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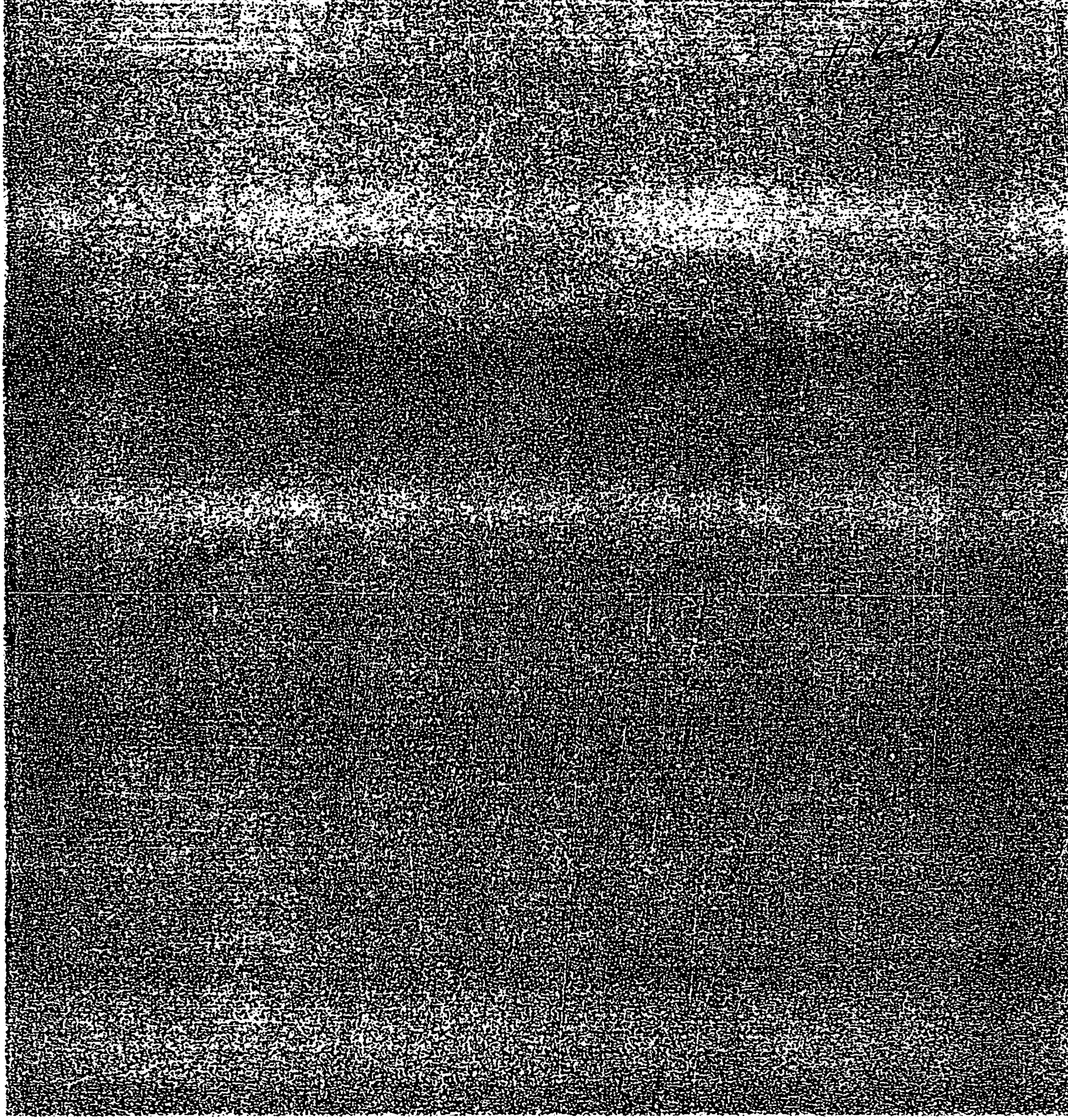

THE DISTRIBUTION, GROWTH CHARACTERISTICS, AND UTILIZATION OF LEHMANN LOVEGRASS IN SOUTHERN AFRICA

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ABSTRACT

Lehmann lovegrass (Eragrostis lehmanniana) a subclimax, perennial, warm-season bunchgrass is native to the semiarid lands along the eastern Kalahari Desert boundary in southern Africa. This grass easily reestablishes after drought and is less palatable than other climax grasses. Selective animal grazing increases the opportunity for Lehmann lovegrass to spread and occupy overgrazed areas.

