THE INFLUENCE OF AN EARLY CUT ON CROWN DEVELOPMENT OF SEEDLING LUCERNE

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Summary

The effect of an early cut on the crown development of Moapa and College Glutinosa lucernes was examined under simulated sward conditions at Lincoln College. The cultivars did not differ in their response to the cut. Cutting increased the development of crown shoots in the first season at the expense of the stubble shoots, the cut plants having 25% more crown shoots than the uncut plants. There were no significant differences in number or yield of shoots in the spring regrowth. The early cut did not impede the development of the lucerne plant as there was a non-significant increase of 4% in total yield over the period of the experiment as a result of the cut.

INTRODUCTION

A relatively common practice when newly established stands of lucerne become dominated by annual weeds is to either graze or mow the stand when the lucerne is 10 to 12 cm high and before the weeds flower and set seed. Iversen (1965, 1967) recommended grazing to bare ground at this stage and maintained that, as lucerne would have a tap root 25 to 30 cm deep at this stage of development, the lucerne would be better able to stand this treatment than most weeds. Others to advocate the practice include Willard (1951) and Mills (1970). However, as far as the writer is aware, no data measuring the effects of this early defoliation on the lucerne component have been published.

The aim of the present study was to measure the early development of the lucerne plant, as affected by an early defoliation. Although two widely differing cultivars were used in this study, the effects of the early cut were similar for both cultivars, so that the data presented in this paper are a mean of the results from the two cultivars.

EXPERIMENTAL METHODS

Simulated swards of College Glutinosa and Moapa lucernes were established outside in large wooden boxes, by hand planting germinated seeds at a spacing of 7.5 cm each way. The top 10 cm of soil was steam sterilized and any weeds appearing were hand pulled. The plants were watered regularly and nutrients applied in non-limiting amounts.

The boxes were arranged in a split plot design with cultivars as main plots, replicated five times, to give a total of ten boxes. The cutting subplots were half a box—70 cm by 120 cm—and were surrounded by a single

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row of border plants. From the 98 plants available for sampling, 80 plants were selected visually for uniformity before the cutting treatments were imposed and randomly allocated to eight samples of ten plants each. Sampled plants were replaced with similar plants, which had been grown in peat pots. Sampling dates and stage of growth at sampling are shown in Table 1.

TABLE 1: TIMETABLE OF HARVESTS AND CUTTING TREATMENTS, AND STAGE OF GROWTH AT THESE TIMES

	<i>Stage of Growth at Harvest</i>	<i>Cut</i>	<i>Uncut</i>
Germination		Day 0 (4/12/68)	
Harvest 1	4-5 true leaf	Day 25	
Harvest 2	—	Day 29	
Harvest 3	—	Day 33	
Harvest 4	10% flowering	Day 85	Day 79
Harvest 5	early regrowth	Day 91	Day 85
Harvest 6	early regrowth	Day 97	Day 91
Harvest 7	equivalent to 10% flowering	Day 142 (25/4/69)	
Harvest 8	10% flowering	10/9/69	

The early cut was immediately before Harvest 1; all plants were defoliated after harvests 4 and 7.

After samples 1 to 7 had been taken, the plants were dissected into crown and stubble shoots and the numbers and dry weights of each category determined. The primary branches of the crown arose from the nodes subtended by the cotyledons and the unifoliate leaf; the rest of the crown shoots were those shoots that arose from nodes less than 5 to 6 mm apart at the base of the preceding order of crown shoots (see Fig. 1a). The primary stubble branches arose from the nodes subtended by the 1st, 2nd and 3rd trifoliate leaves and the rest of the stubble shoots were those shoots arising from nodes greater than 6 mm apart on the bases of crown shoots and all those shoots arising from the bases of the preceding order at stubble shoots (see Fig. 1a). Only those shoots arising below the 5 cm cutting height were included in the analysis.

