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GROWTH STUDIES ON DEFOLIATED *LOTUS PEDUNCULATUS*

cv. 'GRASSLANDS MAKU'.

A thesis presented in partial fulfilment of  
the requirements for the degree of  
Doctor of Philosophy at

Massey University  
Palmerston North  
New Zealand

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April, 1973

## 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.

TABLE OF CONTENTS

	Page
Chapter 1: <u>Introduction and Objectives</u>	1
Chapter 2: <u>Literature Review</u>	4
2.1 <i>Lotus pedunculatus</i> (syn. <i>Lotus uliginosus</i> .)	4
2.2 Plant component growth patterns and relationships.	10
2.2.1 Growth of shoots.	11
2.2.1.1 <i>Lotus corniculatus</i>	11
2.2.1.2 <i>Medicago sativa</i>	12
2.2.1.3 <i>Coronilla varia</i>	14
2.2.2 Growth of underground organs	15
2.2.2.1 Seasonal effects on underground organs	15
2.2.2.2 Defoliation effects on underground organs	16
2.3 Defoliation management and herbage dry matter production	17
2.3.1 General concepts	17
2.3.2 <i>Lotus corniculatus</i>	18
2.3.3 <i>Medicago sativa</i>	20
2.3.4 <i>Coronilla varia</i>	22
2.4 Nonstructural carbohydrates	22
2.4.1 Seasonal changes in nonstructural carbohydrates	23
2.4.2 Defoliation effects on nonstructural carbohydrates	24
2.4.3 Nonstructural carbohydrates and plant regrowth	25
2.5 Carbon partitioning in plants	27
2.5.1 Carbon distribution	27
2.5.2 Carbon redistribution	29
Chapter 3: <u>Morphological characteristics of <i>Lotus pedunculatus</i> cv. 'Grasslands Maku'</u>	31
3.1 Introduction	31
3.2 Experimental	32
3.3 Results	37

	Page
3.3.1 Underground plant components	37
3.3.1.1 Primary crown and taproot	39
3.3.1.2 Rhizome	42
3.3.1.3 Fibrous root	45
3.3.2 Final canopy components	46
3.3.2.1 Final shoot growth	46
3.3.2.2 Final stubble and dead matter	48
3.3.3 Final shoot numbers and characteristics	50
3.3.3.1 Stubble shoots	50
3.3.3.2 Rhizome shoots	52
3.3.3.3 Rhizome shoot initials	55
3.3.3.4 Crown shoots and crown shoot initials	56
3.3.4 Residual shoot numbers	56
3.3.4.1 Residual stubble shoot numbers	60
3.3.4.2 Residual rhizome shoot numbers	60
3.3.4.3 Residual crown shoot numbers	61
3.4 Discussion	61
3.4.1 Underground plant components	61
3.4.2 Crown and taproot	63
3.4.3 Rhizome	64
3.4.4 Fibrous root	64
3.4.5 Stubble shoots	67
3.4.6 Rhizome shoots	68

Chapter 4: Defoliation management and herbage dry matter production of *Lotus pedunculatus* cv. 'Grasslands

<u>Maku'</u>	71
4.1 Introduction	71
4.2 Experimental	72
4.2.1 Experiment 1	72
4.2.2 Experiment 2	72
4.3 Results	75
4.3.1 Experiment 1	75
4.3.1.1 Net herbage production	75
4.3.1.2 Regrowth cycles: (i) spring regrowth cycle; (ii) summer regrowth cycle	76