INTRODUCTION

Within the Kalahari Desert interior, in southern Africa, soils are deep sands, shrubs are widely spaced, and annual rainfall is usually less than 200 mm. Along the eastern Kalahari boundary (central Namibia, southwestern Botswana, and central South Africa), however, fine soil particles increase, grass and shrub densities increase, and annual precipitation exceeds 250 mm (Fourie and Roberts 1976). In these semiarid areas Lehmann lovegrass (Eragrostis lehmanniana), a perennial, warm-season bunchgrass is often the predominant forage species.

Along the eastern Kalahari Desert boundary, the forage produced in dry or drought years is not great enough to support domestic grazing animals because stocking rates are based upon forage produced in years when rainfall is above-average. During drought and overgrazing, perennial grass vigor declines and preferred climax grasses, as well as Lehmann lovegrass, often die. When soil moisture conditions improve, however, Lehmann lovegrass reoccupies void sites because it is a prolific seed producer (Fourie and Roberts 1977). Hence, the distribution of Lehmann lovegrass is increasing while preferred climax grasses are decreasing.

As Lehmann lovegrass densities increase, its importance in animals' diet should increase. Therefore, ecological studies are needed to determine how Lehmann lovegrass responds to climate when plants are found on different soil types, and grazing studies are needed to evaluate management strategies and stocking rate effects on plant production.

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METHODS

Experiment I. The influence of elevation, soil type, temperature and precipitation on Lehmann lovegrass colonization:

Eight sites were selected in southern Africa where Lehmann lovegrass was the predominant forage grass. Site selection was based upon (1) whether Lehmann lovegrass actively colonized disturbed areas, (2) persisted, but did not colonize disturbed areas, and (3) the availability of long-term monthly precipitation and temperature records. Climatic data were summarized by month in the following categories: (1) mean maximum temperature, (2) mean minimum temperature, and (3) precipitation.

Experiment II. Seasonal dry matter production and digestibility of Lehmann lovegrass on three soil types:

Surface soils are sandy in the eastern Kalahari Desert, but surface soils may be underlain by either sand or layers of caliche ($CaCO_3$) and dolomite ($Mg(CO_3)_2$). An area where each soil type prevailed was excluded from grazing, and m^2 plots harvested at the soil surface during spring, summer and fall. Green forage collected at biweekly intervals was oven dried at 90° C, weighed, and converted to digestible organic matter (% DOM) using an in vitro technique (Tilly and Terry 1963).

Experiment III. The influence of two grazing strategies and three stocking rates on plant and animal production:

A 1,000 ha area at Armoedsvlakte Research Station was divided into six pastures, and three pastures were subdivided into six 30 ha paddocks. Large pastures were continuously grazed at light, medium and heavy stocking rates (Table 1) while subdivided pastures were rotationally grazed at light, medium and heavy stocking rates between 1977 and 1981. Animal numbers at the same stocking rate were similar in the continuously- and rotationally-grazed pastures, but animals were moved into a new paddock every seven days in the rotationally-grazed pastures. Equal numbers of Bonsmara steers (1 to 2 years old) were weighed when the study began and at completion in each of the four sampling years.

Table 1. Grazing management strategies and stocking rates at Armoedsvlakte Research Station, Northern Cape Region, South Africa.

Management Strategies	Stocking Rates (ha/Animal Unit)
Continuous Grazing	9.6 (light)
Continuous Grazing	7.0 (medium)
Continuous Grazing	4.0 (heavy)
Rotational Grazing	9.7 (light)
Rotational Grazing	7.1 (medium)
Rotational Grazing	4.1 (heavy)

Basal cover of individual grass species was measured in each pasture and paddock prior to grazing and at six week intervals during active plant growth. Animal utilization was estimated for each grass species using the following formula:

$$\text{Botanical Diet Composition} = \frac{(a \times b)}{\text{Total } (a \times b) \text{ of all species}}$$

Where: a = average frequency of the utilized species

b = botanical composition of individual species

Prior to and during grazing the standing crop of each species was determined in each pasture or paddock. Green forage was separated from dry forage, and both were dried at 70° C for 24 hours. Each forage component was ground over a 1 mm screen, and samples analyzed to determine crude protein and *in vitro* digestibility (Fourie, et al. 1985).

RESULTS

Experiment I

In the semiarid Kalahari Desert area Lehmann lovegrass is found at elevations ranging from 800 to 1,700 m, and where annual precipitation amounts vary from 180 to 630 mm. Surface soils are always sandy and sometimes covered with gravel. Sandy surface soils may be underlain with deep sand or shallow layers of caliche and dolomite (Fourie and Roberts 1976). Mean monthly maximum and minimum temperature extremes vary from 35 to 15° C and from 0 to 20° C in summer and winter, respectively.

