grazed on ¾ of the farm were now insufficient to keep down the first two cells or 2/5ths. We increased the cattle by *c.* 20%. Where no grazing system had been followed previously in areas in northern Natal, this figure was nearer 100%. In large mobs there appears to be a psychological effect on the animal and they graze everything without selecting. We have not come across a grass yet which is not fully utilized the first season after a burn, with the exception of *Ngongoni* in the late summer period. What we have discovered is that all grasses are good, hence the quotation which I opened with. One of the surprises has been the carrying capacity of the tall thatch grass, *Hyparrhenia dregeana* (*aucta*), during the periods of drought.

We then come to the animals for which so much doom was forecast. The actual effect measured by weaner weights, calving percentage, wool weights, etc., was nil. It was noticeable, however, that the cows continued to put on condition well into the autumn, allowing us to graze them longer on rested veld, thus cutting our winter costs. This was without the need of any supplementary licks.

Step 4

This was now to put the theory into practice. Cell 1 is burnt and we concentrate all our management on this area, making certain that there is total utilization. Whenever any part of cell 1 is able to carry stock, they are put in. Cells 2 and 3 are then the previous year's cells 1 and 2 and are grazed by stock in that order when 1 is finished. If stocking rates are correct, then it is usually necessary to graze all these in spring with cell 3 subsequently rested for the remainder of the summer as a drought reserve. In average or above-average rainfall years it would not be utilized except in the autumn when the cow and calf herd is now needing extra grass because of the calf intake. Cells 4 and 5 are rested for two full growing seasons and utilized with licks for winter grazing. Again, in periods of drought, cell 4 may be used for the autumn or at least a portion. We therefore have one complete cell or 1/5th of the area as a drought reserve.

Two observations here, are:

- that ¼ of the veld utilized for winter grazing is only sufficient for approximately 2 months;
- what we consider a drought year is when the rainfall falls to about 55-60% of the average.

Details of veld management

We calve in September/October and the cows are on the veld usually around 1 October. This year, at the start of our first cycle, they went out on the 19 September which may or may not be a significant development.

We wean at the end of April when the cows go into rested veld with their winter licks. They normally come off the veld around 1-15 August. At the moment, we lamb ewes twice a year in autumn and spring. Sheep are normally on the veld from *c.* 1 October to 15 April.

Where only ¼ of the veld is rested, the winter feed period is usually *c.* 100 days, i.e. end of June to beginning of October. We have now reduced that to about 50 days - early August to end of September.

What problems have we encountered?

- With the large number of cattle involved in one herd it is important to have good water available. This will normally be the main cost involved, particularly in the drier areas.
- The boundary and cell boundary fences need to be good.
- We found that the cattle tended to pull out quite a lot of grass but, on closer inspection, these were mostly the grasses with the higher leaf tensile strength, e.g. *Eragrostis plana*.
- There are no pegged out transects, so the long-term effect on the veld can only be judged by eye and recorded results.
- Because there is so much unused veld in a good year, farmers tend to overstock with disastrous results in a drought.
- One farmer grazed cell 5 in spring so as to get a better quality winter grazing. As a result, cell 1 got away, thereby negating the whole object of the exercise.
- Follow-up advice and help over the first year is usually necessary if someone is wishing to improve his grazing along these lines.

Have we solved all the problems? Of course not, but, so far, all the latest research appears to support the principles on which we are working. I believe that this is a good step along the way to better utilization and understanding of our sourveld.

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VIGOUR OF SOURVELD IN RESPONSE TO CATTLE AND SHEEP GRAZING

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Introduction

It is a generally held opinion that when sheep are grazed on sourveld the inevitable result is degradation of the veld due to extreme selective grazing. Such degradation is in the form of a species composition change, where the undesirable species component increases at the expense of the desirable species. An often proposed solution to this problem is that cattle and sheep should graze together. In such a situation the cattle would keep the sward in the short, leafy state which sheep require in order to perform.

It was found however, that there is a lack of information on the processes involved in the degradation of the veld. Species composition measures are rather insensitive, and only show a significant change once fairly large changes in species composition have taken place, and, in many cases, the causes of such changes are unknown. Thus, it was decided to do studies on individual grass tufts, including measures of vigour.

Aims

The aims of the research presented here were :

1) to determine the grazing pattern (history of defoliation) on the principal grass species;
2) to investigate the influence of stocking ratio (cattle:sheep) on the gazing pattern; and
3) to measure the effect of the grazing pattern on the vigour of the principal species.

This article reports in particular on the third aim (vigour), however, the other two aims had to be achieved to get to the third, and will be alluded to only where necessary.

Techniques

The study was carried out within an established grazing trial on the Kokstad Research Station, in the Highland Sourveld. For the purpose of this study the treatments comprised three cattle:sheep ratios: 1:0 - cattle only; 1:1 - mixed stocking; and 0:1 - sheep only. Each ratio treatment was managed as a four-camp fixed rotational grazing system. The ratios were balanced in terms of animal units (AU). All the ratios were stocked at an effective stocking rate of 1 AU ha^{-1}.

As mentioned earlier, the study was confined to the principal species of the Highland Sourveld, *viz. Themeda triandra* and *Tristachya leucothrix.*

In a four-camp rotational grazing system, all the camps go through three consecutive growing seasons during which the are grazed. The three years of grazing is then followed by a one year rest, after which the camp is burnt and enters a further three seasons of grazing, etc. In this study marked tufts of the two species were monitored for the three grazing seasons to determine the grazing history (pattern) of those tufts. This was done by individual visual assessment of the grazing of tufts based on current season growth. The assessments were made at the end of the period of occupation (grazing). Changes in the utilization level of the tufts were looked at, in particular, but other measures were also taken including: leaf table height (at the end of the grazing season), and tuft diameters.

As mentioned above, every fourth year a camp gets a full growing season's rest, whereafter it is burnt and grazed again. From the grazing pattern data tufts were identified which had been subjected to three levels of grazing intensity for the three year period. In the year of the rest and burn (mid-August), these tufts were allowed to grow out until the end of September when they were clipped at crown height, and the herbage dried and weighed. The tuft diameters of the tufts were determined and using the circular tuft theory, basal areas were calculated. The vigour of the tufts was expressed as the mass of regrowth (mg) per unit basal area (cm^{-2}).

Results

Tuft mortalities

From early in the second season of grazing, mortalities of marked tufts were noted in the sheep only and mixed stocking camps. No tuft mortality what-so-ever was seen in the cattle only camp. The tuft mortalities are presented in Table 1 below.

Table 1. Percentage mortality of marked tufts of *Themeda triandra* and *Tristachya leucothrix* in the sheep only (0:1) and mixed stocking (1:1) camps.

Ratio	*T. triandra*	*T. leucothrix*
1:1	14	12
0:1	30	18

These data show that sheep on their own are more damaging than when they are grazed together with cattle, but that mixed stocking is not the solution which it was hoped to be. The data also show that cattle only was the most lenient of the treatments as far as grazing intensity is concerned.

Grazing height

The rates of tuft mortality can probably be attributed to the height at which the tufts were grazed in the different stocking ratio treatments (Table 2).

Table 2. Mean grazing heights (mm) of *Themeda triandra* and *Tristachya leucothrix* under different stocking ratios at the end of the second and third grazing seasons.

Ratio	*Themeda triandra*		*Tristachya leucothrix*	
	Season 2	Season 3	Season 2	Season 3
0:1	13.1	10.8	12.4	7.3
1:1	20.3	13.3	20.5	11.3
1:0	25.7	24.5	23.1	23.5

Note that the more sheep there are in the stocking ratio, the lower is the grazing height.

Vigour

From the grazing pattern study plants were identified which had been subjected to one of three grazing intensities for the majority of the three years of grazing. The levels of grazing intensity were: ungrazed, leniently grazed (>40 mm), and severely grazed (<40 mm). The vigour of these plants is presented in Table 3.

Table 3. Vigour (mg cm^{-2} basal area) of *Themeda triandra* and *Tristachya leucothrix* tufts subjected to three levels of grazing intensity.

Grazing intensity	*T. triandra*	*T. leucothrix*
ungrazed	44	67
lenient	43	44
severe	22	25

Note: the severe treatment means are significantly different ($P<0.01$) from the other treatment means.

It is obvious that those tufts which had been severely grazed were unable to recover their vigour during the one year's rest (Table 3). Tuft diameter data (not shown here) indicated that the severely grazed tufts had significantly smaller areas that leniently and un- grazed tufts, hence, these tufts are producing less off a smaller basal area.

Implications

The implications of these research findings can summarised in three main points.

- Species composition is not the be-all and end-all that it is sometimes made out to be. The species composition data from the camps in which this study was conducted, show no significant change. However, the tuft mortality and vigour data presented show that there has been a fairly large impact on the veld. Future research must, therefore, look at more sensitive measures such as basal area, tuft size and tuft (or sward) vigour.
- The four-camp fixed rotational grazing system is not a viable management option for sheep in the sourveld.
- There is a need to look at alternative grazing **strategies** for sheep in sourveld. Such strategies could be any one of a 2-, 3- or 5- block approach, using the Venter-Drewes principles.

Acknowledgement

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EFFECTS OF GRAZING AND RESTING ON VELD PRODUCTIVITY

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Introduction

Recent research in the sourveld areas of South Africa into the effects of grazing on veld grass vigour has revealed some interesting responses. Results of several trials carried out at Nooitgedacht ADC in the Eastern Transvaal will be presented to illustrate these responses.

Definition of grass vigour

Grass vigour can be defined as the potential or ability of a grass plant to re-grow during the season following defoliation. This measure has direct bearing on management, as it gives an indication of management effects on production of grazing during the following year, and it also serves as a short term measure of the effect of grazing on the "health" of the individual species.

Vigour maintenance of preferred grass species is important both for animal production and for veld condition, or sustained animal production from veld.

Effect of defoliation on grass vigour

In recent local trials, treatment effect on vigour has been determined by applying a range of defoliation treatments to veld in a particular season. During the season after treatment application, the regrowth (production) of all species or a selection of species was measured on both the previously defoliated veld as well as a previously ungrazed control.

Residual effects on vigour of three veld grass subjected to different schedules of grazing and resting

In the first trial, designed to determine the effects of sheep grazing on veld vigour, the following treatments were applied (Barnes 1987):

1. Veld was rested throughout the growing season (ungrazed control).
2. Veld was grazed lightly until mid-January, then rested.
3. Veld was grazed heavily until mid-January, then rested.
4. Veld was grazed lightly until mid-March, then rested.
5. Veld was grazed heavily until mid-March, then rested.
6. Veld was grazed lightly throughout the growing season.
7. Veld was grazed heavily throughout the growing season.

A rotational grazing procedure was simulated, with sheep grazing all treatments for a period of about one week, followed by a three week absence.

The effects of these grazing treatments on the grass vigour was determined by measuring the production during the following season of *Themeda triandra*, *Heteropogon contortus* and *Trachypogon spicatus* as well as the total production of the veld. The results are shown in figure 1.

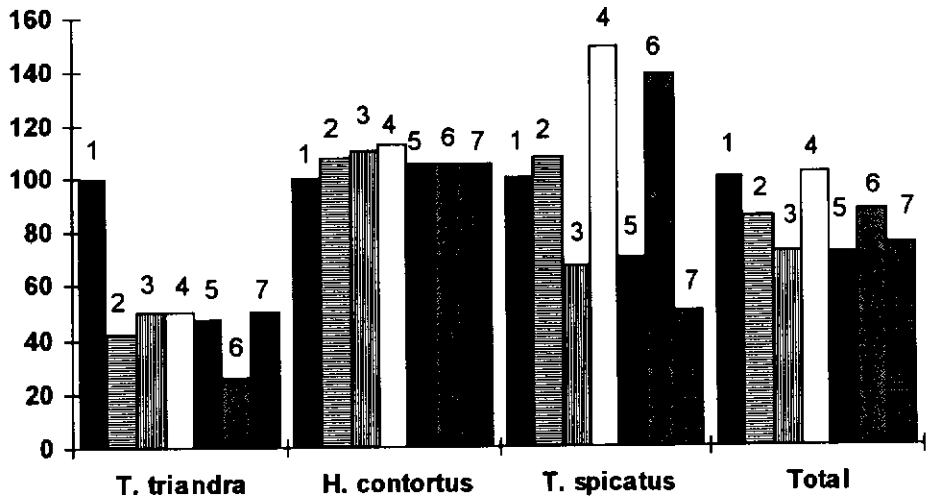

Figure 1 Shoot yields of three veld grass during the season after application of different grazing and resting schedules. Expressed as percentage of the ungrazed control. Treatments were as follows:

1. Veld was rested throughout the growing season (ungrazed control).
2. Veld was grazed lightly until mid-January, then rested.
3. Veld was grazed heavily until mid-January, then rested.
4. Veld was grazed lightly until mid-March, then rested.
5. Veld was grazed heavily until mid-March, then rested.
6. Veld was grazed lightly throughout the growing season.
7. Veld was grazed heavily throughout the growing season.

