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# EFFECT OF SHADE ON GROWTH OF TOWNSVILLE LUCERNE (STYLOSANTHES HUMILIS H.B.K.)

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SUMMARY

**Reduction in light intensity to 0·74 daylight and lower caused a marked decrease in both top dry-matter and root dry-matter production.**

## Introduction

The influence of light on the maintenance of grass-legume balance in temperate pastures has been widely demonstrated (e.g. Blackman 1938). Competition from pasture grasses has a marked effect on the production, regeneration and rate of colonization of the tropical legume Townsville lucerne (*Stylosanthes humilis* H.B.K.) (Shaw 1961; Norman 1962; Graham 1963). There are field indications that the light environment in a sward exerts a profound influence on Townsville lucerne, which becomes subordinate at reduced intensity, but critical information on this point is lacking.

An experiment was conducted to measure the effect of various reductions in light intensity, imposed at planting, on the growth of Townsville lucerne.

## Materials and Methods

Thirty Townsville lucerne seeds from a commercial source were surface-sown in December 1963 at Mackay in each of 20 plastic pots (7-in. diam.) which had been filled with a sandy loam. The soil was considered to be of adequate fertility for Townsville lucerne growth; analysis indicated pH 6·0, available $P_2O_5$ 83 p.p.m., replaceable K 0·18 m-equiv. %, Morgan test $NO_3$ nitrogen medium, $NH_4$ nitrogen very low.

Immediately after sowing, five pots were placed in each of four shading treatments which had measured light transmissions of 1·0, 0·74, 0·54 and 0·38 of full sunlight, respectively. Wooden rectangular frames covered with one, two and three layers of zincoid gauze 18/14 mesh provided the three reduced light intensity treatments. The frames were pivoted in the centre and orientated east-west in the long axis. Movement of the frames about the pivot twice daily protected pots from low-angle morning and afternoon sunlight. Adequate soil moisture was maintained with daily surface watering. The Townsville lucerne plant population was reduced to three plants per pot at the first trifoliate leaf stage.

Oven-dry weight of shoots was determined at two harvests made 76 and 112 days after sowing. At harvesting, each plant was cut back to approximately ¼ in. above the lowest branch. Root dry-matter was determined at the second harvest. Root and top growth composite treatment samples were analysed for total nitrogen at the second harvest.

## Results

The production of dry matter as shoots at 76 days and 112 days and as roots at 112 days is shown in Table 1.

TABLE 1

DRY-MATTER YIELD UNDER VARIOUS LIGHT VALUES
g/pot

| Light Value (fraction of full daylight) | Shoots | | | Roots |
|---|---|---|---|---|
| | 1st Harvest (76 days) | 2nd Harvest (112 days) | Total | 2nd Harvest (112 days) |
| 1·00 | 8·46 | 5·46 | 13·92 | 2·42 |
| 0·74 | 4·54 | 2·86 | 7·40 | 1·36 |
| 0·54 | 4·73 | 1·40 | 6·13 | 0·96 |
| 0·38 | 2·50 | 0·50 | 3·00 | 0·34 |
| Necessary differences for significance 5% | 2·91 | 1·37 | 3·97 | 0·60 |
| Necessary differences for significance 1% | 4·11 | 1·93 | 5·60 | 0·85 |

A reduction in light intensity to 0·74 daylight caused a marked decrease in top growth of Townsville lucerne; total top growth showed an average decrease in yield of 47%, which was of the same order at both harvests. At the second harvest, reduction in light intensity to 0·54 and 0·38 caused a further significant decrease in top dry-matter production. This decrease in top dry-matter production was confounded with plant mortality (7% and 33% at 0·54 and 0·38 daylight respectively) prior to the second harvest.

Root dry-matter decreased by 44% with a reduction in intensity to 0·74 daylight. Between 0·54 and 0·38 daylight, root dry-matter was further decreased, causing a reduction in the root to total plant weight ratio.

Shading did not reduce nitrogen concentration in roots or tops but total nitrogen uptake was substantially lowered. The average nitrogen content on a moisture-free basis was 3·3 and 1·8 for shoots and roots respectively.

## Discussion

Townsville lucerne has shown an extreme sensitivity to continuous artificial shade imposed at planting. The marked decrease in growth with a small reduction in light intensity follows the established pattern for "sun" species (Black 1957). It will be appreciated that under the experimental conditions, radiation received by the plant may also have been associated with reduced leaf temperature.

This result points to the need to develop management techniques to minimize shading in pastures based on Townsville lucerne.

Recognition of an optimal grass–Townsville lucerne balance is a necessary prerequisite to pasture management decisions. Norman (1962) considered the advantages and disadvantages of a perennial grass companion in Townsville lucerne pastures, which may be justified more by the provision of additional and hypothetical increase in total yield.

Increased grazing pressure is the technique most conveniently employed to improve the competitive position of Townsville lucerne in relation to light. When this involves grasses which are vulnerable to heavy stocking pressure, Townsville lucerne dominance can result. A refinement by attention to timing and pressure of grazing could possibly be used to retain balance.

Another technique could be the use of introduced grasses (e.g. *Dichanthium aristatum* and *Bothriochloa pertusa*) compatible with the necessary management for optimum Townsville lucerne production yet exhibiting a growth rhythm not detrimental to legume regeneration.

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