	Page
4.3.2 Experiment 2	77
4.3.2.1 Treatment RS	82
4.3.2.2 Treatment SAS	86
4.3.2.3 Treatment 6S	87
4.3.2.4 Treatment 6L	91
4.3.2.5 Treatment SAL	92
4.3.2.6 Treatment LS	96
4.3.3 Winter production of Experiment 1 and 2	97
4.4 Discussion	98
4.4.1 Stubble shoots	99
4.4.2 Rhizome shoots	101
4.4.3 Secondary axillary shoots	102
4.4.4 Stubble and dead matter	103
4.4.5 Leaf area	104
4.4.6 Net canopy growth	105
4.4.7 Proposed management	107
Chapter 5: <u>Nonstructural carbohydrate levels in <i>Lotus pedunculatus</i> cv. 'Grasslands Maku'</u>	109
5.1 Introduction	109
5.2 Experimental	110
5.3 Results	112
5.3.1 Experiment 1	112
5.3.1.1 Central system total nonstructural carbohydrates	114
5.3.1.2 Peripheral system total nonstructural carbohydrates	116
5.3.2 Experiment 2	
5.3.2.1 Spring sampling	119
5.3.2.2 Autumn sampling	119
5.4 Discussion	121
Chapter 6: <u>The importance of several residual plant factors in determining early regrowth in <i>Lotus pedunculatus</i> cv. 'Grasslands Maku'</u>	125
6.1 Introduction	125

	Page
6.2 Experimental	126
6.3 Results	128
6.3.1 Shoot regrowth	128
6.3.2 Shoot numbers	133
6.3.3 Residual leaf area, stubble weight and underground weight	137
6.3.4 Nonstructural carbohydrate status	139
6.4 Discussion	144
 Chapter 7 <u>The partitioning of C<sup>14</sup> labelled assimilates in def-</u> <u>oliated <i>Lotus pedunculatus</i> 'Grasslands Maku'</u>	150
7.1 Introduction	150
7.2 Experimental	151
7.3 Results	154
7.3.1 C <sup>14</sup> Distribution experiment	154
7.3.2 C <sup>14</sup> Redistribution experiment	160
7.4 Discussion	168
7.4.1 C <sup>14</sup> Distribution experiment	168
7.4.2 C <sup>14</sup> Redistribution experiment	171
 Chapter 8: <u>General Discussion</u>	174
 <u>Acknowledgements</u>	182
 <u>Bibliography</u>	183
 <u>Appendices</u>	197



LIST OF TABLES

Table		Page
1	Plant densities for pre-autumn and post-winter samplings.	40
2	Total underground dry weight.	40
3	Crown plus taproot dry weight.	43
4	Rhizome dry weight.	43
5	Fibrous root dry weight.	45
6	Percentage contribution of stubble and rhizome shoots to final canopy weight.	47
7	Percentage contribution of stubble and dead matter to final canopy weight.	49
8	Number of final stubble shoots.	51
9	Number of final rhizome shoots.	51
10	Number of rhizome shoot initials.	55
11	Number of final crown shoots and crown shoot initials.	58
12	Residual shoot numbers.	59
13	Net herbage production in Experiment 1.	76
14	Leaf area indices during a spring and summer regrowth cycle of Experiment 1.	79
15	Total and component dry matter production in Experiment 2.	81
16	Net dry matter production during winter in Experiment 1 and 2.	97
17	Nonstructural carbohydrate status of the central plant system in Experiment 1.	115
18	Nonstructural carbohydrate status of the peripheral plant system in Experiment 1.	117
19	Nonstructural carbohydrate status of the rhizome and above-ground fractions of the peripheral system sampled on 6/4/76.	118
20	TNC concentrations and dry weights of underground organs during late spring and autumn in Experiment 2.	120
21	Total, stubble and rhizome shoot dry weights.	129
22	Shoot dry weight relationships with regrowth time.	132
23	Individual stubble and rhizome shoot dry weights.	134
24	Stubble and rhizome shoot numbers.	136
25	Leaf area of stubble, stubble shoots and rhizome shoots.	138

Table		page
26	Stubble and total underground dry weights	139
27	Dry weights of plant components during regrowth in the $C^{14}$ Distribution experiment	155
28	Specific activities of plant components in the $C^{14}$ Distribution experiment	156
29	Absolute activity of plant components in the $C^{14}$ Distribution experiment	157
30	Percentage distribution of total plant activity between components in the $C^{14}$ Distribution experiment	158
31	Dry weights of plant components during regrowth in the $C^{14}$ Redistribution experiment	161
32	Specific activity of plant components in the $C^{14}$ Redistribution experiment	162
33	Absolute activity of plant components in the $C^{14}$ Redistribution experiment	164
34	Percentage distribution of total plant activity between components in the $C^{14}$ Redistribution experiment	165
35	Activity levels of plant components, as a percentage of their original activity on day 0, in the $C^{14}$ Redistribution experiment	167