Dense Lehmann lovegrass stands often occur along the eastern Kalahari boundary (see dark line in figure 1), and only in these areas does the species actively colonize disturbed sites (Sites 1, 2, 3 and 4). The species occurs, but does not actively colonize disturbed sites to the west and south where annual precipitation varies from 180 to 270 mm (Sites 5 and 6) or to the east where annual precipitation varies from 550 to 630 mm (Sites 7 and 8).

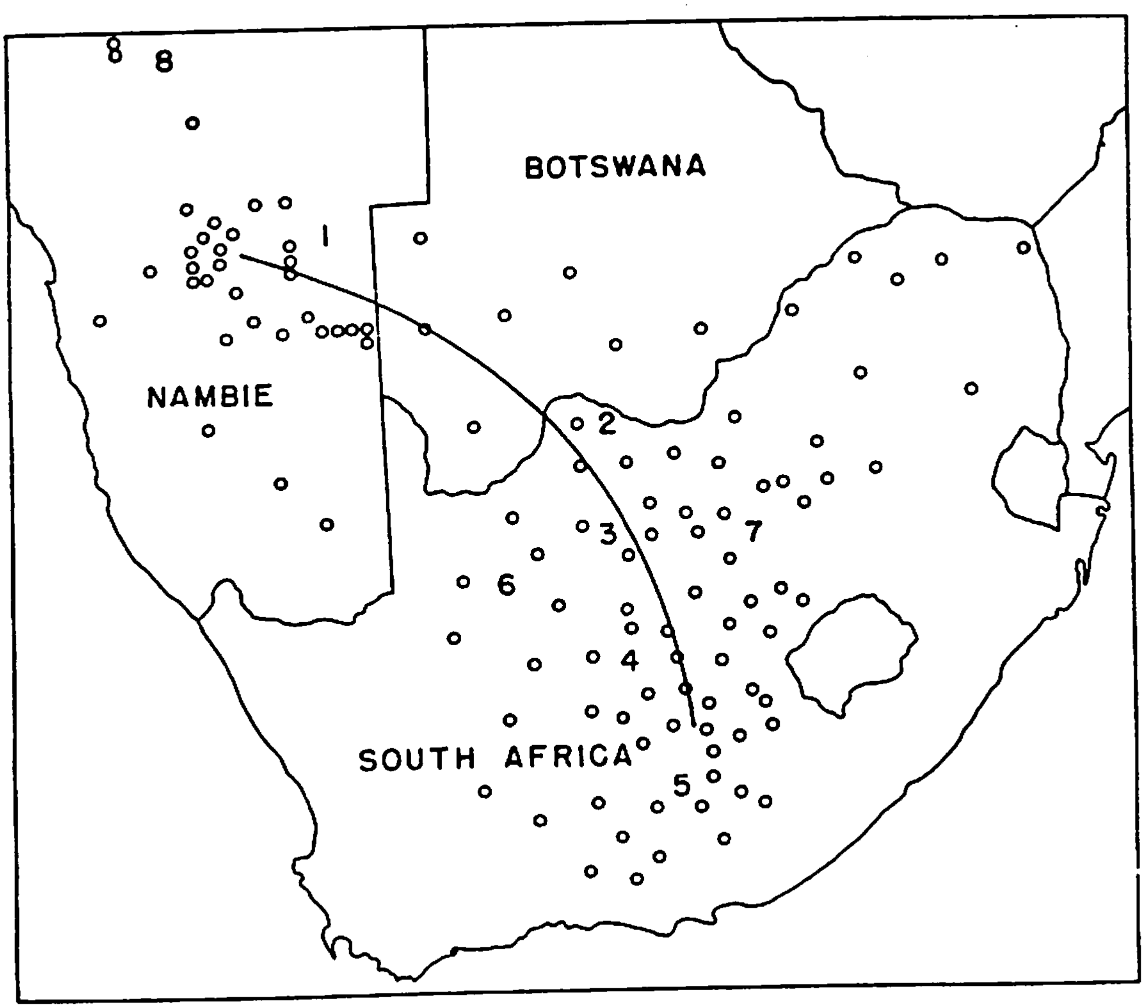

Figure 1. The Distribution of Lehmann Lovegrass in Southern Africa.