The grazing treatment negatively affected the production of *Themeda triandra* during the following season, while the other two species were not affected to the same degree. The effect on total veld vigour depended on the proportion of the sensitive species present. The unexpected drastic effects of grazing on the vigour of *Themeda triandra*, a locally common and important veld grass, led to further trials designed to quantify these effects under varying conditions.

Effect of different cutting treatments on *Themeda triandra*

A cutting trial with controlled frequencies and intensities of defoliation was carried out to obtain more clarity of the effects of defoliation (Moore 1989).

The following defoliation treatments were carried out on *Themeda triandra*:

1. Undefoliated control.
2. Cut three times at six weekly intervals at 40 mm above ground level.
3. Cut five times at six weekly intervals at 40 mm above ground level.
4. Cut three times at six weekly intervals at 20 mm above ground level.
5. Cut five times at six weekly intervals at 20 mm above ground level.

Treatments two and four, which were cut three times during the season, were left to grow undisturbed after the last cut at the beginning of January, while treatments 3 and 5 were cut twice more, totalling five cuts over the whole season. The results are shown in figure 2.

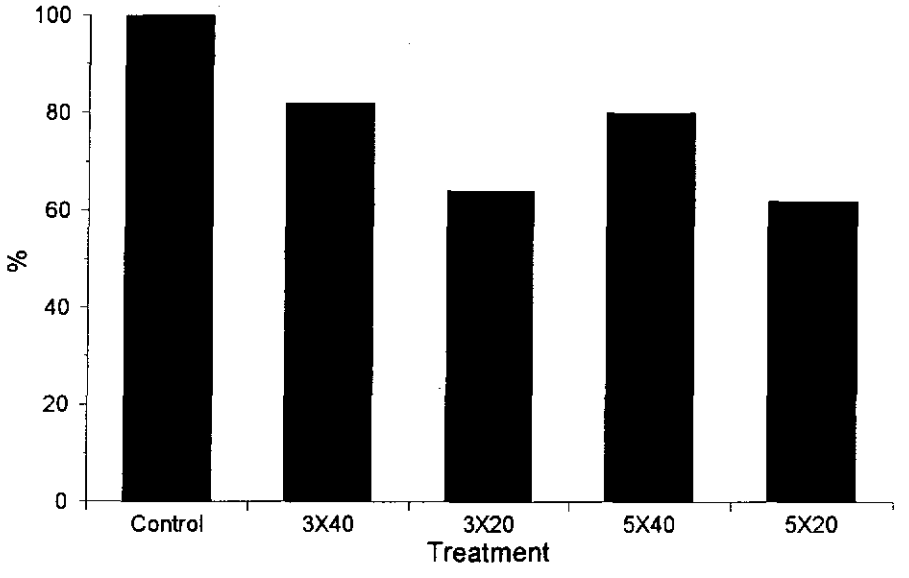

Figure 2 Effect of defoliation by cutting on the yield of *Themeda triandra* during the season following treatment application. Expressed as percentage of the ungrazed control. All defoliation treatments negatively affected vigour relative to the undefoliated control during the following season.

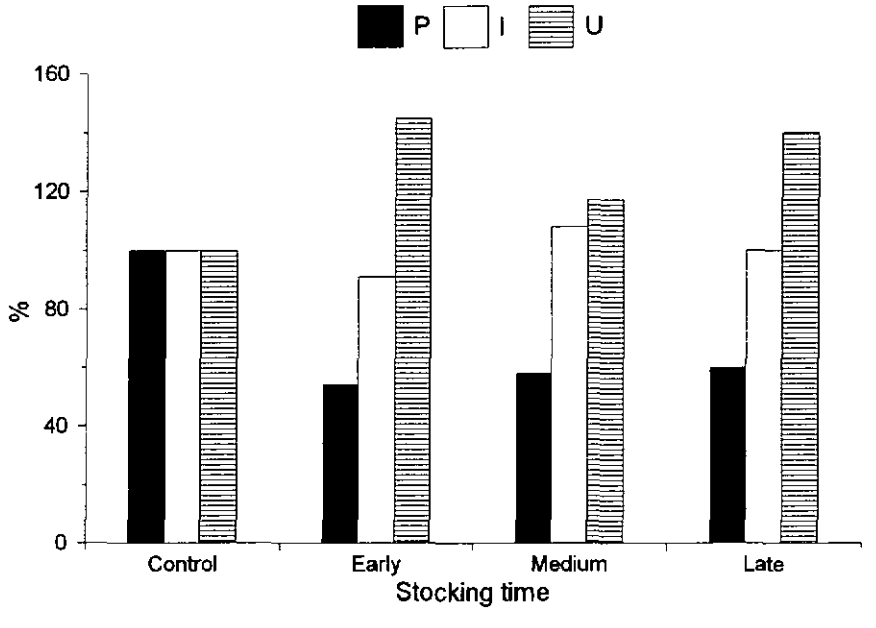

Figure 3 Vigour of veld grass grazed by sheep with three times of stocking after spring burning. Grass has been divided into three classes (P=palatable, I=intermediate, U=unpalatable) Expressed as percentage of the ungrazed control.

Influence of period of deferment on veld productivity

A full scale grazing trial was then initiated. Included in the objectives was the measurement of the effects on veld vigour of sheep grazing when stocked at different intervals after a spring burn (Barnes & Demspey 1992). The first time of stocking was as soon after the spring burn as possible (treatment 1), the second time approximately three weeks later (treatment 2) and the third time was approximately three weeks after the second (treatment 3). The vigour indices for each of three palatability classes are shown in figure 3 for each time of stocking relative to an ungrazed control. The trial was grazed rotationally using a four week cycle.

The production of the palatable grasses in all three treatments was reduced in the season following grazing to between 50 and 60 % of that of the palatable grasses in the ungrazed control. The production of the intermediate grasses in all treatments was approximately similar to that of the intermediate grasses in the control. The unpalatable grasses showed an increased production in all treatments relative to the unpalatable grasses of the control.

Vigour of the palatable grasses was depressed by grazing even when time of stocking was delayed in spring. Delaying the time of stocking in spring thus had a relatively small effect on fostering vigour. Sheep performance on the latest time of stocking treatment was approximately 50 % of the performance on the early time of stocking treatment.

Discussion

From the results of the above trials, several important points are obvious:

- Grazing (or defoliation) negatively affects veld vigour. This effect is positively correlated to grazing pressure (intensity and frequency).
- Grazing has a greater negative effect on palatable grasses (which are subjected to a relatively high grazing pressure) than on unpalatable grasses (which are ungrazed or only lightly grazed). The vigour of unpalatable grasses appears to be stimulated by grazing, probably partly because of reduced competition from the palatable grasses.
- Delaying the time of stocking in spring has a small positive effect on veld vigour relative to stocking early. However, even stocking late in spring reduced vigour of the palatable grasses to less than 60 %, and reduced sheep performance by approximately 50 % relative to early stocking.
- Periods "out" in a rotational grazing procedure do not adequately compensate for vigour loss caused by grazing. The above three trials were carried out under simulated rotational grazing, cutting at predetermined intervals and rotational grazing respectively. This, along with results from Barnes & Denny (1991); Gammon (1978a; 1978b; 1978c) and Gammon & Twiddy (1990) indicate that grazing procedure (number of camps, periods in and periods out of camps) is relatively unimportant in terms of the effect on veld.
- Results from current unpublished research indicate that, while increasing stocking rate has a greater negative effect on vigour, even grazing at light stocking rates has a serious detrimental effect on vigour of preferred species. Also, cattle have virtually the same negative effect on veld vigour as a whole, although the negative effect of cattle on the vigour of preferred species is smaller than in the case of sheep.

Compensation for vigour loss

It seems that any grazing, by sheep or cattle, irrespective of grazing procedure, will result in a decline in vigour of particularly the preferred species. The only way to compensate for this severe loss of vigour caused by grazing is to implement periodic long term rests (i.e. full growing season rests).

Conclusions

The following principles stand out:

- Any grazing has a negative effect on veld vigour, and in particular the vigour of preferred grasses.
- Number of camps per group of animals, and periods in and periods out of those camps within a season are relatively unimportant in terms of the effects of grazing on veld vigour.
- Deferring grazing at the beginning of the season is also relatively unimportant in terms of compensating for vigour loss, but leads to a marked decline in sheep performance.
- Grazing management systems should incorporate periodic long term rests (full growing season rests) as a means of compensating for vigour loss caused by grazing.
- This rested veld can form a source of cheap roughage for winter use with appropriate supplementation.

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BLAZE 'N GRAZE: MANAGEMENT OF SOURVELD AFTER THE BURN

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OBJECTIVE

The objective of this article is to discuss the use of post-burn grazing management STRATEGIES to improve animal performance, in Sourveld. The research that this discussion is based on took place in the Döhne Sourveld over a period of seven years.

INTRODUCTION

Before considering the management of sourveld I believe that I should explain why the word STRATEGY has been placed in capitals. We normally refer to GRAZING SYSTEMS and recommend camp layouts based on several configurations of size and number. Unfortunately these are often interpreted as specific recommendations and followed rigidly in the form of a recipe. I believe, therefore, that we should rather talk of STRATEGIES which are linked to specific objectives. The strategies of the land owner can then be changed to meet specific short or long term goals. I believe also that this will move us away from what has historically been a paternalistic approach to extension to one where the land owner is made aware of the consequences of particular actions. In so doing we will expose land owners to the tools they require to make decisions. In this way we will very quickly become aware of the shortfalls in our knowledge base. The benefits to both land owners and the efficient use of declining research funds should be obvious.

It has been well established that fire is an important driving variable in all vegetation systems.

Fire has been used for millennia to provide nutritious grazing for both domestic and wild animals.

- Eastern Cape and Drakensberg pastoralists used fire prior to their displacement by agriculturalists from North Africa and Europe, to manage the vegetation to achieve specific objectives. These included attracting game to burnt areas and providing grazing.

Therefore fire has always been an essential tool in vegetation management and its use has been recommended since 1947. Recommendation for using fire are covered by BURNING GUIDELINES in most provinces in South Africa.

Several reasons for burning sourveld are suggested in the literature. A common reason is to remove old material. However the most common reason in sourveld is to **PRODUCE NUTRITIOUS GRAZING FOR LIVESTOCK**.

We have an abundance of work on the role of fire in vegetation as well as a very detailed understanding of fire behaviour. However the routine use of fire in management strategies is relatively uncommon.

As a management tool, fire is poorly understood in respect of the interaction between plants and animals in burnt and unburnt situations.

Dogma and legislation dictate that:

- burning takes place after the first spring rains.
- burnt veld be rested to allow for 100 to 150 mm of regrowth before grazing; and

These statements and recommendations, particularly the second, are, at best, poorly supported by formal research data. An important aspect of the debate is that most of the work on which such recommendations and the burning guidelines are has been DONE IN THE ABSENCE OF GRAZING. Because of this three main questions need to be addressed:

1) ***what is the effect of time of burning?***;
2) ***how much of an advantage is early post-burn grazing?***; and
3) ***how long does any advantage last?***

WHEN SHOULD WE BURN SOURVELD?

