THE INFLUENCE OF PLANT DENSITY AND LEVEL OF NITROGEN FERTILIZATION ON THE PRODUCTION OF *ERAGROSTIS CURVULA*

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ABSTRACT

The objective of this study was to determine whether plant density would have an influence on dry matter (CM) yield and to determine it's interaction (if any) with levels of N fertilization. Plants on a broadcast establishment of lovegrass (*Eragrostis curvula)* were mechanically thinned, to leave 30 cm rows with spacing of 0.5 and 1 m. N fertilizer was applied in spring at levels equivalent to 0, 50, 100 and 150 kg N ha^{-1}. The trial was conducted over three growing seasons. In the second and third years the DM yields with 100 and 150 kg N ha^{-1} on the broadcast establishment were significantly higher that with other treatment combinations.

KEYWORDS

Cutting trial, plant density, N fertilization, dry matter yield, rainfed.

INTRODUCTION

The decision whether to use broadcast or row establishment depends entirely on the availability of soil water (Booysen 1988). According to Walton (1983) there is a considerable amount of information available to show, that for most forage crops, row planting gives superior stands and yields to broadcast seeding. The objective of this study was to determine the influence of stand density on dry-matter production and to see if there is any interaction between stand density and N fertilization.

MATERIALS AND METHODS

The study was done on an established pasture on the Hatfield Experimental Farm of the University of Pretoria (25^0 45' S: 28^0 16' E), at an altitude of 1 372 m. The long term average rainfall is 686 mm yr^{-1}. The soil is classified as a red sandy loam, with a clay content of 20%, a pH(H_2O) of 5.9 and P and K levels of 8(Bray 1) and 56 mg kg^{-1} respectively. The area on which the trial was conducted was previously used as a hay field and was fertilized at the rate of approximately 75 kg N ha^{-1} yr^{-1}.

The trial was conducted as a randomized block design with three densities (broadcast and rows of 30 cm in width, spaced 0.5 and 1 m apart respectively) and four levels of N application, (equivalent to 0, 50, 100 and 150 kg N ha^{-1} yr^{-1}), applied as a dressing in early spring. Thirty-six plots of 5 m x 4 m were laid out on a broadcast establishment of *Eragrostis curvula*. The grass on twenty-four randomly chosen plots was mechanically thinned to create the required row spacements. Each treatment combination was replicated three times.

The grass was grown under rainfed conditions. The net plot was 1.2 x 2.6 m and was harvested with a motor-driven scythe, every time the grass reached the flowering stage and again at the end of the growing season. The material of the net plot was weighed and a sample was dried in an oven to determine the dry matter (DM) content of the material.

RESULTS AND DISCUSSION

The first season (1992/93) was relatively dry, with the first effective rains (ž 20 mm week $^{-1}$) falling during the first week of November. The total precipitation for the growing season (to 31 March) added up to 396.7 mm. The rainfall was also poorly distributed, as only 150 mm was received during the first half of the season and only 19 mm during February. The second season was relatively wet, with the first effective rains being recorded during the first week of October. The total precipitation for the growing season was 759 mm. Of this, almost 400 mm was received before the end of December. In the third season, the first effective rains were received during the last week of October and the total precipitation for the growing season added up to 530.2 mm. Of the 530 mm, almost 300 mm was received before the end of December.

During the first season, the level of N fertilization did not have a significant (P - 0.05) effect on DM yield. The reason for this lack of response may be due to the very dry season and the possible carry-over effect from the previous season, which was also very dry (375.9 mm). As far as the density treatments are concerned, the DM yield on the broadcast establishment plots was, against all expectations (Walton 1983), significantly higher than on the row spaced plots. The lowest DM yields were obtained on plots with a 1 mm spacing.

Because of the excellent growing conditions during the second season, the DM yield was 200-400% higher than in the first season. During the second and third seasons, the highest DM yields were obtained with applications of 100 and 150 kg N ha^{-1}, on the broadcast plots (no significant differences between the two N levels). The DM yields with these treatment combinations were significantly higher than with any other treatment combination. The only other significant treatment effect on the DM yield, was that of the 0 kg N ha^{-1}, 0.5 m row spacing treatment combination during the second season, which was significantly lower than with the 50 kg N ha^{-1}, broadcast establishment and the 100 kg N ha^{-1}, 0.5 m row spacing treatment combination. During the third season there was no other significant treatment effect on DM yield (Fig. 1).

On the row spaced pastures there were only non significant DM yield responses to N fertilization (Fig. 1). This may be due to improved N mineralization (Catchpoole 1984), on these treatments, as they were cultivated once or twice a year to control weeds.

There were no significant DM yield responses to 50 kg N ha^{-1}, on any of the density treatments (Fig. 1). This confirms the findings of Pieterse and Rethman (1995) on a *Digitaria eriantha* pasture and the results from pot trials by Pieterse et al. (1994) and Pieterse et al. (1995) with *Pancium maximum* and *Digitaria eriantha*, respectively. In none of these studies could a significant DM yield response be obtained with N applications of less that 80 kg ha^{-1} yr^{-1}.

The results of this study further suggest that, with a precipitation of more than 500 mm yr^{-1}, the highest DM yields on an *Eragrostis curvula* pasture will be obtained with a broadcast establishment.

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Figure 1
Dry matter yield response to differnet levels nitrogen fertilization on a broadcast establishement (sp 1) and row spaced (sp2 = 0,5 m and sp3 = 1 m spaced rows) *Eragrostis curvula* pasture, during the second (s2) and third season (s3).