The amount and distribution of summer rainfall apparently determines the abundance of Lehmann lovegrass (Cox and Ruyle 1986). Where the species actively spreads in southern Africa growth occurs in spring and summer, but peak production immediately follows a series of summer storms that deposit approximately 140 mm in 30 to 45 days (figure 1; Sites 1, 2, 3 and 4). Lehmann lovegrass frequently dies during mid-summer droughts at Sites 5 and 6, but it reestablishes from seed when soil moisture conditions improve, or fails to compete with more robust grasses at Sites 7 and 8 where summer rainfall exceeds 300 mm.

Experiment II

Lehmann lovegrass initiates growth as temperatures warm in spring, but peak production amounts are dependent upon the amount and distribution of precipitation and sand depth (Fourie and Roberts 1977). Lehmann lovegrass stands growing in deep sands may produce 1,260 kg/ha if light, but frequent showers occur in spring. While stands growing in shallow sand underlain by dolomite or caliche produce 150 and 330 kg/ha, respectively. When early summer droughts occur, stands growing in deep sands produce 560 kg/ha, but stands on shallow sands produce from 0 to 150 kg/ha. If late spring and early summer are dry, stands growing in shallow sand may die, but when soil moisture conditions improve in late summer, seed germinate and seedlings reoccupy the site.

Peak green forage production of Lehmann lovegrass growing in the three soils occurs in late summer (Fourie and Roberts 1977) when culms elongate (Fourie, et al. 1985). Green forage production is greatest from plants growing in deep sand (1,540 kg/ha) intermediate from plants growing in shallow sand underlain by caliche (900 kg/ha) and least from plants growing in shallow sand underlain by dolomite (250 kg/ha).

The digestible organic matter (DOM) of Lehamnn lovegrass growing in the three soil types averaged 48% in spring, 68% in summer and 36% in fall; and was substantially less than other climax grasses (Fourie and Roberts 1977). DOM of plants growing in the three soil types was similar in spring and fall, but greater in summer from plants growing in shallow sand underlain by dolomite. Lehmann lovegrass seedlings that reoccupied the dolomite soil type were smaller and less fibrous than surviving mature plants on deep sand and shallow sand underlain by caliche.

Experiment III

Steers selectively grazed the palatable climax grasses; such as *Chrysopogon serrulatus*, *Sporobolus fimbriatus*, *Themedia triandra*, *Digitaria seriata* and *Cymbopogon plurinodis* and avoided Lehmann lovegrass. This trend occurred in all pastures and was not influenced by grazing strategy or stocking rate (Fourie, et al. 1986).

It was difficult for steers to consume the small basal Lehmann lovegrass leaves in spring, and they refused to graze the rapidly growing culms in summer (Fourie, et al. 1984). Animals preferred the large basal leaves and culm leaves produced by climax grasses.

The basal area and botanical composition of climax grasses and Lehmann lovegrass declined at all stocking rates in the continuously-grazed pastures an at the high stocking rate in the rotationally-grazed pasture (Fourie, et al. 1984). Mean daily animal gains were similar in the two grazing strategies and increased as stocking rates decreased (Fourie, et al. 1986). While forage quality was usually superior in highly grazed pastures (Fourie, et al. 1985).

Forage intake increased as stocking rates decreased, and there were no differences between the two grazing strategies (Fourie, et al. 1986). Forage intake in spring, summer and fall did not differ between the two grazing strategies when stocking rates were the same. In winter, however, steers in the continuously-grazed pastures consumed less forage, gained less weight and spent longer searching for forage than steers in the rotationally-grazed pastures.

The vigor of climax grasses declined in all pastures between year one and four, while Lehmann lovegrass production increased; the exceptions were the heavily-grazed pastures of both grazing strategies (Fourie, et al. 1985). The crude protein and digestibility of Lehmann lovegrass standing crop annually varied from 2 to 13% and from 40 to 69%, respectively. The crude protein and digestibility amounts measured for climax grasses were usually greater than those measured for Lehmann lovegrass.

DISCUSSION

In southern Africa (Fourie, et al. 1985), southeastern Arizona and northern Mexico (Cox and Ruyle 1986) Lehmann lovegrass initiates growth earlier than other climax grasses. Early growth in this instance does not necessarily imply animal use because leaves are difficult to graze. Grazing animals selectively graze other grasses because the quantity and quality of Lehmann lovegrass forage is less desirable. Grazing preference reduces the vigor of climax grasses and densities decline. This action increases the opportunity for Lehmann lovegrass to spread and colonize new sites. Since animal selectivity is the primary factor influencing the colonization of Lehmann lovegrass it seems likely that the grass will spread regardless of grazing stragegies and stocking rates.

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