Whilst not the main thrust of this article, it is necessary to consider, in the context of using fire as a management tool, the following important issues:

- fire intensity - because it has a major impact on SAFETY during burning;
- tiller mortality - as this provides the basis for veld PRODUCTION and LONGEVITY; and
- veld condition - because of the impacts of species composition on FORAGE FLOW.

Data which could be used to address these issues are available from several sources and we can conclude, in general, that:

- burning during the late winter/spring period has little effect on veld;
- time of burning has a major impact on fire intensity and therefore SAFETY;
- burning too early (autumn) or too late (summer) is likely to lead to undesirable changes in species composition;
- control of problem plants requires specific *ad hoc* strategies; and
- burning to provide nutritious grazing for livestock should take place AFTER RAIN **BEFORE** THE ONSET OF THE GROWING SEASON or WITHOUT RAIN **AFTER** THE ONSET OF THE GROWING SEASON.

WHAT OF POST-BURN GRAZING MANAGEMENT?

One of the major challenges in affecting efficient use of sourveld is to exploit the vegetation when it is in a highly nutritious state.

The objective here is to use the veld when the animals can benefit from the quality. In sourveld, most management strategies should aim at achieving this in a SUSTAINABLE way. Essentially, then, the efficient use of sourveld is a question of managing forage quality.

HOW LONG DOES EARLY SEASON QUALITY OF SOURVELD LAST?

Although specific data on the flow of forage quality are not abundant, most authors show that quality declines as the plants mature. Some data from a study in humid and semi-arid areas of the eastern seaboard show that there is a rapid decline in the quality of rooigras (*Themeda triandra*) in the early part of the season (Figure 1).

If we assume that the minimum requirements for nitrogen for growing animals is around 1% (i.e. 6.25% crude protein) then it is clear that the quality of sourveld is inadequate for most of the year.

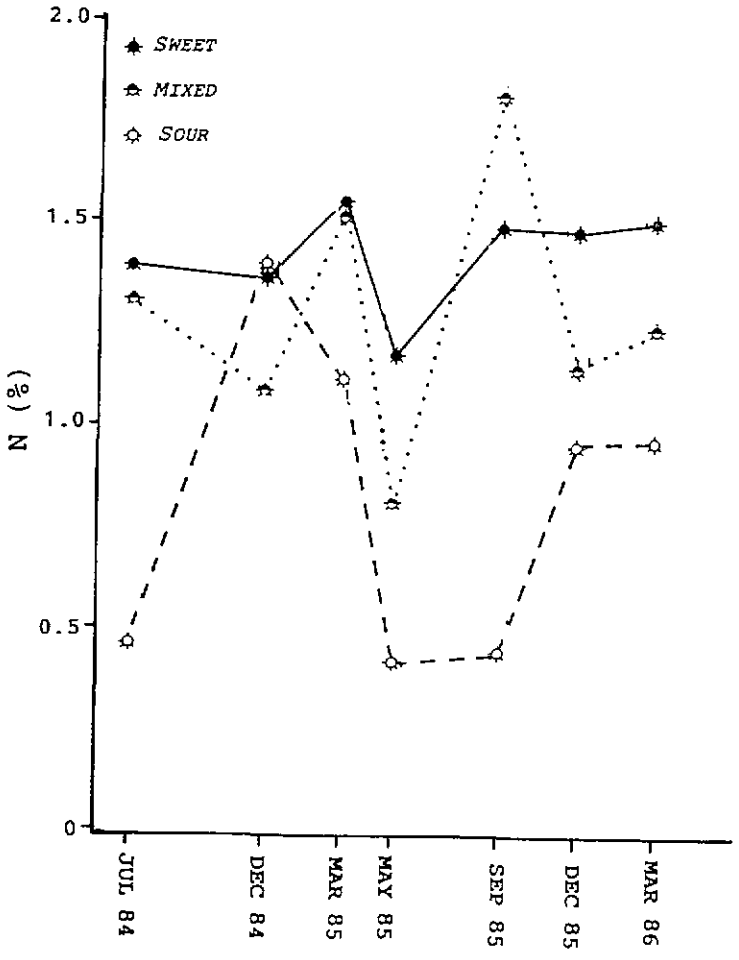

Figure 1 Seasonal trends in nitrogen content (%) for **sweet, mixed,** and **sour** veld in KwaZulu-Natal.

If we look at what is generally recommended for sourveld management, or search for evidence to support any recommendation, we will discover an interesting fact. This is that little evidence exists for the current recommendations. What will be found, however, is what I call THE GRAZIER'S DILEMMA. From a nine year study, published in 1945, Botha was able to conclude the following:

> *"If the [burnt] veld must rest - which is essential - it would be unwise to let it rest during the spring, as has so often been done in the past."*

His conclusion was based on evidence from both plants and animals (in this experiment he used cattle).

In terms of the objective of exploiting forage quality, Botha provided good advice in 1945, but this has been contradicted by regulations and recommendations to farmers since then. Although there has been a degree of modification to regulations governing post-burning management of most regional extension guidelines, most state that:

- post-burn resting must allow for 100 to 150 mm of regrowth before grazing; and
- too frequent burning is seldom tolerated.

As far as the time required to achieve 100 to 150 mm of regrowth is concerned, this may take more than eight weeks in some seasons. In most cases, therefore, the period of maximum quality will be lost (Figure 1). A review, by researchers and extension officers, of the basis for these recommendations is therefore appropriate.

WHAT IS THE CONSEQUENCE OF FOLLOWING THIS ADVICE?

In order to address the specific issue of post-burning grazing management a trial has been running at Döhne since 1987. The treatments are designed to make comparisons between combinations of EARLY (within 10 days of a fire) versus LATE (allowing for 100 to 150 mm of regrowth) grazing, ANNUAL versus BIENNIAL burning and CONTINUOUS versus ROTATIONAL grazing. The trial was stocked with sheep.

Several parameters of both the animals and the plants were recorded and some of the important results are presented here.

Seasonal gains

During the seven years of the trial both wet and dry years were experienced. In all situations early grazing resulted in superior weight gains from the animals (Table 1). In the initial phases of trial early grazing with burning resulted in nearly three times the production per animal when compared with late grazing. This difference has, however, declined with time. Treatments that were not burnt resulted in poor animal performance irrespective of whether they were grazed early or late.

An interesting feature of this study is that there was essentially no difference between continuous and rotational grazing for the duration of the trial.

Table 1 Comparison of weight gains (kg animal^{-1}) for sheep under various management strategies on Döhne Sourveld

	1987	1988	1989	1990	1991	1992
Early vs Late						
E	15.3	12.3	9.6	12.5	6.0	12.6
L	5.9	8.1	5.0	10.2	3.9	9.4
Annual vs Biennial						
A	10.6	14.0	7.4	13.9	5.8	11.8
B	10.4	6.4	7.2	8.8	4.2	10.2
Continuous vs Rotational						
C		10.0	7.5	11.9	6.3	11.6
R		10.4	7.1	10.8	3.7	10.4

Seasonal production

Despite the specific research programme having a relatively complex design only three 'types' of management strategy emerged as being different. These are EARLY GRAZING WITH BURNING (Early burnt), LATE GRAZING WITH BURNING (Late burnt) and UNBURNT veld irrespective of time of grazing (Unburnt) (Figure 2).

Although there was some differences between seasons essentially the pattern that emerges is as follows:

(1) animals grazing burnt veld early gain weight early in the season and maintain this advantage;
(2) animals grazing late only start gaining weight later and do not make up for lost time; and
(3) it appears that the relative advantage of burning veld and grazing early declines with time.

WHAT DOES THIS MEAN ECONOMICALLY?

On the assumption that this research situation is a simulation of a bigger system, the production data for mass gain can be analysed economically (Table 2). This analysis reveals a major economic advantage of early grazing and frequent burning. What is of importance here is that this analysis (Table 2) is the average over the seven years of data. If only the first two or three years are considered the advantage will be greater. From an animal production point of view, therefore, it appears that we have been under-exploiting our sourveld resource or at least managing it inefficiently.

Before any changes can be made to recommendations, however, it is important that the performance of the plants be examined.

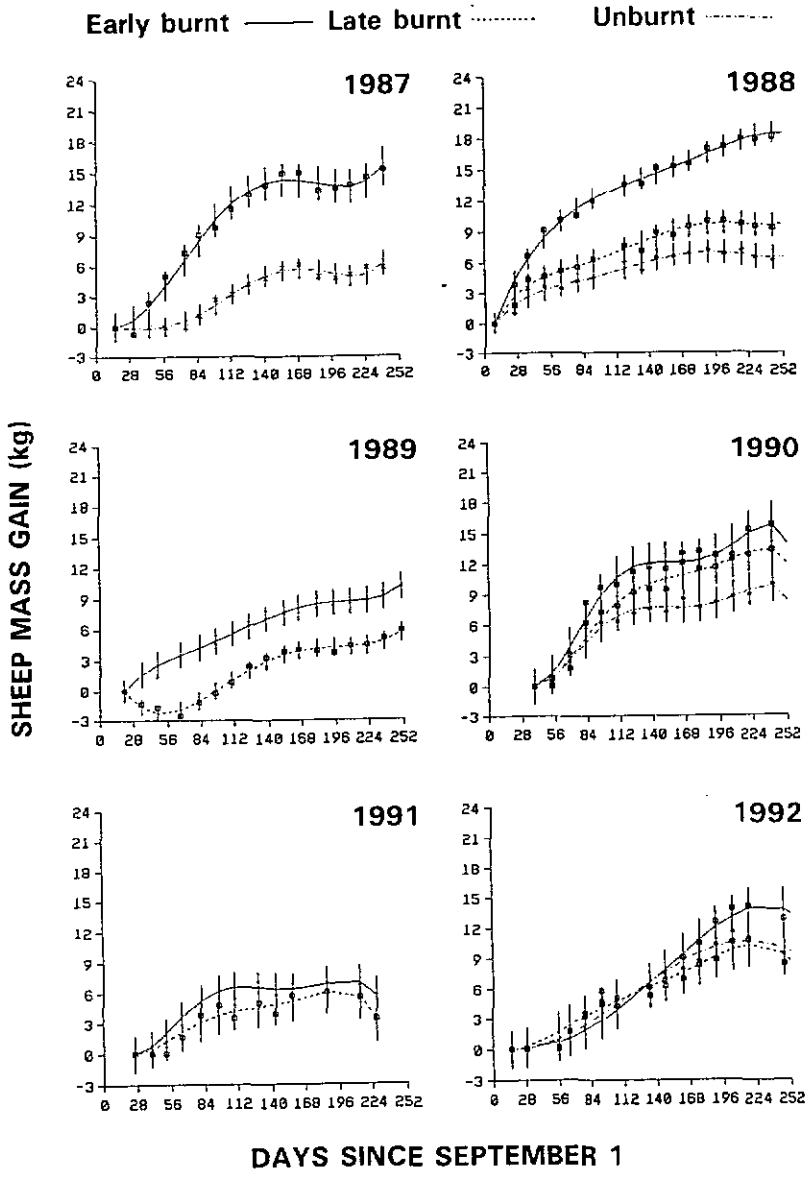

Figure 2 Seasonal trends in mass gains for sheep from 1987 to 1992

Table 2 Financial comparison of sheep gains (kg) from various grazing strategies on Döhne Sourveld from 1987 to 1992

	Total gain (kg)	Benefit per sheep (R animal^{-1} a^{-1})	Advantage (R ha^{-1} a^{-1})
Early vs Late			
E	68.3	11.07	44.29
L	42.5		
Annual vs Biennial			
A	63.5	7.14	28.55
B	47.2		
Continuous vs Rotational			
C	47.3	2.73	10.91
R	42.4		

Assumptions
1) Based on actual market figures for the years under test.
2) All carcass grades were the same from all treatments.
3) Fixed and variable costs for all strategies assumed equal.

Note: the comparison of continuous vs rotational grazing is not statistically significant (P>0.05)

BUT WHAT WILL HAPPEN TO THE VELD?

