Effects of cutting, nitrogen, closing date and water on herbage and seed production in Ruzi grass (*Brachiaria ruziziensis* Germain and Everard)

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ABSTRACT

The successful production of Ruzi grass (*Brachiaria ruziziensis*) for both herbage and seed production requires a knowledge of vegetative and reproductive development and their reaction to management. Several management aspects were investigated in the present study, i.e. defoliation, closing date, nitrogen fertilizer application and water stress effects during reproductive development. In addition, an attempt was made to describe more fully phenotypic variation in a Ruzi grass population, an aspect which may provide information useful for a future plant breeding programme in this species.

Phenotypic variation in Ruzi grass was investigated under plastic house conditions where minimum and maximum temperatures were set at 20 C and 30 C respectively. The seed used was from a commercial seedlot obtained from Thailand. Single plant measurements were made during the vegetative stage (herbage production and tiller development, growth form, plant height, canopy width, leaf width, leaf hairiness, ligule colour, and stem colour) and during the reproductive stage (date of first flower initiation, tiller numbers at harvest, and development of inflorescences).

Erect and semi-erect plants had significantly higher herbage production than prostrate plants but failed to show significant differences in tiller numbers. Seed yield was unaffected by plant growth form. Other parameters such as ligule colour, stem colour, leaf width and hairiness also showed considerable variation from plant to plant. However there was little evidence they were linked to any particular plant growth form.

Management practices for herbage and seed production, particularly in terms of defoliation, time of closing and nitrogen fertilizer application were studied in miniature swards in a plastic house at 20 C and 30 C (night and day temperature). These swards were established in wooden bins each with 49 seedlings at a 15 cm square spacing.

In a complete randomised block design, the treatments comprised a combination of cutting frequencies viz. at 20, 35, 50 and 65 cm height and cutting intensities *viz.* 4 and 12 cm

stubble height, with 3 replications. This experiment was designed to determine the most appropriate defoliation management practice for Ruzi grass "pasture", and to provide a reasoned justification for the defoliation strategy adopted in subsequent studies.

Differences in cutting intensity between 4 cm (hard) and 12 cm (lax) had no significant effect on total plant dry matter, but under lax cutting plants produced significantly greater leaf dry matter and a higher leaf:stem ratio. Despite this, herbage quality was not significantly different mainly due to the longer cutting interval under hard cutting conditions resulting in plants producing bigger leaves and a significantly higher LAI compared with lax cutting. Although plants in the longer cutting frequency treatment had a significantly higher LAI than with more frequent cutting, the greater proportion of stem had a major effect in lowering herbage quality.

The overall assessment of the data from the defoliation treatments concluded that the most appropriate defoliation management for a Ruzi sward was 12-35 cm i.e. cutting when the canopy reached a height of 35 cm down to 12 cm. This was the defoliation strategy subsequently employed in studies on the management of Ruzi swards for herbage and seed production.

The effects of nitrogen and "closing date" (cessation of cutting) on herbage and seed production of Ruzi grass, were examined under three nitrogen levels viz. 50, 150 and 250 kg N/ha and three closing dates viz. early (24th March 1997), medium (7th April 1997) and late (21st April 1997) with 3 replications in a complete randomised block design. The experiment was conducted in "miniature swards" as previously described.

Herbage dry matter production prior to closing increased progressively with increasing levels of nitrogen supply. This nitrogen effect continued to produce significantly higher herbage production (250 kg N/ha) even after seed harvest, but there were no significant differences between 50 and 150 kg N/ha. Different closing dates did not cause similar effects to nitrogen application, simply because plant growth rate declined with the approach of the reproductive stage. This was particularly evident in medium and late closing treatments.

However, as expected, the earlier the closing date the higher the amount of herbage dry matter yield obtained after seed harvest. This was mainly contributed by both new vegetative and old reproductive tillers.

Nitrogen application up to 150 kg/ha increased seed yield mainly by increasing total and harvested ripe inflorescence density, total floret numbers, and seed numbers. However nitrogen had no effect on percentage seed set or seed weight. Early and medium closing dates produced significantly greater seed yields than the late closing date mainly through an effect on total and harvested ripe inflorescence density, seed numbers, seed weight. Closing date had no effect on percentage seed set, but early closing resulted in greater inflorescence size (floret numbers/inflorescence). The interaction of nitrogen level and closing date suggested that higher nitrogen supply (150 kg N/ha) and early closing increased the percentage of pure germinating seed, suggesting that this is the most appropriate management for enhancing seed quality and yield.

The final experiment in this study was established to determine the effects of different levels of water stress applied at different stages of reproductive development on seed yield, yield components and seed quality in Ruzi grass. Individual plants were grown in 10 litre pots filled with potting mixture. Three levels of water stress were imposed (control (nil), mild and severe) at three different reproductive development stages (floral initiation, ear emergence and full flowering).

The response of plants to different levels of water application were clearly shown in terms of physiological and morphological changes particularly when these applications were continued throughout the entire reproductive development stage. Although the higher the amount of water applied the greater the dry matter produced, in terms of reproductive development, there was relatively little difference between non stressed and mild stressed plants. Under severe stress, however, although plants developed inflorescences, they were unable to exsert to full ear emergence. Generally, the stage of plant development and level of water stress applied had a bearing on plant dry matter, seed yield and seed yield components.

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