The plants in Sample 8 were dissected into four categories. The first order (1°) basal shoots were defined as those shoots arising from nodes less than 6 mm apart on the bases of the crown stems remaining viable from the previous growing season, second order (2°) basal shoots as those arising from nodes less than 6 mm apart on the bases of the 1° basal shoots. The first order (1°) axillary shoots were defined as those shoots arising from the nodes greater than 6 mm apart on the bases of the crown stems remaining from the previous growing season, second order (2°) axillary shoots as those arising from nodes greater than 6 mm apart on the 1° basal shoots and all those arising from nodes at the bases of the 1° axillary shoots (see Fig. 1b).

RESULTS

The effects of an early cut on numbers of shoots present during the first growing season are shown in Table 2.

FIG. 1: Schematic diagram of shoot classification. (a) Harvests 1 to 7.
(b) Harvest 8.

TABLE 2: EFFECT OF AN EARLY CUT ON SHOOT NUMBERS PER PLANT DURING THE FIRST GROWING SEASON

Shoot Category	Harvest No.						
	1	2	3	4	5	6	7
Crown:							
Cut	1.1	1.2	1.3	8.7	9.7	12.7	27.8
Uncut	1.1	1.2	1.4	7.6	7.7	8.0	22.3
S.E.	0.05	0.06	0.06	0.34	0.33	0.67	1.59
Significance	n.s.	n.s.	n.s.	n.s.	**	**	*
Stubble:							
Cut	0.3	0.7	1.4	6.9	8.1	9.6	19.1
Uncut	0.5	1.3	2.0	5.6	7.2	9.5	23.3
S.E.	0.04	0.07	0.09	0.34	0.39	0.44	1.08
Significance	n.s.	**	**	*	n.s.	n.s.	*
Total:							
Cut	1.4	2.0	2.7	15.5	16.9	22.3	46.9
Uncut	1.7	2.5	3.4	13.3	15.9	17.5	45.6
S.E.	0.05	0.09	0.11	0.42	0.62	0.84	2.58
Significance	n.s.	*	n.s.	**	n.s.	**	n.s.

* $P < 0.05$; ** $P < 0.01$.

n.s., not significant.

Cutting had little effect on crown shoot numbers over the first regrowth period, but during the second regrowth period the cut plants had significantly more crown shoots. Except for harvests 4, 5 and 6 there was a tendency for the cut plants to have fewer stubble shoots so that differences in total shoot numbers were small and showed no consistent trend. However, the crown shoots that were initiated earlier on the cut plants had more stubble sites at harvest 4 than those on the uncut plants, which produced a temporary increase in stubble shoot numbers on the cut plants at this stage.

The effects of cutting on mean shoot weights were generally small and the tendency for the uncut plants to have heavier shoots only achieved significance for the crown shoots at harvest 4.

The effects of the weed control cut on total shoot weights are shown in Table 3.

Initial differences in the weight of crown shoots produced were small, but, because of higher numbers, the cut plants had significantly higher total weights of shoots during the second regrowth period. As with the stubble shoot numbers, there was a tendency for the uncut plants to have higher stubble shoot weights, but the difference only reached significance at harvest 7. Although the cut plants had significantly greater total shoot weights early in the second regrowth phase, by harvest 7 the difference was not sufficiently large to achieve significance.

The effects of the early cut on the numbers of shoots and the total shoot weights in the following spring are shown in Table 4.

Although none of the differences were significant, there was a 16% increase in basal shoot numbers on the cut plants and a 7% increase in the weight of basal shoots.

The only significant interaction occurring between cultivar and early cutting is shown in Table 5.

TABLE 3: EFFECT OF AN EARLY CUT ON TOTAL SHOOT WEIGHTS PER PLANT DURING THE FIRST GROWING SEASON (g)

Shoot Category	Harvest No.						
	1	2	3	4	5	6	7
Crown:							
Cut	0.064	0.074	0.083	1.850	0.400	0.700	2.690
Uncut	0.065	0.082	0.105	1.900	0.310	0.500	2.000
S.E.	0.009	0.010	0.012	0.116	0.017	0.026	0.199
Significance	n.s.	n.s.	n.s.	n.s.	**	**	*
Stubble:							
Cut	0.001	0.013	0.062	0.750	0.110	0.200	0.470
Uncut	0.001	0.016	0.064	0.680	0.120	0.230	0.820
S.E.	0.000	0.003	0.009	0.121	0.013	0.018	0.072
Significance	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	**
Total:							
Cut	0.070	0.102	0.141	2.600	0.510	0.930	3.160
Uncut	0.083	0.131	0.211	2.680	0.430	0.730	2.820
S.E.	0.008	0.010	0.012	0.135	0.023	0.035	0.191
Significance	n.s.	n.s.	n.s.	n.s.	*	**	n.s.

n.s., not significant.