LIST OF FIGURES

Figure		Page
1	A diagrammatic representation of the morphology of 'Grasslands Maku', <i>Lotus pedunculatus</i> .	35
2	Total underground weight per plant at six-weekly harvest dates.	38
3	Net herbage production during a six week spring period in Experiment 1.	78
4	Net herbage production during a six week summer period in Experiment 1.	80
5	Component dry matter yields for treatments RS (A) and SAS (B).	84
6	Shoot numbers and LAI for treatments RS (A) and SAS (B).	85
7	Component dry matter yields for treatments 6S (A) and 6L (B).	89
8	Shoot numbers and LAI for treatments 6S (A) and 6L (B).	90
9	Component dry matter yields for treatments SAL (A) and LS (B).	94
10	Shoot numbers and LAI for treatments SAL (A) and LS (B).	95
11	TNC status of residual plants following cutting.	113
12	RGR of collective total (A), stubble (B) and rhizome (C) shoot pools.	131
13	RGR of individual stubble (A) and rhizome (B) shoots.	135
14	Nonstructural carbohydrate levels in stubble shoots (A); rhizome shoots (B); stubble (C); rhizome (D); and crown plus taproot (E).	142 & 143
15	Percentage distribution of total plant activity in collective components of high and low cut plants in the C <sup>14</sup> Distribution experiment	159
16	Percentage distribution of total plant activity in collective components of high and low cut plants in the C <sup>14</sup> Redistribution experiment.	166

LIST OF PLATES

Plate		Page
1.	A multicrown and taprooted plant linked by woody rhizome growth; considered as one plant unit.	41
2.	Primary crown and forked taproot; pink crown shoot initials are also evident.	41
3 and 4.	Rhizome components: non-woody rhizome; woody rhizome with a swollen nodal region and concentrated shoot locii; basal portion of a terminal rhizome shoot.	44
5.	A stubble node possessing three axillary shoots at different stages of development.	53
6.	Contrasting leaf and stem complements in rhizome shoots and stubble shoots during early regrowth.	53
7.	A rhizome shoot characteristically dominating two stubble shoots and a rhizome shoot with a basal underground portion.	54
8.	Two rhizome shoots and several rhizome shoot initials at different stages of development.	54
9.	Early rhizome shoot development ranging from a leafy orthotropic rhizome shoot to an underground rhizome shoot initial.	57
10.	Stages of abnormal rhizome shoot initials; apical death; subtended axillary bud development; resumed rhizome shoot initial growth.	57
11.	A spreading, open plant habit, typical of 9.5 cm cutting (LF) where underground growth was extensive.	65
12.	Intermediate plant habit of 5.0 cm cutting (MF).	65
13.	A compact plant habit resulting from 1.5 cm cutting and reduced rhizome expansion (SF).	66
14.	A dorsal view indicating concentrated shoot locii at swollen rhizome nodes distant from the crown.	66

LIST OF APPENDICES

Appendix	Page
1    Percentage soil moisture during 1975/76 for 0-5 cm, *    5-15 cm and 15-30 cm depths	197
2    Meteorological measurements, D.S.I.R, Palmerston North	198
3    Residual and final dry matter levels of Experiment 1.	199
4    Residual and final leaf area indices of Experiment 1.	200
5    Growth rates in treatment RS	201
6    Growth rates in treatment SAS	202
7    Growth rates in treatment 6S	203
8    Growth rates in treatment 6L	204
9    Growth rates in treatment SAL	205
10   Growth rates in treatment LS	206
11   Environmental details of the controlled climates in Experiment 3 and 4.	207
12   Leaf to stem dry weight ratios of stubble, stubble shoots and rhizome shoots.	208
13   Experimental details of the C <sup>14</sup> Redistribution and Distribution experiments.	209
14   Total plant leaf area in the C <sup>14</sup> Distribution experiment	210
15   Rhizome and crown plus taproot TNC in the C <sup>14</sup> Redistribution experiment	210