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The effects of summer moisture stress and its interaction
with spring cutting managements on the production and
persistence of a ryegrass (Lolium perenne L.) sward

A thesis presented in partial fulfilment of the
requirements for the degree of Master of Agricultural
Science in Plant Science at Massey University, Palmerston
North, New Zealand.

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1983

47211-69

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Acknowledgements

I would like to acknowledge the assistance given to me by the following:

Dr A.C.P. Chu, my supervisor, for his assistance in many aspects throughout my course and especially for his work (in the wider sense) in obtaining the research contract which made this study possible.

Dr C.J. Korte, my co-supervisor, for his advice and discussion during the experiment and thesis preparation and also for his assistance with computer programming.

Grasslands Division DSIR for a) providing the seed used in the experiment; b) allowing me time during work to complete this study, and c) providing computing facilities.

Dr H.G. McPherson for helpful discussion and comment during the preparatory stages of the project.

Dr B. Clothier, DSIR, for lending the neutron probe.

Mr A. Green and Mr J. Gordon, DSIR, for their electronic and mechanical expertise in setting up and maintaining the rain-out shelter.

Dr I. Gordon, Massey University, for statistical assistance.

Mr A. Hall, DSIR, for computing assistance.

The technical and field services staff of the Agronomy Dept, Massey University, particularly Flora Bartholomew and Marc Hancox for technical assistance.

Fellow post graduate students, members of the Agronomy Department, Massey University, and staff of the Grasslands and Plant Physiology Divisions, DSIR, for their discussions and comments.

And finally to Miss D. Rosvall for her time and effort in typing this thesis.

Financial assistance from the following is acknowledged:

Leonard Condell Scholarship 1981
Leonard Condell Scholarship 1982
Johannes August Anderson 1981
DSIR contract SIR UV/4/45

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Abstract

The effect of an increasing water deficit during summer, achieved by means of an automatic Rain-Out Shelter, on the production and persistence of a perennial ryegrass (Lolium perenne L. "Grasslands Nui") was compared to that under irrigation. In addition, the effect and interaction with water deficit, of 2 different cutting intensities (i.e. heights of 2.5 and 7.5 cms) during spring were also investigated.

The responses of perennial ryegrass to an imposed drought, compared to those under irrigation, were related to measurements of soil and plant water status; where the soil and plant water status were measured by soil water deficit and leaf water potential respectively. It was found that the growth of the components of pasture production (particularly tiller and leaf dynamics) was reduced when the soil water deficit exceeded a critical point of 104-111 mm, which could be predicted for the Tokomaru silt loam soil type, according to the soil water balance of Scotter, Clothier and Turner (1979). At this point the soil water potential was approximately equal to -0.1 MPa and had not reached the permanent wilting point (-1.5 MPa). This critical point was characterised by a sharp 0.6 MPa decrease in dawn leaf water potential which contrasted with a more gradual decline in mid-afternoon leaf water potential. Such a change in leaf water potential (particularly at dawn) was found to be a very sensitive indicator showing that this change in water status had occurred. At deficits exceeding the critical point reductions in pasture yield were attributable to a reduction in the rate of tiller appearance, an increase in the rate of tiller death, and a reduction in the rate of leaf production (i.e. extension and appearance).

Furthermore it was found that spring managements to increase tiller density will result in a greater tiller

density at the end of drought, but will not give an advantage in dry matter yield during the drought. Any benefit which might result from a management system to prepare a sward for drought is unlikely to be in summer production but may be in the potential for faster recovery after drought.

Keywords perennial ryegrass, water stress, leaf water potential, cutting intensity, tiller dynamics, leaf dynamics, Rain-Out shelter.