In the data presented for the performance of animals it is clear that the relative advantage of the early grazing and annual burning over the other practises has declined with time.

However, the degree of decline in animal performance cannot be specified because this is confounded with season.

If on the other hand consideration is given to the performance of the plants some interesting patterns emerge (Table 3). The performance of the grass plants was recorded by measuring the amount of leaf produced by individual tillers on several important sourveld species. These species were chosen because they represent the groups of palatable (*Themeda triandra, Tristachya leucothrix*), unpalatable (*Sporobolus africanus*) and avoided or problem (*Elionurus muticus*) species.

Table 3 Changes in vigour of four grasses subjected to various management practices in the Döhne Sourveld from 1987 to 1990

	Early		Late	
	Annual	Biennial	Annual	Biennial
Themeda triandra (Rooigras)				
Change by 1990 (%)	-46	-44	-37	-11
Tristachya leucothrix (Trident grass)				
Change by 1990 (%)	-21	-28	-25	-32
Sporobolus africanus (Cats tail)				
Change by 1990 (%)	-49	-63	-61	-57
Elionurus muticus (Wire lemon grass)				
Change by 1989 (%)	+15	+70	+25	+56

What is interesting about these data is that ALL grazing strategies resulted in a decline in the vigour of any species that was grazed (Table 3). Even late grazing with biennial burning, considered to be a lenient grazing practice, resulted in reduced vigour for the grazed species. Of interest also is that *Elionurus muticus* was advantaged most by BIENNIAL burning in this study. Despite this **obvious impact by all grazing strategies** the species composition and measures of basal cover did not reflect these changes (Figure 3).

Associated with basal cover is soil loss and this was shown to be low relative to cropping systems where several tons of soil are lost per hectare each year (Figure 4). (It must be noted that the early grazing, annual burn continuous treatment (EAC) has higher soil loss than the rest of the grazing strategies because of equipment failure during very intense storms).

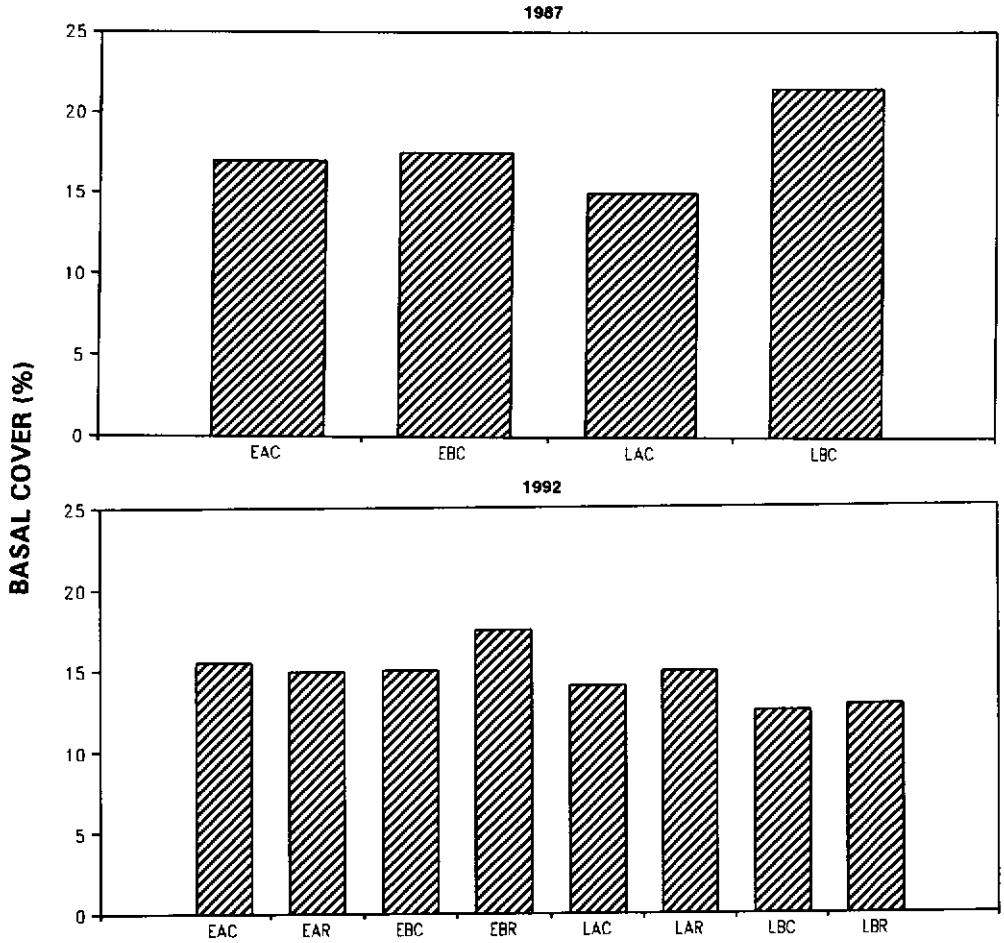

Figure 3 Basal cover (%) in 1987 vs 1992 from plot in Döhne Sourveld subject to various grazing strategies from 1987 to 1992 (E = early grazing; L = late grazing; A = annual burning; B = biennial burning; C = continuous grazing; R = rotational grazing).

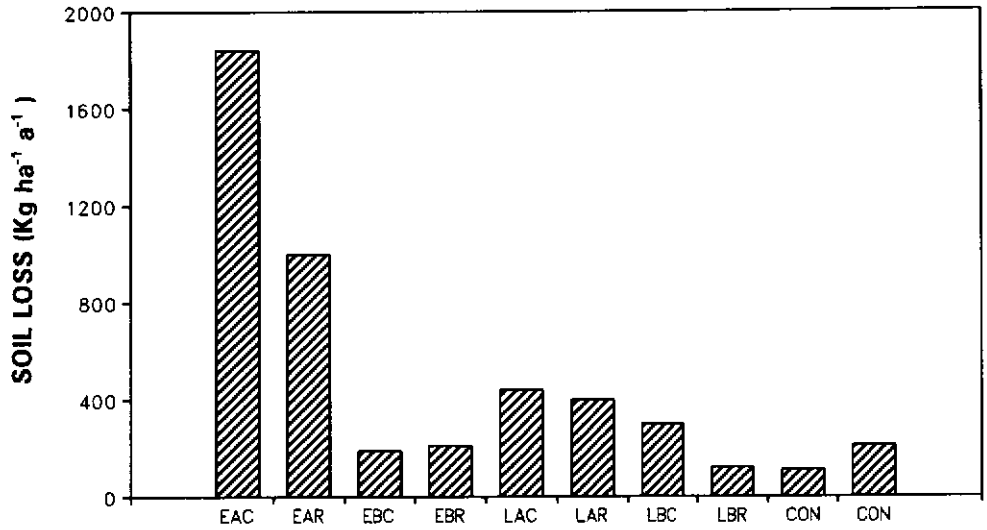

Figure 4 The mean annual soil loss (kg ha^{-1} a^{-1}) from 10 bounded runoff plots in the Döhne Sourveld subjected to combinations of early (E) vs late (L) grazing, annual (A) vs biennial (B) burning and continuous (C) vs rotational grazing from 1980 to 1993 (CON refers to an early graze continuous treatment never burnt).

CONCLUSIONS

On the basis of the research presented here it is apparent that our thinking on the management of sour grassveld requires a critical review. It is also clear that better animal performance is possible with certain grazing strategies. Although the strategies used here have 'lasted' for a period of seven years it does not mean that the system will not be damaged in the long term. On the evidence presented here, however, I offer the following contribution to this critical look at the management of sour grassveld:

1) considerations of safety and flexibility are the most important aspects with respect to time of burning;
2) early grazing is superior to late grazing - especially with burning;
3) grazing UNBURNT VELD early is of no benefit;
4) continuous vs rotational grazing showed no advantage of either strategy but the choice has significant economic impacts; and
5) economic implications of these results will have a major impact on the profitability of sheep production in the Sourveld.

How do we take advantage of early grazing?

The objectives of sustainable use of resources demand that 'safe' strategies are used in the exploitation of these resources. Therefore an over arching objective for veld management is:

☞ WE MUST MAINTAIN VIGOUR OF THE VELD ☜

In order to achieve this the following are recommended as a broad set of principles:

1) use mixed cattle & sheep at 1:6 ratio;
2) **essential** to have **season-long** rests every 2 to 4 years;
3) use recommended stocking rates; and
4) employ a strategy using three camps per unit to allow a **FULL YEAR'S REST FOLLOWED BY A BURN** at least once in three years.

If any clear pattern has emerged from this research, and that of others, it is that SEASON LONG RESTS AT REGULAR AND FREQUENT INTERVALS is far more important than GRAZING SYSTEMS!

oooOooo

STOCKING RATE AND ANIMAL PERFORMANCE AT DöHNE

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The recommended stocking rate for the Döhne Sourveld is 0.53 LSU/ha. This is, however, based on mature animals. As there were no relevant trials using young, growing animals, it was decided to study the effect of stocking rates on the growth of young animals and their effect on the veld.

The trial was laid out in 1986 with four stocking rates. These were roughly 0.54, 0.80, 1.00 and 1.22 LSU/ha and the animal's weight $^{0.75}$ was used to calculate its LSU equivalence to an animal weighing 450 kg. This system tends to load the weights of small animals relatively more than large animals and, in this case, may have suggested unrealistically high stocking rates. The cattle weighed in the vicinity of 180 to 330 kg and the sheep roughly 35 kg at the beginning of the season. Sheep to cattle ratios on a LSU basis were 1:1.

There were six paddocks per treatment and the animals were rotated in these according to the Venter & Drewes system. In this system a paddock (usually burnt that spring) is selected as the key paddock and the animals are placed in this first. They are removed when 80 to 90% of the preferred tufts have been grazed and placed in other camps. The animals are returned to the key paddock when it has recovered, irrespective of whether all the paddocks have been grazed or not. If there is a large amount of ungrazed herbage in the paddock at the end of the season it is burnt. (In this system any number of the paddocks may be burnt in spring.) The next season another paddock is selected as the key paddock. In the present trial the paddocks that were stocked lightly were burnt more frequently than those that were stocked heavily.

In 1989 a further treatment was added to the trial. This was a continuously grazed paddock which represents a "one farm-one paddock" situation. The stocking rate was 1 LSU/ha and surplus herbage was burnt when possible.

There were important differences in the initial veld condition. The medium heavy stocking rate (1 LSU/ha) had noticeably more *Tristachya leucothrix* (39% relative cover than the other treatments (26% to 33%), and the *Themeda triandra* varied between 9% (heavy) and 21% (light stocking rate).

Until 1989 there was a slight tendency for *T. triandra* to increase slightly while the abundance of *T. leucothrix* stayed the same. However, by 1995 *T. leucothrix* had decreased greatly in all the treatments. The medium-heavy stocking rate still had the most *T. leucothrix* (28%) while the other treatments had between 9% and 21%. *Themeda triandra* had increased to between 43% (continuously grazed paddock) and 20% and the ranking of the treatments with regard to *T. triandra* had changed. At this stage the vegetation has probably not stabilized, and is still changing under the influence of the treatments.

The weight gains of the cattle generally conform to the expected trend of decreasing gains per animal with increasing stocking rate (Fig. 1a). In the average season the greatest weight gains per season are obtained at the highest stocking rates, and the predictions indicate that higher weight gains will be obtained at even higher stocking rates. The differences observed in weight gains between seasons are tremendous, varying between 18 and 136 kg/ha in poor and good seasons.

Other experiments have shown that the higher financial return per ha can be expected at about half of the stocking rate at which the highest weight gains/ha are achieved. This is due to the higher grades obtained at the lower stocking rates. In the present case, with the particular mix and sizes of animals the stocking rate at which the animals would achieve the highest gains per hectare is 2.4 LSU. This would mean that, if the animals were sold before they started to lose weight, the "most profitable" stocking rate would be 1.2 LSU/ha.

