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The Influence of Stocking Rate on the Grass Yield in the Camel Thorn Savanna

INTRODUCTION AND METHODOLOGY

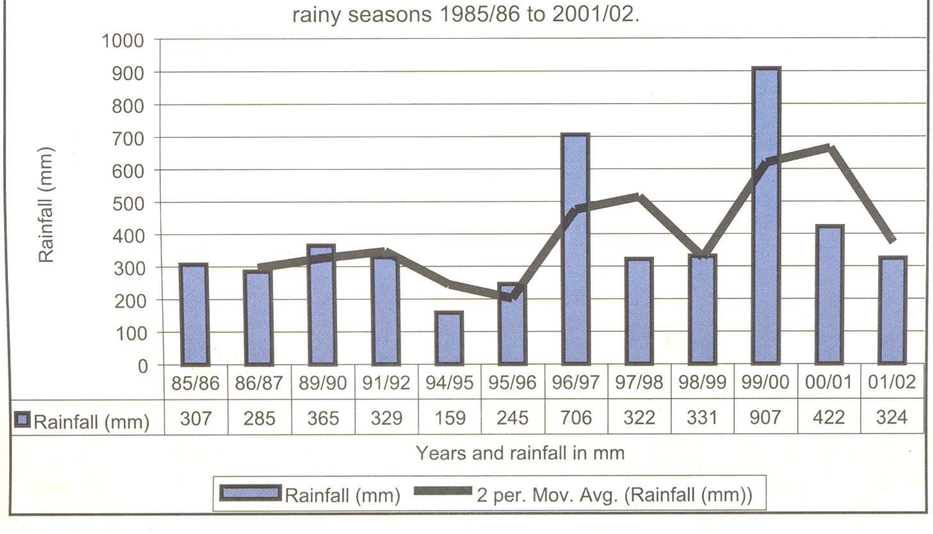
The primary form of land use in the Camel Thorn Savanna is the utilization of natural vegetation by cattle. Aucamp (1990) is of the opinion that the introduction of domestic livestock has resulted in radical changes in the natural rangeland of South Africa. These changes are detrimental as they result in lower grazing capacity, soil erosion and general degradation of the environment. Fourie, Opperman and Roberts (1985) indicate that increased stocking rates brought a progressive decline in above-ground production of the grass layer. Ward and Ngairorue (2000) compared sites in Namibia that had been stocked at moderate and heavy densities over the long term. They conclude that heavy stocking densities cause lowered herbage production in Namibia, although this effect has been very gradual. Dye (1983) in Zimbabwe shows that the year-to-year productivity of the rangeland depends to a large extent on the availability of soil moisture and consequently varies in response to the highly variable rainfall of that region. This paper is to evaluate rangeland production at different stocking rates and rainfall regimes.

The treatments consist of a large- and small-framed type of cattle allotted to four different stocking rates. The stocking rates applied are 15, 25, 35 and 45 kg live animal mass per hectare respectively. The small frame type animal is the indigenous Sanga breed and the large frame type animal an Afrikaner x Simmentaler cross breed. The trial was conducted at the Sandveld Research Station in the Camel Thorn Savanna from 1998 to 2002. In order to determine the annual dry-material grass yield available for the animal to graze, a total of 40 one m^2 quadrates were harvested annually (48 camps) from 1998 to 2002. The dry-material grass yield includes all perennial and annual grass species and were harvested at ground level at the end of the growing season during June. *Aristida* species were not included. This grass yield is the total grazeable yield and is expressed as kg/ha. To interpret the results of this experimental period meaningfully, the results will be compared with those of the experimental period 1985 to 1992 (Kruger, 1998).

RESULTS AND DISCUSSION

The annual rainfall for Sandveld Research Station for the rainy seasons 1985/86 to 2001/02 is presented in Figure 1. The dry-material grass yield (DM-yield) for the three stocking rate treatments is presented in Figure 2. The 15 kg/ha stocking rate represents a light stocking rate treatment while the 35 kg/ha and 45 kg/ha represents a medium to heavy stocking rate. The 25 kg/ha stocking rate can be regarded as a light to medium stocking rate and therefore for convenience not reported in this paper.

Figure 1. Total annual rainfall for Sandveld Research Station for the rainy seasons 1985/86 to 2001/02.



The average rainfall for the trial periods 1985 to 1992, 1985 to 1996 and 1996 to 2002 is 322, 282 and 502 mm respectively. These figures show a marked difference between the different periods. During the period 1998 to 2002 the rainfall shows an increase from the rainy season 1897/98 to the rainy season 1999/00 and thereafter a decline from 2001 to 2002.

