EFFECT OF SIMULATED INSECT DAMAGE TO WHITE CLOVER SEEDLINGS

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Summary

Seedlings of white clover (*Trifolium repens*) were subjected to leaf excision treatments which simulated sublethal insect damage previously observed in oversown clover in Otago mid-altitude tussock country. Partial and complete removal of cotyledon leaves adversely affected subsequent growth of the plants over a 93-day period of assessment.

INTRODUCTION

Considerable areas of Otago mid-altitude tussock grassland are topdressed and oversown with superphosphate and clover to improve soil fertility and pasture quality. Rhizobial inoculation of clover seed is essential and lime-pelleting enhances establishment on these acid soils (Lowther and McDonald 1973). Nevertheless, clover establishment trials have often shown unexpectedly poor results (pers comm W.L. Lowther).

Current research on insect damage to clover seedlings suggests that adult native weevils are mainly responsible for injury to the foliage, particularly the cotyledon leaves soon after germination. Bignoli (1950) found that early defoliation of lucerne (*Medicago sativa*) seedlings produced a marked reduction in size and yield which persisted for five months. Similarly in peas (*Pisum sativum*), cotyledon excision before day 13 after germination caused a reduced rate of axis growth (Killeen and Larson 1968).

This trial was designed to investigate the effect of simulated insect damage to white clover seedlings on the subsequent growth of the plants.

METHOD

The trial was carried out in an unheated screenhouse during September to December 1979. Seed of 'Grasslands Huia' white clover was sown in 15.5 cm pots and thinned to six evenly spaced seedlings eight to ten days after germination. Treatments were applied as below on the basis of field observations of insect damage to seedlings at a similar stage of development. Each pot, with all seedlings treated alike, was replicated ten times.

Treatment	Days After Sowing	Nature Of Treatment
1	13	one cotyledon leaf removed
2	13	one and half cotyledon leaves removed
3	13	both cotyledon leaves removed
4	37	unfoliate leaf removed
5	55	complete defoliation without damage to the growing point
control	-	no treatment

Treatment 5 was included as a comparative example of 'severe' damage to the plant at a later stage of development, which would simulate herbivore grazing rather than insect damage.

TABLE 1: White clover seedling measurements at three stages following treatments simulating insect damage.

Treatment	Days after sowing											
	44		55		55		55		93		93	
	leaf length (mm)		length (mm)		dry† (wet) wt (mg)		number trifoliolate leaves		length (mm)		dry (wet) wt (mg)	
	unifoliolate	apical trifoliolate	shoots	roots	shoots	roots	shoots	roots	shoots	roots	shoots	roots
1	4.93*	4.51	31.1*	105.6	15.20 (124.20)	8.84 (71.24)	3.05	146.9	204.8	642.0 (4196)	303.3 (2646)	
2	3.94*	3.80*	26.8*	95.8	11.10 (94.68)*	6.52 (59.49)*	2.72	163.7	204.1	680.3 (4986)	260.0 (2346)	
3	3.05*	2.74*	19.1*	76.6*	5.27 (46.20)*	3.35 (28.27)*	2.23*	121.8*	203.6	323.4* (2676)*	162.0* (1613)*	
4	removed	4.64	26.6*	90.4	12.04 (120.97)	7.30 (64.48)*	2.70	165.8	208.0	818.6 (5523)	318.9 (2878)	
5	5.56	4.39	-	-	-	-	-	133.2*	182.4*	366.5* (2547)*	161.3* (1508)*	
control	5.80	5.05	34.8	98.3	15.66 (131.10)	10.41 (94.81)	2.92	156.2	218.5	744.6 (4748)	331.8 (2691)	
SEM	0.15	0.15	0.87	3.43	(6.97)	(4.97)	0.08	4.65	5.20	48.9 (325)	17.7 (177)	

* — significantly different to control ($P \leq 0.001$)

† — samples bulked for dry weights so confidence limits not available

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Forty-four days after sowing, the length along the mid-vein of both the unifoliate leaf and the apical leaflet of the first trifoliate leaf was measured for each seedling, and 11 days later the number of fully developed trifoliate leaves was recorded for each plant. Three seedlings were carefully removed from each pot and washed on day 55 for root and shoot measurements and green and dry weight estimates as were the remaining plants on day 93 when the trial was terminated.

RESULTS

Results are presented in Table 1. Measurements on day 44 show that treatments 1 to 3 resulted in seedlings with successively smaller leaves with those of treatment 3 plants reduced in length to almost 50% of that of the control plants. All treatments resulted in reduced shoot length on day 55 but by day 93 only treatments 3 and 5 retained significantly smaller plants. Root length was reduced at 55 days only in plants with both cotyledons removed but by the end of the trial they were not significantly shorter than those of intact plants.

The green and dry weights of shoots and roots of treatment 2 and 3 seedlings and roots of treatment 4 plants were considerably reduced in comparison with control plant weights on day 55. By the end of the trial, only treatments 3 and 5 resulted in plant yields which were significantly below that of the controls and they were reduced by 57% and 51% respectively.

The number of fully formed trifoliate leaves present on day 55 was significantly reduced in seedlings with both cotyledons removed.

Treatment 5 seedlings, which were defoliated on day 55, recovered to equal, and in some cases surpass the yield and size of seedlings subjected to treatment 3.

DISCUSSION

A lasting inhibitory effect of partial and complete removal of the cotyledon leaves has been demonstrated for white clover over a 93-day period. In field conditions, where plants are subjected to low temperatures, high winds and frequently to moisture stress, growth rate is relatively slow and seedlings remain in the cotyledon stage, vulnerable to insect feeding damage, for several weeks.

Although insect damage is more clearly defined when plants are destroyed, the effects of sublethal and seemingly superficial injury should not be underestimated, particularly in harsh environmental conditions.

Complementary work on the extent of seedling damage attributable to insects, the response of the insect fauna to clover introduction and the possibility of using insecticides to protect young clover seedlings is presently being undertaken.

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