By the time that the animals of the heavy stocking rate had lost 10% of their maximum weight, the other treatments had lost less weight (the animals of the continuously grazed treatment had lost surprisingly little weight). At this stage the "optimum" stocking rate had declined to 1.2 LSU per hectare (Fig. 1b). If it was required to graze the veld throughout the year, the recommended stocking rate would probably be even lower.

The weight gains of the sheep vary from 26 kg/ha to 3 kg/ha. (Fig. 2a). They do not follow the expected trend of decreasing gain per animal with increase in stocking rate and this seems to be related to the low sheep weight gains on the medium-heavy stocking rate. The reason for this anomaly is not clear but it is interesting. If there is a linear relationship between sheep weight gains/ha and stocking rate it would be very interesting. By the time the cattle had lost 10% of their weight, the sheep had generally lost roughly 12% their weight (Fig. 2b). This may indicate that the sheep were more sensitive to the decrease in fodder quality than the cattle.

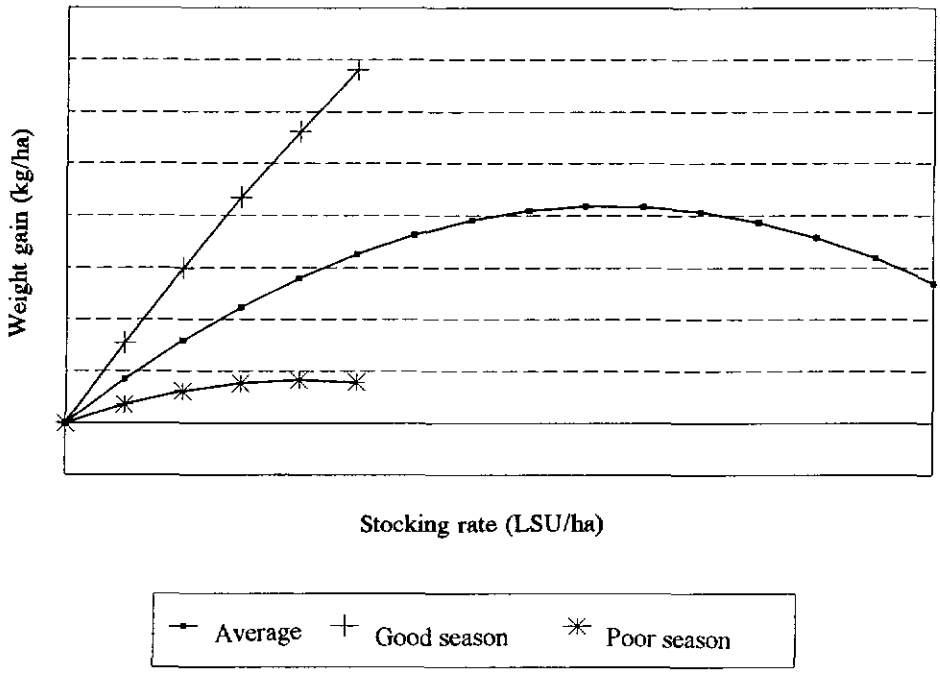

Figure 1a Maximum cattle weight gains at different stocking rates.

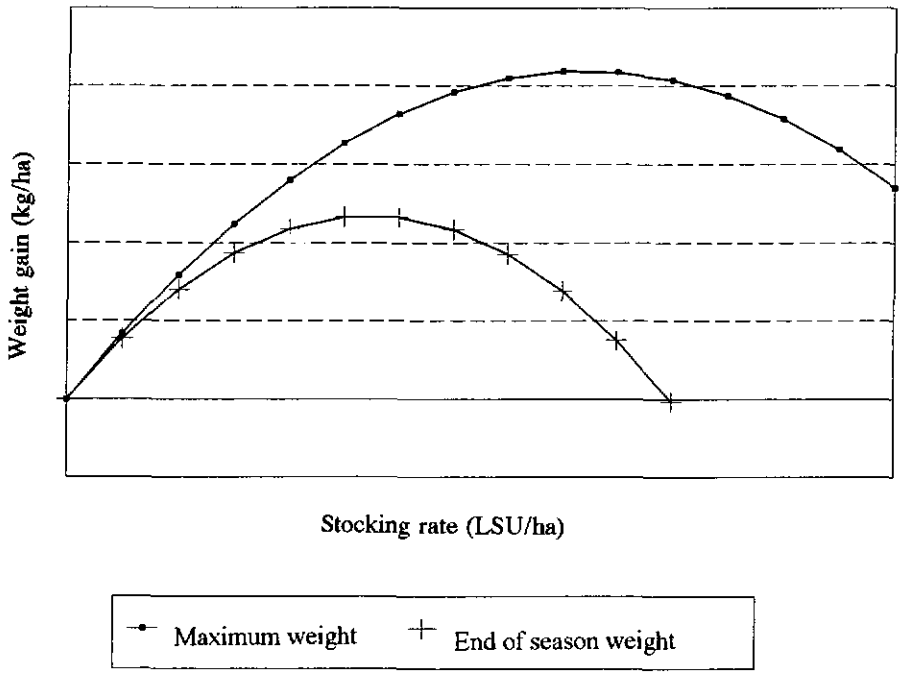

Figure 1b Cattle gains at different times of season.

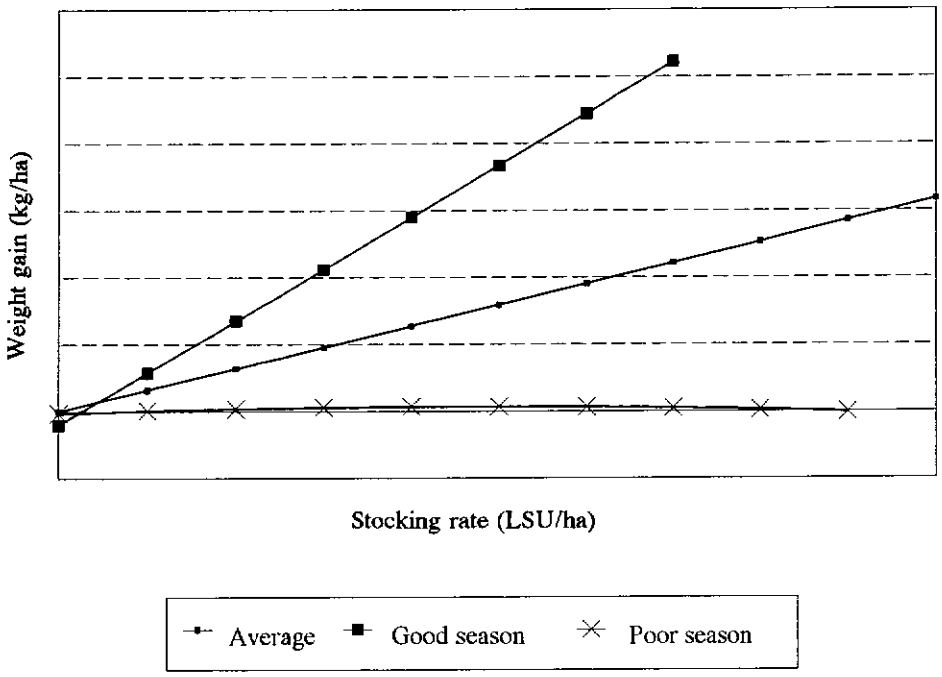

Figure 2a Maximum sheep weight gains at different stocking rates.

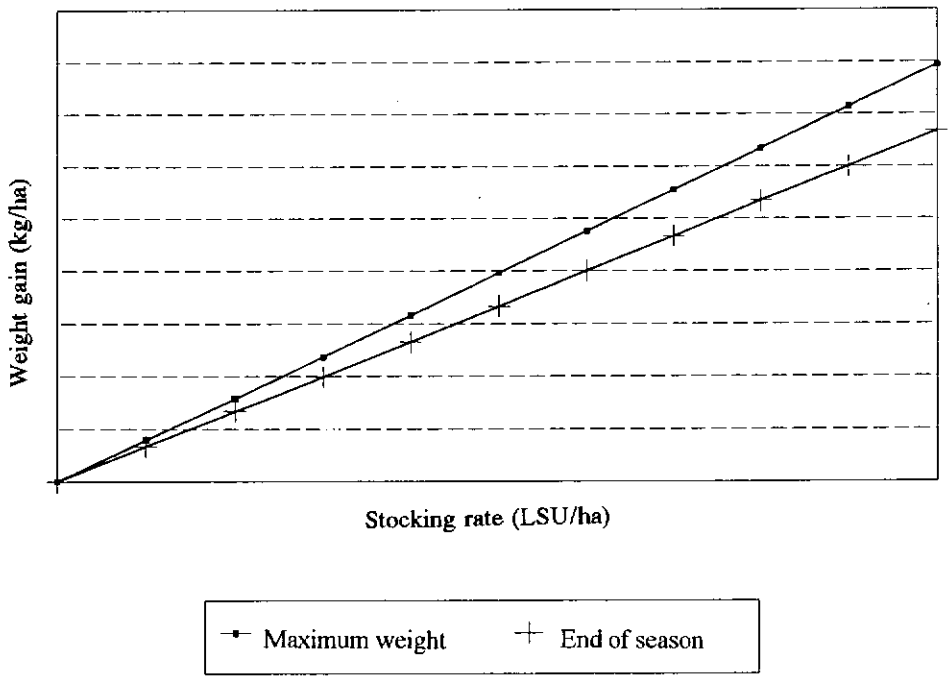

Figure 2b Sheep weight gains at different times of season.

NUWE VELDBESTUURSTELSEL OP WILDEBEESFONTEIN PROEFPLAAS

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Inleiding

Weidingkundiges het in die verlede verskeie veldbestuurstelsels ontwikkel. Voorbeelde hiervan is die nie selektiewe beweiding (NSB) stelsel, die beheerde selektiewe beweiding (BSB) stelsel en verskeie kampstelsels wat op 'n sekere aantal kampe per trop berus het. Baie van hierdie stelsels het nie oor die langtermyn geslaag nie en boere was ook huiwerig om dit toe te pas. Van die stelsels was duur om te implementeer aangesien baie kampe per trop dikwels deel van die vereistes van 'n stelsel was. Stelsels was ook nie buigbaar nie en dikwels het die klem hoofsaaklik op plantproduksie en nie op ekonomiese diereproduksie geval nie.

Teen hierdie agtergrond, het ons op Wildebeesfontein na 'n veldbestuurstelsel gesoek wat aan die volgende basiese vereistes voldoen :

- Die veld se groeikrag, spesiesamestelling en bedekking moet oor die korttermyn (vyf jaar) ten minste in stand gehou word, maar oor die langtermyn moet dit verbeter.
- Beeste en skape moet op die veld gedy. Veld is die goedkoopste weiding, maar ekonomies aanvaarbare reproduksie, wolproduksie en vleisproduksie moet vanaf veld gehandhaaf word.
- Die stelsel moet goedkoop geïmplementeer en in stand gehou word. Die minimum koste moet aan drade en watervoorsiening spandeer word.
- Die stelsel moet eenvoudig en buigbaar wees. Reënval het 'n oorheersende invloed op plantproduksie en daarom moet die stelsel buigbaar wees om vir veranderende klimaats- en ander faktore voorsiening te maak.

Beskrywing van die Wildebeesfontein veldbestuurstelsel

Wildebeesfontein proefplaas is tussen Bethal en Middelburg in Mpumalanga geleë. Dit is 'n tipiese somerreënvalgebied waar ongeveer 75 % van die jaarlikse reënval in die maande Oktober tot Februarie val. Die langtermyn (70 jaar) gemiddelde reënval van Wildebeesfontein is 697 mm per jaar.

Die Wildebeesfontein veldbestuurstelsel word skematies in Tabel 1 aangetoon. Die stelsel staan ook bekend as die sogenaamde "DERDE" stelsel.

