GROWTH STUDIES ON DEFOLIATED *LOTUS PEDUNCULATUS* cv. 'GRASSLANDS MAKU'.

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ABSTRACT

This thesis reports on a series of experiments designed to study the response of 'Grasslands Maku' to defoliation and thereby extend the understanding of growth and production of *Lotus pedunculatus*. Morphological structuring, production and nonstructural carbohydrate status of 'Grasslands Maku' were assessed for different defoliation regimes in two separate field experiments. The relative importance of several residual plant factors and assimilate partitioning in early shoot regrowth, was studied in controlled environmental conditions.

In the first field experiment, seasonal differences in the partitioning of growth were recorded, with the spring to mid-summer period being dominated by aerial shoot growth and the late-summer, autumn period by underground growth. Of the underground components, rhizome growth was the most responsive to seasonal and defoliation changes and it was this horizontal stem system that formed the basis of basal shoot initiation.

Canopy growth became increasingly dominated by rhizome shoots as cutting height and frequency decreased and stubble shoots, stubble and dead matter declined. Following defoliation, regrowth was consistently slow during the first two to three weeks, thus production increases were achieved where regrowth intervals were extended and subsequent, higher growth rates were allowed to be expressed. Higher cutting improved shoot regrowth, particularly in the stubble shoot pool, but increased within-canopy dry matter losses that were related to death and decomposition processes, resulted in little, if any improvement in net productivity.

Shoot regrowth responses resulting from higher cutting were primarily related to increases in the size of the residual shoot pools from which regrowth commenced. Residual shoot number and individual size were therefore important determinants of early regrowth. Any direct influence of residual nonstructural carbohydrate status on regrowth appeared to be principally confined to the rhizome shoot pool for the first few days of regrowth. The importance of accumulated starch would appear to be related to the provision of metabolic substrate for underground respiration during late autumn to early spring.

Where defoliation is incomplete, residual stubble would appear to be an important source of current and redistributed assimilates during early regrowth. Following defoliation, redistribution of carbon compounds to shoot growth was principally confined to the rhizome shoot pool. Total shoot growth increasingly dominated the partitioning of current assimilates as plants recovered from defoliation. Where defoliation is incomplete it is proposed that assimilate utilization is a more important limitation to early shoot regrowth than assimilate supply.

The defoliation responses recorded with 'Grasslands Maku' in these experiments are finally considered with regard to the role of *L. pedunculatus* in agriculture. Management guidelines are proposed and improved regrowth characteristics, necessary for any further extension of *L. pedunculatus* into grasslands farming, are suggested.

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