* $P < 0.05$; ** $P < 0.01$.

TABLE 4: EFFECT OF THE EARLY CUT ON SHOOT NUMBERS (PER PLANT) AND TOTAL SHOOT WEIGHTS (g/PLANT) IN THE FOLLOWING SPRING WHEN HARVESTED AT THE 10% FLOWER STAGE

Shoot Category	Shoot Nos.			Total Shoot Weights (g/plant)		
	Cut	Uncut	S.E.	Cut	Uncut	S.E.
1° Basal ...	13.37	10.85	1.08	4.23	3.87	0.48
2° Basal ...	17.47	15.54	1.31	0.32	0.39	0.08
1° Axillary	1.67	1.56	0.31	0.05	0.14	0.05
2° Axillary	10.12	10.08	0.80	0.07	0.12	0.03

None of the differences were significant.

TABLE 5: THE EFFECT OF AN INTERACTION BETWEEN CULTIVAR AND EARLY CUTTING ON THE NUMBERS OF STUBBLE SHOOTS AT HARVEST 5

Cultivar				Cut	Uncut
Moapa				5.68	8.82
College Glutinosa				8.78	7.42

Significant at $P < 0.01$.

The more vigorous growth of Moapa after the cut meant that more of the shoots forming the new regrowth were cut at the defoliation after harvest 4. This gave the reduction in stubble shoot numbers on the cut Moapa plants at the first harvest following the defoliation, but the effect did not persist to later harvests.

DISCUSSION

Cutting the main stem axis at this relatively early stage of development removed the majority of the stubble sites. This had the effect of initiating earlier the shoots originating from the remaining sites on the main axis. As these sites were mainly in the crown zone, the contribution of the crown shoots to overall yield in the first season was increased from 72% on the uncut to 79% on the cut plants. Since regrowth in the spring comes from the crown (Nelson and Smith, 1968; M. S. Offutt, pers. comm.; Singh, 1970), one would expect that higher numbers of crown shoots in the late autumn would increase the numbers of shoots forming the initial regrowth in the spring. This did in fact happen, the cut plants having 25% more crown shoots at harvest 7 and having 23% more first order basal shoots in the spring regrowth, although the difference in spring numbers was not significant. There tended to be an inverse relationship between weight and number of shoots, so that the total weight of first order basal shoots on cut was only 9% higher than on uncut plants, a nonsignificant difference. Although the difference was not significant, there was a small increase of 4% in the total shoot yield over the whole period of the experiment from the cut plants.

Under the conditions of this experiment, an early cut did not impede the development of the lucerne crown and had no significant effect on subsequent yield. In a field situation where weed growth can create intense interplant competition, one could expect the advantages of an early cut to be greater. In the opinions of Iversen (1965, 1967) and Mills (1970), grazing preferably, or mowing, at this stage, adequately controls weed growth. Thus, in this situation there is the possibility of being able to graze some stock and control weeds at the same time, without any damage to the young lucerne.

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REFERENCES

- Iversen, C. E., 1965. *Proc. Lincoln Coll. Frms' Conf.*: 78-83.
——— 1967. In Langer, R. H. M. (Ed.) *The Lucerne Crop*. Reed, Wellington. pp. 129-33.
Mills, W. D., 1970. *Queensland Agric. J.*, 96: 688-95.
Nelson, C. J., Smith, D., 1968. *Crop. Sci.*, 8: 21-5.
Singh, Y., 1970. *Regrowth bud developmental patterns of Alfalfa*. M.Sc. thesis, Univ. of Guelph, Canada.
Willard, C. J., 1951: *Adv. Agron.*, 3: 94-110.