Tabel 1 Skematiese voorstelling van die Wildebeesfontein veldbestuurstelsel

Jaar	Blok 1 K1, K6, K11	Blok 2 K3, K8, K10	Blok 3 K2, K4, K9
1 1992/93	Brand en wei hoofsaaklik met skape	Wei hoofsaaklik met beeste	Rus vir volle groeiseisoen
2 1993/94	Wei hoofsaaklik met beeste	Rus vir volle groeiseisoen	Brand en wei hoofsaaklik met skape
3 1994/95	Rus vir volle groeiseisoen	Brand en wei hoofsaaklik met skape	Wei hoofsaaklik met beeste

Bestaande kampe is gebruik om die veld in drie nagenoeg ewe groot blokke te verdeel. In Jaar 1 byvoorbeeld word Blok 1 gebrand en hoofsaaklik met skape bewei, Blok 2 word hoofsaaklik met beeste bewei en Blok 3 word gespaar. Nadat 'n blok vir die volle groeiseisoen gerus het, dit wil sê vanaf September tot April, word die gespaarde veld vir oorwintering van vee gebruik. Indien surplus materiaal aan die end van die winter oor is, of kampe is oneweredig benut, word die kampe in die tweede helfte van Augustus gebrand. Daar word dus jaarliks besluit of dit nodig is om te brand of nie.

Die bees tot skaapverhouding is 1 tot 4.2. Beeste en skape word op grond van produksiestadium in voorkeurtroppe verdeel. Troppe met die hoogste voedingsbehoefte kry voorkeur tot die beste kwaliteit weiding.

Resultate in die praktyk behaal

Veldproduksie

Die effek van 'n seisoensrus op die groeikragtigheid van veld word met behulp van uitsluitingshokke bepaal. Die resultate wat in 'n spesifieke jaar behaal is, word in Tabel 2 aangetoon.

Produksie van smaaklike spesies word aansienlik bevorder deur 'n seisoensrus. Volgens die resultate het die produksie van ongewenste spesies egter na 'n seisoensrus afgeneem. Groeikragtigheid en produksie van gewenste grasse word dus deur die veldbestuurstelsel bevorder, maar dit is nog nie duidelik of spesiesamestelling oor die langtermyn sal verander nie. Weidingkundiges moet geskikte metingstegnieke ontwikkel om spesiesamestelling oor die langtermyn te monitor.

Tabel 2 Produksie van veld na 'n seisoensrus in vergelyking met veld wat bewei was (Kemp *et al.* 1994)

Spesie	Gewone naam	Seisoensrus (kg/ha)	Bewei (kg/ha)	Bewei as % van gerus
Toename in geruste veld				
Andropogon appendiculatus	Vleiblougras	434	114	26
Digitaria eriantha	Vingergras	153	33	21
Eragrostis curvula	Oulandsgras	932	437	47
Leersia hexandra	Rysgras	463	212	46
Paspalum dilatatum	Gewone Paspalum	140	23	16
Setaria sphacelata	Mannagras	148	39	26
Themeda triandra	Rooigras	868	321	37
Afname in geruste veld				
Eragrostis plana	Taaipol	995	1 720	173
Biesies		367	527	143

Diereproduksie

Oorwintering van vee op spaarveld

Verskeie oorwinteringsproewe is die afgelope twee jaar met skape en beeste op spaarveld gedoen. Die proewe het in Meimaand begin en het tot aan die end van Augustus geduur. Data van die 1993 skaapoorwinteringsproef word in Tabel 3 opgesom. Vyf verskillende aanvullings is in die proef getoets.

Tabel 3 Opsomming van produksiedata van die 1993 skaapoorwinteringsproef op spaarveld

Gemiddeld per skaap	Skaapblok	Onderhouds-lek	Verrykte mielies	Sojaboon-pitte	BKM
Inname en koste					
Inname/dag (g)	47	89	150	100	118
Koste/dag (c)	3,6	5,9	7,5	7,5	1,8
Groeidata					
Beginmassa (kg)	39,5	39,3	39,6	39,6	39,6
Endmassa (kg)	38,1	35,7	38,6	40,6	38,9
Massaverandering (kg)	- 1,4	- 3,6	- 1,0	1,0	- 0,7
Massaverandering (%)	- 3,5	- 9,2	- 2,5	2,5	- 1,8
Wolproduksie					
Veseldikte (mikron)	20,4	20,4	21,2	20,9	20,3
Produksie (g/100 cm²)	12,3	12,8	12,0	13,8	12,7

Die opbrengs van die veld wat vir die volle somer gespaar was, was 3,054 ton DM/ha. Met 'n veelading van 6,1 tweetand Merinohamels per hektaar vir 103 dae, is 1,024 ton DM/ha oor die winter verwyder. Vir die doel van oorwintering, het skape op al vyf die aanvullings aanvaarbare produksie getoon. Nogtans was daar betekenisvolle verskille tussen die beste (sojaboonpitte) en die swakste aanvulling (onderhoudslek).

In 'n opvolgstudie in 1994 is 'n behandeling ingesluit wat slegs sout ontvang het. Hierdie skape het egter 17 % van hul aanvangsmassa verloor wat daarop dui dat aanvulling noodsaaklik is.

'n Proef is in 1994 met 13 maande oue Drakensbergerosse gedoen. Vier verskillende lekaanvullings is gedoen en die proefdata word in Tabel 4 opgesom. 'n Veelading van 1,8 os per hektaar is vir 99 dae toegepas. Osse het suksesvol op al vier behandelings oorwinter, alhoewel daar redelike groot verskille tussen die behandelings was.

Tabel 4 Opsomming van die 1994 beesoorwinteringsproef op spaarveld

Gemiddeld per bees	BKM	Beesblok	Winterlek 1	Winterlek 2
Inname en koste				
Inname/dag (g)	879	415	440	403
Koste/dag (c)	15,3	30,0	31,2	27,3
Groeidata				
Beginmassa (kg)	264,0	262,2	262,9	261,8
Endmassa (kg)	257,2	245,4	246,0	236,8
Massaverandering (kg)	- 6,8	- 16,8	- 16,9	- 25,0
Massaverandering (%)	- 2,5	- 6,4	- 6,4	- 9,5

Skaapproduksie op gebrande somerveld

Produksienorme word ingesamel om vas te stel wat die waarde van gebrande veld na 'n seisoensrus is. In die 1994/95 somer is gebrande veld met twee ouderdomsgroepe Merino-ramlammers benut om produksiedata in te samel. Die weiperiode het vanaf 13 Oktober 1994 tot einde Maart 1995 gestrek.

Die produksiedata word in Tabel 5 opgesom.

Tabel 5 Produksiedata van twee ouderdomsgroepe ramlammers op gebrande somerveld

Item	7 maande ouderdom	11 maande ouderdom
Veelading		
Ramlammers/ha	3,9	5,4
Beginmassa (kg)	40,6	44,2
Groeidata		
GDT (g)	100	140
Massatoename oor somer/skaap (kg)	14,6	20,5
Lewende massa/ha geproduseer (kg)	57,0	111,0
Wolproduksiedata (7,5 maande wolgroei)		
Veseldikte (mikron)	19,4	20,4
Produksie/skaap (kg)	3,7	4,1
Skoonopbrengs (%)	70	70
Handelstipe	MF 250	MF 260
Wolproduksie/ha (kg)	14,4	22,0
Wolprys: 14 Junie 1995 veiling (R/kg)	17,50	17,50

Die doel van die data in Tabel 5 is nie soseer om 'n vergelyking tussen die twee groepe diere te maak nie, maar eerder om 'n aanduiding van diereproduksie op gebrande veld te kry. Die ramlammers het slegs 'n soutaanvulling ontvang en uit die resultate is dit duidelik dat goeie groei en wolproduksie gehandhaaf word.

Veelading, wat 'n bestuursbesluit is, bepaal tot 'n groot mate produksie per hektaar. Indien 'n netto wolprys van R13,50/kg en 'n lewende massa prys van R3,70/kg aanvaar word, is die produksiewaarde van gebrande veld in die orde van R400/ha. Die laer produksie van die 7 maande ouderdomsgroep is hierby in berekening gebring. Om hierdie inkomste te realiseer, moet die wol en diere natuurlik verkoop word.

Opsomming

Soos met enige bestuurspraktyk, het die nuwe veldbestuurstelsel ook potensiële swakpunte. Die grootste gevaarpunt van die stelsel is onbeheerde veldbrande wat aanleiding kan gee tot kritieke weidingstekorte in die winter. Dit is ook nog onbekend hoe spesiesamestelling oor die langtermyn deur die stelsel beïnvloed sal word. Weidingkundiges moet 'n eenvoudige

metodiek ontwikkel om spesiesamestelling oor die langtermyn te monitor. Die veldbestuurstelsel het goeie diereproduksie tot gevolg. Droë diere kan suksesvol op gespaarde veld teen aanvaarbare kostes oorwinter. Goeie diereproduksie word in die somer gehandhaaf. Die stelsel is buigbaar en eenvoudig om te implementeer. Op Wildebeesfontein is geen addisionele kostes aan draad of drinkwatervoorsiening spandeer nie.

Verwysing

Kemp JH, Engelbrecht A, Kirkman KP & Cockcroft V 1994. Bepaling van die invloed van beweiding en 'n seisoensrus op die groeikragtigheid van veld. OTK Interne Veekunde en Weiding Navorsingsverslag 1994, 1-21.

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VELD MANAGEMENT STRATEGIES FOR LIVESTOCK FARMERS IN THE SOURVELD REGIONS OF SOUTH AFRICA

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Introduction

If one looks back over the past few decades, farmers have consistently experienced problems related to poor animal performance (particularly sheep) during summer on sourveld, wintering has always been difficult and is becoming increasingly costly, and scientists have established that the condition of sourveld is deteriorating. Recent literature reviews and research results indicate that traditional veld management recommendations have not provided solutions for either of these two problems.

Research results obtained over the last ten years have highlighted certain principles, which, if incorporated into grazing management, have the potential to facilitate improved animal performance, improved fodder flow (particularly in terms of wintering dry stock) and an increase in vigour of preferred veld grass species thus leading to potential veld condition improvement.

New veld management strategies

It is not the intention to provide rigid systems or recipes. The intention is to highlight important principles and outline practical guidelines, obtained from recent research, for veld management which will enable livestock farmers to produce livestock on a sustainable basis from veld. The farmers can evaluate the principles and guidelines and then decide on an appropriate strategy for their particular situations.

THE MAIN PRINCIPLES ARE:

- Any grazing has a negative effect on vigour of preferred species.
- The productivity of unpreferred species is stimulated as a result of reduced competition from preferred species with a low vigour.
- The effect of grazing on veld vigour as a whole is negative.
- Manipulation of grazing procedure (number of paddocks per herd and period in and out of paddocks) does not compensate for the effects of grazing on vigour.
- Periodic full growing season rests are necessary to allow vigour recovery in order to maintain veld productivity at a high level and maintain the vigour of the preferred species.
- Sheep potentially have a greater negative effect on grass vigour than cattle, and thus with higher sheep numbers relative to cattle, more frequent resting is necessary.
- Sheep should preferably only graze a specific area of veld for one growing season, after which a rest, or grazing by cattle and then a rest, follows.
- Rested veld can form an important source of cheap feed during winter for dry stock with appropriate protein supplementation, and improves feed supply throughout the year. Rested veld has a higher winter value than veld which has been partially (selectively) grazed during the growing season.
- Sheep performance is enhanced if veld is burned, sheep are put on the burnt veld as early as possible and veld is kept short.
- Cattle performance is not influenced by burning or veld grass height to the same extent as that of sheep.
- Provision is made for burning veld which has rested during the previous season if necessary.

These principles differ from those forming the basis of traditional recommendations in that:

- Animal performance is considered important as well as maintenance of veld productivity and condition.
- The detrimental effects of grazing on grass vigour is recognised.
- The main emphasis is on compensation for the detrimental effects of grazing on vigour by incorporating long term rests.
- Grazing procedure (number of paddocks per herd and period in and out of paddocks) is not considered to be of primary importance because it has a negligible (if any) effect on compensating for vigour loss.
- Sheep and cattle are recognised as having different requirements for good performance and different effects on veld vigour.
- Sheep have a more serious detrimental effect on vigour than cattle.
- Annual grazing by sheep on the same area of veld is discouraged.
- The provision of rested veld during winter as a cheap source of roughage is considered an important means of improving feed supply through the dry winter months.
- Principles and guidelines are provided for the farmer to devise a strategy for his own situation.