The average grass yield of all treatments for the trial period, followed suite along with rainfall. The grass production showed an increase from 1998 to the 1999/2000 growing season and decreased thereafter. The average grass yield for the five growing

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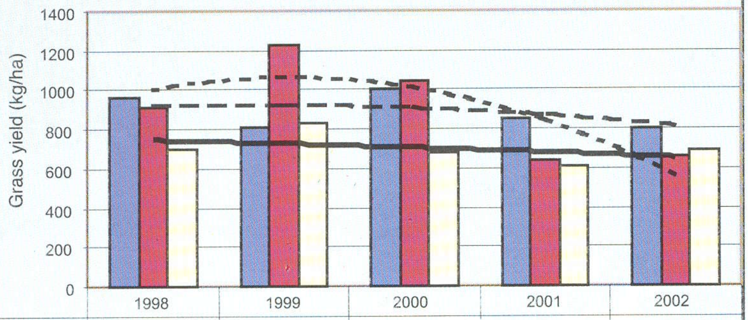
Figure 2. Average grass yield of the two frame type treatments for the three stocking rate treatments over the years 1998 to 2002.



	1998	1999	2000	2001	2002
15 kg/ha	960	812	1006	855	806
35 kg/ha	915	1228	1043	636	661
45 kg/ha	700	831	681	613	692

Years, stocking rates and grass yield

15 kg/ha — 35 kg/ha — 45 kg/ha
Poly. (15 kg/ha) — Poly. (35 kg/ha) — Poly. (45 kg/ha)

seasons was in the order of 858, 957, 910, 701 and 720 kg/ha.

Kruger (1998) found no significant difference in the available grass yield between the different stocking rate treatments. The average available grass yields for that experimental period are 644, 694 and 621 kg/ha for the 15, 35 and 45 kg/ha stocking rate treatments respectively. For the period under review the yield was 888, 897 and 703 kg/ha respectively. The 35 kg/ha stocking rate treatment produced in both experimental periods the highest yield and the 45 kg/ha treatment the lowest. The rainfall regime for the two trial periods had a marked influence on total grazeable production per hectare. The average rainfall for the two trial periods was in the order of 322 and 502 mm. The trial period 1998 to 2002 started off with a total rainfall of 707 mm for the 1996/97 rain season and a peak of 907 mm for the 1999/2000 rain season.

The grass production for the 15 and 35 kg/ha stocking rate treatments started off with a grass production way above that of the 45 kg/ha treatment. The grass production was 960, 915 and 700 kg/ha respectively. The grass production per hectare (Figure 2) of the 15 kg/ha treatment was relatively stable over the trial period and could only maximize a production of 1006 kg/ha at the end of the 1999/2000 growing season. Although a much lower production per hectare throughout the trial period compared to that of the 15 kg/ha treatment, the production of the 45 kg/ha treatment also remained relatively stable over this period. The latter treatment could only maximize a production of 831 kg/ha. Although the average production from 1998 to 2002 for the 15 and 35 kg/ha only differed with 9 kg/ha in favour of the 35 kg/ha treatment, the later treatment maximized a production of 1228 and 1043 kg/ha at the end of the 1998 and 2000 growing seasons. However, of utmost importance, the results presented in Figure 2 reveal very clearly that a decrease in the rainfall results in a drastic decline in grazeable production per hectare for the heavier stocking rate treatments. The average production for the 15, 35 and 45 kg/ha stocking rate treatments during the last two growing seasons of the trial was 831, 649 and 653 kg/ha respectively.

CONCLUSIONS

The conclusions that follow are made irrespective of species composition and forage preference of the grazing animal as well as recovery and grazing periods at the time of harvesting.

The 15 kg/ha stocking rate treatments benefited the higher rainfall regime of this trial period. However, it also maintained a higher production compared to the 1985/1992 trial period despite the decrease in the rainfall during the 2000/2001 and 2001/2002 rainy seasons. The production was 855 and 806 kg/ha for the last two rainy seasons. This could be ascribed to the long-term effect of the unrealistically light stocking rate.

The 45 kg/ha stocking rate treatment also maintained a relative stable production. However, comparing the average production between the 45 and the 35 kg/ha treatments, the latter stocking rate produced 194 kg/ha more, benefiting the above average rainfall years during the 1998/2002 trial period.

The average production of the 35 and 45 kg/ha treatments for the trial period of Kruger (1998) and for the same two treatments for the last two rainy seasons during the 1998/2002 trial period was in the order of 658 and 651kg/ha. The average production per hectare of the 35 kg/ha treatment for this trial period is 897 kg/ha. Should one convert these into kilograms live animal mass per hectare (Bester, 2003) the stocking rates are 30, 30 and 41 kg/ha respectively.

Emanating from the above it can be concluded that grass yield is dependent of total annual rainfall as well as average rainfall over an extended period. Further, lower grass yields can be expected at heavier stocking rates compared to lighter stocking rates, and that intermediate stocking rates can benefit peak rainfall years to produce maximum yields. These results are in agreement with those of Dye (1983) who concludes that low levels of grass yield may be assessed and used to set long-term stocking rates. From above results it can be concluded that the short term stocking rate for the Camel Thorn Savanna would be in the order of 35 kg/ha and for the long term a stocking rate in the order of 30 kg/ha.

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