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THE EFFECTS OF SHADING AND DEFOLIATION ON THE
NODULATION AND NITROGEN FIXATION
OF WHITE CLOVER (TRIFOLIUM REPENS L.)

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Alexander Cheong Ping Chu

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SUMMARY

In a glasshouse experiment, single plants of ten-weeks-old white clover (Trifolium repens L.) were subjected to two levels of shading and two levels of defoliation. Plant growth, nodulation and nitrogen fixation parameters were collected on six sequential harvests over four weeks.

Losses of roots and nodules resulting from the treatments were probably due to a reduction in photosynthate supply. Decreases in nodule number and hence nodule dry weight per plant were due to nodule decay, sloughing off and non-production, and were related to the losses in root dry weight. Total nodule numbers on both 'control' and 'treated' plants increased with time, due mainly to increases in numbers of medium sized (1-3mm) nodules. Reduction in nodule weight per plant in the 'treated' plants was later reflected in a lower mean nodule weight.

Severe defoliation caused degradation of the pink pigment, leghaemoglobin, an effect which was seen in less than three days from treatment. It also led to a temporary marked decrease in the nitrogen fixing capability of the nodules as measured by the acetylene reduction assay. Recovery of normal activity by the nitrogen fixing system in the defoliated plants took about ten days.

The suitability of acetylene reduction assay for a short term experiment, and the relationship between rates of acetylene reduction and nodule colour are briefly discussed.

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GENERAL INTRODUCTION

The ability of the legume-Rhizobium symbiosis to fix atmospheric nitrogen, hence contributing towards the maintenance of soil fertility is well recognised. Although increasing usage of mineral nitrogen is evident in agricultural practices overseas (Watkin, Williams 1970), in New Zealand legume nitrogen is still by far the most important source of nitrogen in grassland farming.

Nitrogen fixation in a fertile ryegrass-white clover association has been estimated to yield as much as 550 lb N per acre per annum (Sears 1953), and it has been emphasised that for maximum benefit to the grass component in a mixed sward the white clover should be periodically defoliated and have ample light for regrowth (Butler, Greenwood & Soper 1959).

The present study examines the effects of defoliation and shading on nodulation and nitrogen fixation in white clover.