Proposed strategies

The incorporation of the principles outlined above into grazing management strategies is based firstly on the provision of adequate rests (in the form of full growing season rests) to enable

preferred plants to regain vigour after a season or seasons of defoliation and thus provide for sustainable production of preferred feed, as well as maintenance or improvement of veld condition. Secondly, provision is be made for satisfactory animal performance and improved fodder flow (on an economic basis). Thirdly, recommendations are based on easily understood principles, are cheap (non-capital intensive) and easy to implement.

Veld management basics

Before outlining broad strategies for different scenarios, it is necessary to highlight a few basic principles.

1. Stocking rate

It must be recognised that stocking rate is of primary importance in any grazing management system and the animal intake should never exceed the production of utilisable feed in the grazing area at any period during the season. While the improvement of the vigour of the preferred grasses due to regular resting may result in higher production of palatable material relative to unpalatable material in the grazing area, compared to a system without regular resting, it is not implied that an increase in stocking rate is possible with the incorporation of regular resting. Rather, grazing capacity can be estimated based on the utilisation of veld for relevant periods according to the system used, including winter utilisation of the rested veld. The relation between this and grazing capacity or stocking rate in a system not incorporating regular rests is impossible to predict because of the uncertain nature of the starting point.

2. Subdivision of veld

Veld is invariably extremely heterogeneous, with units often differing markedly from neighbouring units. The species composition, slope, aspect, rainfall, temperature, soil and many other factors may differ from one part of a farm to another, giving rise to heterogeneity. This heterogeneity is manifested in differences in palatability and acceptability of veld, both within and between species over different areas. The physical planning of veld involves the subdivision of the veld into homogeneous units and the supply and correct placing of watering points and gates. This subdivision of veld is indicated firstly to minimise area selective grazing and increase the efficiency of utilisation of homogeneous units, and secondly to provide sufficient camps for the application of animal management and veld management practises such as resting and burning.

Management strategies for different scenarios

Four differing scenarios are presented, ranging from sheep production to cattle production with two broad combinations of varying sheep:cattle ratios between.

Two block strategy

It has for many years been advocated that sheep should be stocked together with cattle in a ratio not exceeding 6:1, to prevent veld degradation. Little or no effort has been put into developing grazing management recommendations suitable for sheep alone. There are, however, many sourveld livestock farmers who farm with sheep alone and many who have sheep to cattle ratios wider than 6:1. This is largely due to economic reasons, as sheep production is much more profitable than beef production locally.

It seems that a rational approach to management of veld for sheep production would be to apply practices which favour sheep performance, i.e. burning combined with early stocking, in one season. As mentioned earlier, any grazing detrimentally affects grass vigour, whatever the system or procedure applied. A long term rest is necessary to compensate for this vigour loss, and this can be accomplished by resting in the next season.

Such a system would logically involve dividing a farm into two blocks of comparable grazing capacity. There should normally be several camps within each block after separation of veld types. During year one, block one is burned during the late dormant season to remove residual dead herbage if necessary. The block is grazed for the duration of the growing season in a manner to facilitate satisfactory animal performance. During the dormant season, block two is available for grazing. During year two, block two is grazed during the growing season, while block one rests in preparation for winter utilisation (Fig. 1).

Figure 1 Schematic outline of two block grazing strategy.

While this strategy was originally designed for situations with sheep alone (burnt veld for animal performance and adequate rest for vigour compensation), it is in fact suitable for sheep and cattle together or cattle alone as well, particularly where shortages of cheap winter feed are a problem.

Obviously, careful fodder flow planning is required to utilise the veld optimally with a suitable class of animals at the correct time of year. For example, while rested veld with a protein supplement may be sufficient for wintering dry stock, it will be unsuitable for lactating or producing stock. Also, the period between the burning of the rested veld and its subsequent utilisation can be a critical period. Staggered burning can partially overcome this problem, but alternative cheap feed sources are usually necessary for this period. The incorporation of rested veld reduces the need for alternative feed sources to a minimum.

Three block strategy

Sheep and cattle are often stocked together in ratios wider than 6:1. A realistic management strategy for this scenario would be to divide a farm into three blocks of comparable grazing capacity. During year one, block one is burnt if necessary and grazed by sheep during the growing season in a manner to facilitate satisfactory sheep production. Block two (which was grazed by sheep during the previous season) is grazed by cattle. The

defoliation of the preferred grasses in block two will be less severe than the defoliation by sheep in the previous season, as cattle graze more uniformly, and there are fewer large stock units of cattle relative to sheep in this scenario. Block three (which was grazed by cattle in the previous season) rests during the growing season in preparation for winter grazing and a late dormant season burn if necessary. This cycle is repeated every three years (Fig. 2). Although untested, it is felt that the lower sheep numbers (due to the cattle component) relative to a situation where sheep graze alone, allows the resting frequency to be relaxed from every second to every third year.

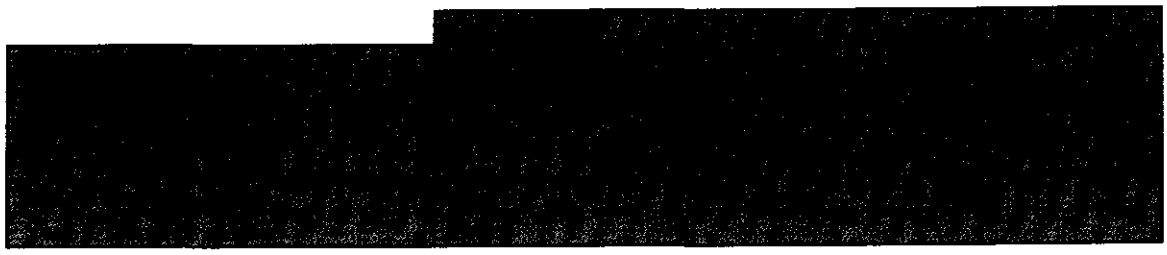

Figure 2 Schematic outline of three block strategy.

It may be desirable to graze sheep and cattle together on the same block, and this can be accommodated, although currently it would seem desirable not to graze a specific block with sheep for more than one season without resting.

This strategy was designed for a scenario with more than six sheep per head of cattle, but is also suitable for lower ratios of sheep to cattle or cattle alone.

Four block strategy

Producers with sheep and cattle in a ratio of less than 6:1 could divide the farm or unit into four blocks of equivalent grazing capacity.

Figure 3 Schematic outline of four block strategy.

During year one, block one is burnt during the late dormant season if necessary and grazed by sheep, again in a manner that will ensure satisfactory sheep performance. Block two and three are now grazed by cattle as there are relatively more cattle in this scenario. Block four is rested in preparation for winter utilisation. This cycle is repeated every four years (Fig. 3).

Again, it may be desirable to graze sheep and cattle together on the same block, and this can be accommodated, although again it would seem desirable not to graze a specific block with sheep for more than one season without resting.

Careful fodder flow planning is necessary for the optimal utilisation of the veld. In the absence of supporting evidence, it is suggested that in such a scenario with relatively few or no sheep, at least one quarter of the veld should be rested annually. It may be necessary to rest more than one quarter of the veld to provide sufficient winter feed. In the crop growing areas of the sourveld, many farmers winter sheep on crop residues, and, in that case it is suggested that the rested veld be used primarily for cattle as well as for sheep during the periods before crops are harvested and after crop residues are depleted.

Cattle alone

Cattle are intrinsically more suited than sheep to the utilisation of sourveld. However, even if veld is stocked at the correct stocking rate with cattle, periodic full season rests are necessary. It has been shown that even lenient and infrequent defoliation reduces the vigour of the preferred grasses. In the absence of empirical data, it seems that a rest at least every four years is indicated to improve vigour of the preferred grasses.

As a basis, enough veld should be rested to provide the required amount of winter grazing, with the constraint that at least one quarter of the veld should be rested annually on a rotational basis.

Any of the above strategies can be used for cattle alone. Cattle with the highest quality feed requirement will obviously replace the sheep in the scenarios above.

Grazing procedure within blocks - the indicator camp approach

Recent research indicates that multi-camp rotational grazing systems offer little advantage over few camp systems in terms of

manipulating defoliation patterns and the periods "out" in rotational grazing systems are usually too short to allow for vigour recovery. It makes sense then to manage veld within a block that is being grazed in a manner flexible enough to take advantage of seasonal fluctuations in production, and in a manner to facilitate good animal performance (keeping grass short and leafy).

The so-called indicator camp system is one method of doing this. In principle one concentrates on one or more "indicator" camps during the growing season. These camps are then well grazed throughout the season. Other camps within the block are only grazed when necessary, and animals are returned to indicator camps as soon as they are again ready for grazing. In this way, quality is maintained on the indicator camps by keeping them short and leafy. Also, in years of good rainfall, some camps in the grazing block may not be grazed at all or may only be grazed at a low frequency, resulting in more than the recommended area being rested. In years of poor rainfall, if all feed in the grazing block has been used, it may be necessary move into a block designated for resting, resulting in less than the recommended area being rested. This should serve as a timely warning that there will be a shortage of winter feed, and decisions regarding stock numbers or alternative feeding strategies can be taken timeously. In the long term, if the stocking rate is correct, the correct amount of veld should be rested.

Conclusions

These strategies have been based on research results and designed to cover most scenarios in sheep and cattle farming situations in sourveld. They have been applied successfully on research farms and commercial farms. However, they are by no means the last word in veld management. For example, the "five cell system" as applied by Neil Murray, a farmer from Kokstad, includes most of the principles outlined above, but also formally incorporates a drought reserve, and veld in each cell rests for two consecutive years in a five year cycle.

The strategies outlined above offer the following advantages over traditional veld management recommendations:

- Provision is made for vigour maintenance of vigour.
- Sheep grazing frequency is reduced i.e. annual grazing by sheep no longer takes place.
- Provision is made for facilitating satisfactory sheep performance.
- Provision is made for winter grazing of rested veld which has a beneficial effect on fodder flow and economics.

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MAXIMUM PRODUCTION OR MAXIMUM PROFIT ?

Claude Cloete
Carlton, Dordrecht, Eastern Cape, South Africa

The main aspect of my presentation will be that, in most facets of farming, maximum profit occurs before maximum production. The farmers amongst us will have heard the phrase "he is a good stockman" or "he is a good farmer". How often do these "good farmers/stockmen" go for maximum production rather than maximum profit? I hope I am not preaching to the converted and that I shall be able to pass on some ideas to the people present.

This Pasture Forum has dealt with conditions in sourveld areas. In sweetveld areas one can get away with minimal inputs and you can, so to say, farm in harmony with nature. However, in sourveld areas supplements and inputs are required to ensure even minimal production. It is the job of each farmer to settle on a level of production between zero and maximum which will ensure the highest profit. This, in most cases, is very difficult to determine and probably changes from year to year. Most farmers usually settle on a system which suits them best and then modify it from time to time.

I farm in partnership with my brother. We farm with Merino sheep and Angus/Brangus cattle. With the rising input costs and falling product prices of recent times we have changed our farming system.

We farm in an area where the veld is very good for growing out animals but we are unable to finish animals on the veld. Finishing animals for market is thus our greatest single expense. In trying to minimise this cost we now keep our animals to sell at an older age.

We sell oxen at 30 months and hamels at 4-5 years old. Previously, oxen were sold at 18 months. The change means that we can now fatten the oxen in 30 days as opposed to 60 days. The savings in feed (which is all home produced) are dramatic. The mature hamels are also easy to fatten as they put on fat only when fed and do not have to grow out as well

We are a marginal area as far as producing maize, hay, etc, is concerned, and so the less 'expensive feed' we use the better. I do not think this system would suit the Free State where grain is plentiful and veld in short supply, but it works for us.

I believe farming is about minimising risk and not putting oneself under pressure. The modified system we are applying takes a lot of the pressure off. The breeding ewes and cows make up only about ⅓ of the total which in itself brings a tremendous saving in feed requirements. When we sold younger sheep and oxen, we always felt we were chasing our tails to produce enough feed for these animals.

