

Invloed van stikstofbemesting, grondtipe en waterstremming op die produksie en watergebruikdoeltreffendheid van *Digitaria eriantha* cv. Irene onder glashuistoestande

PA Pieterse, NFG Rethman and J van Bosch

Departement Plantproduksie en Grondkunde, Fakulteit Biologiese en Landbou Wetenskappe,
Universiteit van Pretoria 0002, Suid-Afrika.

Abstract

The influence of N-fertilization, soil type and water stress on the growth rate and water-use efficiency (WUE) of *Digitaria eriantha* was evaluated in a pot trial at the University of Pretoria. There were five levels of N, on three soil types and the treatment combinations were replicated under conditions of sufficient water supply and water stress. It was concluded that N fertilization, at levels higher than 80 kg N-ha⁻¹, had a significant effect on both growth rate and WUE. In the case of growth rate, the influence was overshadowed by soil type. Water stress had a severe effect on growth rate, but only at relative high levels of N application was WUE affected. Growth rate and therefore also WUE, decreased as the season progressed. It would therefore be good policy to scale down or stop irrigation as soon as the crop's growth rate start to decrease.

Uittreksel

Die invloed van N-bemesting, grondtipe en waterstremming op die groeitempo en watergebruikdoeltreffendheid (WGD) van *Digitaria eriantha* is in 'n potproef aan die Universiteit van Pretoria ondersoek. Daar was vyf N-peile op drie grondtipes en al die behandelings-kombinasies is onder toestande van voldoende watervoorsiening en waterstremming toegepas. Daar is tot die gevolgtrekking gekom dat N-bemesting teen peile van meer as 80 kg N-ha⁻¹, 'n betekenisvolle invloed op beide groeitempo en WGD van *D. eriantha* het. In die geval van groeitempo, word die effek oorskadu deur die invloed van grondtipe. Waterstremming het 'n skerp afname in groeitempo tot gevolg gehad, maar het slegs by relatief hoe N-peile 'n invloed op die WGD gehad. Die groeitempo en daarom ook die WGD, het afgeneem soos die seisoen gevorder het. Dit mag dus goeie beleid wees om besproeiing van die gewas af te skaal of heeltemal te stop sodra die groeitempo afneem.

Extended summary

The aim of this trial was to determine the influence of N fertilization, soil type and water stress on the growth rate and water use efficiency (WUE) of *Digitaria eriantha*. The research was conducted as a pot trial in a controlled environment and was done over three seasons, using a different type of soil each season. In the 89/90 season, it was on sandy clay loam1 with a clay content of 34% and the N levels were 0, 20, 60, 180 and 300 kg N-ha⁻¹. In the 90/91 season, it was repeated on sandy clay loam2 with a clay content of 21% and the N levels were 0, 20, 60, 180, and 540 kg-ha⁻¹. In the 91/92 season, it was done on a clay soil with a clay content of 46% and the N levels were 0, 80, 160, 240 and 320 kg-ha⁻¹. All the N was applied in a single dressing. There were 2 levels of irrigation: half the pots were watered to 90% of the mass at field capacity every 2 to 3 d (treatment (a)), the other half received on average 19.3 mm per week (treatment (b)), with the result that this treatment eventually observed frequent water stress. The grass was harvested at a height of 70 mm, when the first inflorescences appeared, resulting in four cuts per season on the treatment (a) and three cuts on treatment (b).

From the results it is obvious that N levels of less than 80 kg N-ha⁻¹ had little or no effect on the growth rate or water-use efficiency of *D. eriantha*. The highest growth rate was obtained

on sandy clay loam2, when water was freely available and N was applied at a rate of 450 kg N-ha⁻¹. WUE was greatly effected by level of N application. Where water was freely available, soil type did not have a influence on WUE, but it did have a significant effect under conditions of water stress. On any particular soil, water stress only had an effect on WUE, where relatively high levels of N was applied. The highest WUE under irrigation can be achieved at an N application of between 350 and 400 kg N-ha⁻¹. Because WUE decreased as the season progress, it may be recommended to scale down or stop irrigation as soon as the growth rate has decreased considerably, under local conditions, usually at the second half of March, after which the crop should produce and survive on natural precipitation. The effect of this on growth in subsequent seasons need to be investigated. The highest stubble mass was also obtained with the highest N application when water application was sufficient, but not when the plants were water stressed. It must, however, be stressed that the data was obtained from a pot trial and need to be validated in the veld.

Different reactions to N application and water stress were observed on the different soils and it has been concluded that although the level of N application does have an influence on growth rate and water use efficiency, other soil factors overshadow this influence, especially when it comes to growth rate.

* To whom all correspondence should be addressed.

*(012) 420-3226; Fax: (012) 342-2713; E-mail: pieter@scientia.up.ac.za

Received 15 September 1994; accepted in revised form 26 June 1995.