This system does bring about a reduction in turnover but there is a much greater saving in input costs.

When a drought comes one has a lot of room to move with plenty of 'dry stock' to sell or move to grazing. It also enables one to concentrate what feed one has on much fewer breeding animals.

I would be the first to agree that, at the moment, a weaner system is probably the most profitable. I, however, do not like a weaner system as the prices vary so greatly from year to year. Second, a weaner system puts one under too much pressure to produce good weaners and one has to put too much into one's cows.

I think when choosing a system one must look at the long-term situation and pick the most stable alternative rather than a system which goes from boom to bust. Farming has enough risks without adding Russian roulette to one's income equation.

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A RESEARCH NEED IN THE SOURVELD

Prof. Neil M Tainton
Pietermaritzburg, South Africa

Recent prestige farmers days undertaken under the auspices of the Grassland Society of southern Africa have highlighted a major controversy surrounding the management of our sour grassvelds. This has been presented in the guise of a controversy over early post-burn management (the recommendation to 'blaze and graze'), but it needs to be seen in a broader context than management only during the period immediately following a burn. The argument may be seen to revolve essentially around the relative prominence given to sustainability as against the short term economic gains which can be derived from the forage produced by sourveld. Traditionally, the guidelines which have governed sourveld management have aimed, first and foremost, at protecting the resource through promoting the continued dominance of the palatable species of the sourveld. This approach derives from the fact that the replacement of palatable species by unpalatable species is, to all intents and purposes, permanent in our sour grassvelds, so that management which places the palatable species at risk is considered to be completely unacceptable. Appropriate management of such veld therefore requires that veld be rested out after it has been burnt, that it be rotationally rather than continuously grazed and that bulk grazers, usually cattle, should always be grazed together with such selective grazers as sheep (usually in the recommended ratio of 6 sheep to one head of cattle) in order to reduce the detrimental impact of the concentrate grazers on the veld. Such treatment will, however, inevitably place a restriction on the level of animal performance which can be achieved because of the relatively rapid decline in the quality of sourveld as it matures during the mandatory recovery period following fire or grazing.

Contrasting the above approach is one which emphasises the need to maximise animal performance from sourveld, even if this requires that treatments are applied which are known to detrimentally affect such veld, provided such treatments are then followed by ameliorative treatments, such as extended rests, to allow the veld to recover. Here the veld is utilised when its quality is at its highest, and so the veld must be stocked soon after it is burnt and should then be grazed continuously (or at worst using a rapid rotation) and heavily, at least through the immediate post-fire season, to ensure that new growth is not allowed to mature. The veld is then provided with a recovery rest before it is again burnt and the grazing treatment repeated. There is no requirement here to moderate the impact of concentrate grazers by grazing them together with bulk grazers, so that the grazing treatment needs to be intense where sheep only are grazed to ensure the complete utilisation of all the forage that is produced, as it is produced.

While the latter management approach clearly has its appeal, particularly from the point of view of the short-term profitability of livestock farming on sourveld, I must express some concern at the extent to which the approach is being widely recommended with, as yet, no real evidence of its long term effect on the condition, and therefore future productivity, of the sourveld. I therefore believe we need to urgently address the following questions in relation to sourveld management:

- **to what extent can individual tufts of our major forage species tolerate even a single season of intense grazing by selective grazers such as sheep?** Will the commonly prescribed years rest which follows heavy and continuous grazing by sheep not come too late for at least a proportion of the plants of the main forage producing species, particularly where they are in competition, as they invariably are, with less palatable species which will always be less severely grazed? Note that I am here calling for an investigation of the fate of individual tufts. The use of averages in data manipulation may often mask real treatment effects so that an insidious run-down of the veld through the death of a proportion of the palatable species during each burn/graze cycle may go unnoticed until it is too late.

- **is it possible to manage sourveld without the assistance of bulk grazers such as cattle to moderate the impact of concentrate grazers such as sheep by promoting a more even utilisation of the veld?** Has the need for 'blaze and graze' not been necessitated largely by the elimination of bulk grazers from the system, and the consequent poor performance of sheep grazing alone on sourveld managed in the conventional way? Are we not simply compounding one error with another?

- As a discipline, we need to be sure of the **long-term consequences** of our advice to the livestock manager on matters which can 'permanently' effect the condition of his primary resource. Answers to the above questions are therefore urgent and should be seriously addressed by researchers in the sourveld regions.

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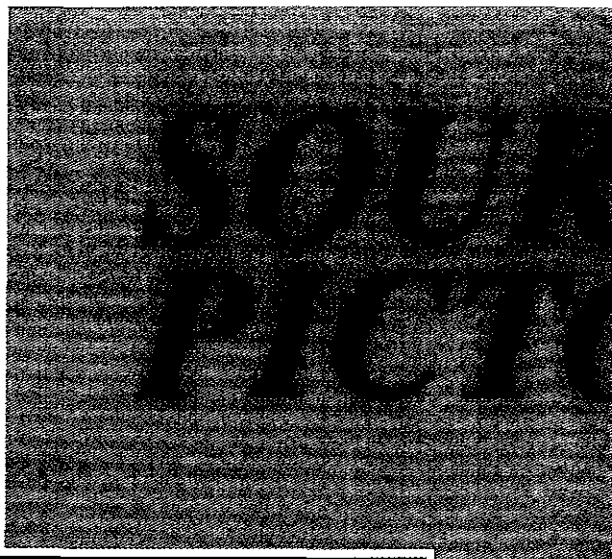
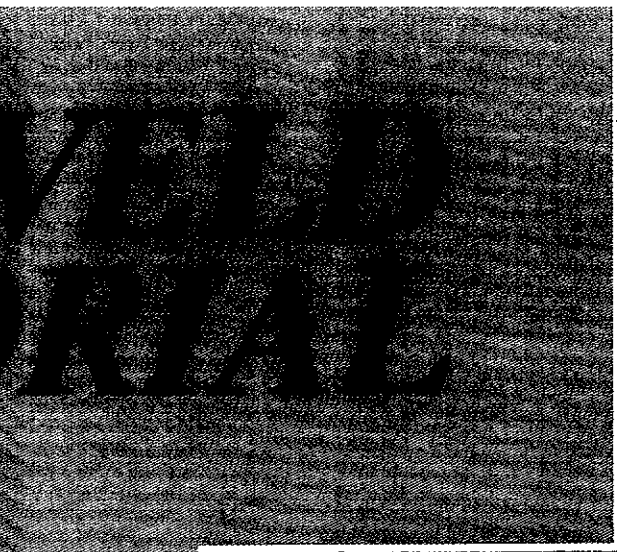


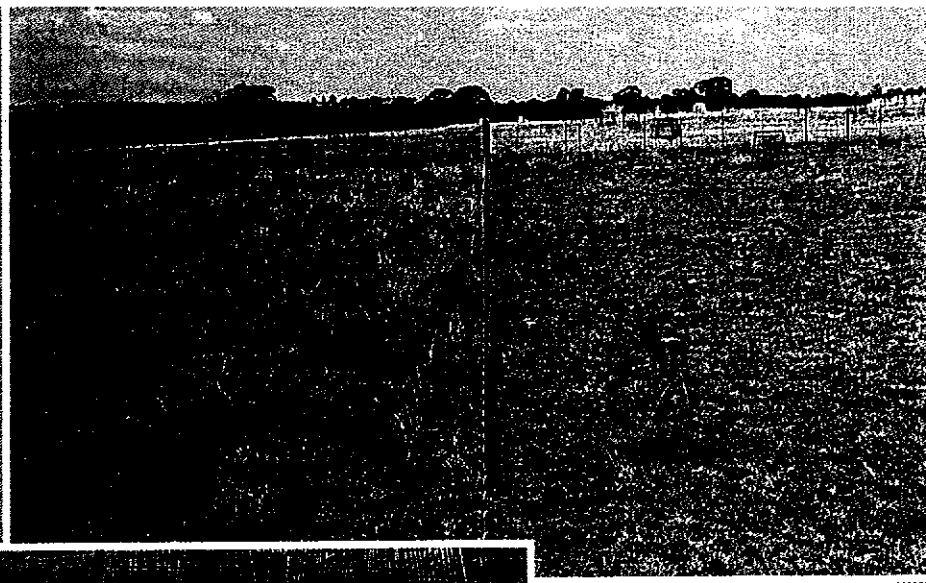
Fire is an important tool in sourveld management (*photo: MB Hardy*).

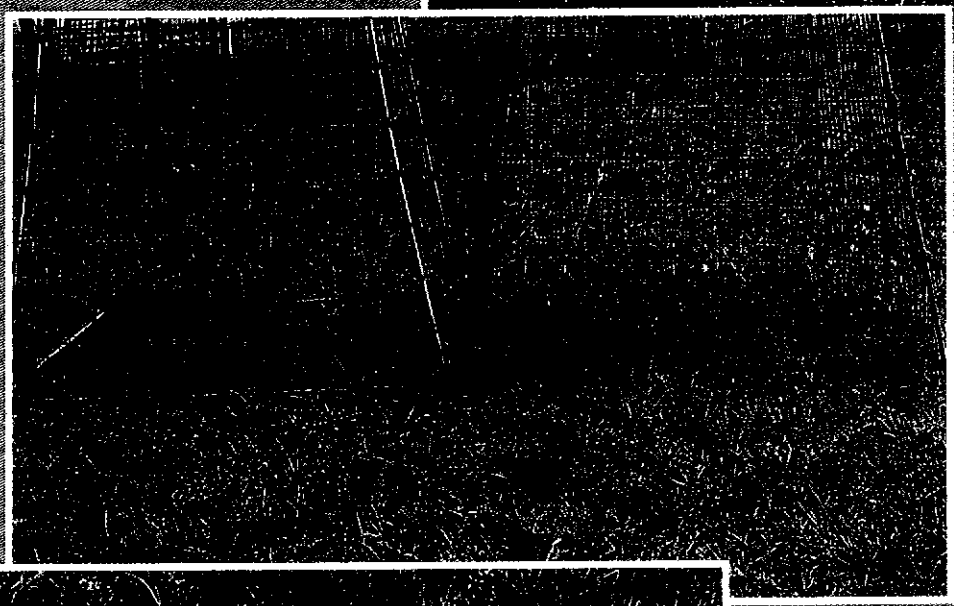
Beef on Smuts foggage in August (*photo: MB Hardy*).

The impact of cattle:sheep grazing ratio with a 3:1 cattle:sheep ratio (*photo: MB Hardy*).

The impact of cattle:sheep grazing ratio 1:3 cattle:sheep ratio (*photo: MB Hardy*).

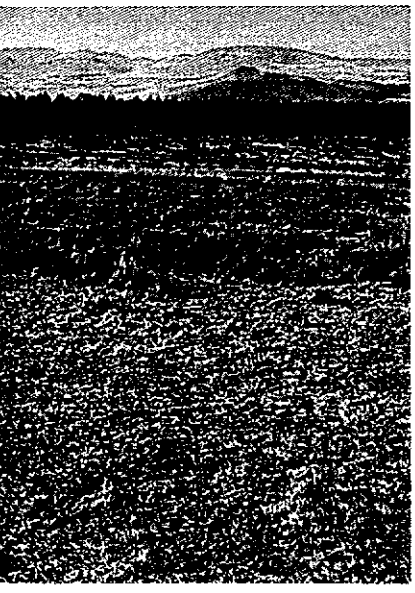






Illustrating selective grazing of sheep (left) with the more uniform grazing of cattle (right) *(photo: KP Kirkman)*.

Vigour of veld rested during the previous growing season (right) versus veld grazed in the previous growing season (left). Residual dead material was removed during the dormant season. Material present is regrowth from beginning of season to early November *(photo: KP Kirkman)*.



Vigour of *Themeda triandra* tested in a greenhouse during (left) dormant season (July) and (right) active growth period (November) after removal of previous season's growth. Residual dead material was removed during the dormant season and present is regrowth from beginning of season to early December *(photo: KP Kirkman)*.