EFFECT OF PASTURE COVER ON THE GERMINATION OF CERTAIN WEED SEEDS

H.T. PHUNG and A.I. POPAY

Research Division, MAF, Palmerston North

SUMMARY

Germination of some common pasture weed seeds was tested in the absence of pasture cover and under different heights of vegetation canopies. A vegetation canopy 6-7 cm high reduced the germination of nodding thistle (*Carduus nutans*) and giant buttercup (*Ranunculus acris*) seeds by up to 90%. The inhibitory effect of vegetation canopies on germination was less for Californian thistle (*Cirsium arvense*), stinking mayweed (*Anthemis cotula*), variegated thistle (*Silybum marianum*), ragwort (*Senecio jacobaea*) and Scotch thistle (*Cirsium vulgare*). Germination of gorse seeds (*Ulex europaeus*) was slightly increased compared with that on bare ground.

INTRODUCTION

Some pasture weeds appear in large numbers when pasture cover is removed or damaged. A good pasture cover can inhibit seed germination and suppress growth of weed seedlings by competition. Gorski *et al* (1978) and Silvertown (1980) have shown that germination of some species in a grassland flora was significantly lower under a leaf canopy than in diffuse white light.

In this study, the effect of pasture cover on the germination of some common pasture weeds was tested.

MATERIALS AND METHOD

Seeds of the species listed in Table 1 were collected in 1980 around Palmerston North, except for nodding thistle seeds collected from Waipawa and giant buttercup seeds from Woodville. Good seeds were selected and stored at room temperature. To break dormancy of gorse seeds, dry heat at 90°C was applied for 10 minutes.

Turves of sheep-grazed pasture with about 7 cm of topsoil were collected from Hauorongo Research Station and placed in plastic trays of 30 cm x 42 cm. The vegetation cover was subjected to one of three treatments:

- Paraquat sprayed (12 ml/litre) 10 days before sowing to remove the vegetation cover completely.
- Trimmed weekly to 2-3 cm high.
- Trimmed weekly to 6-7 cm high.

There were five replicates of each sward treatment, arranged in randomised blocks in a glasshouse.

Fifty seeds of each of three weed species were sown onto the soil in each tray, using plastic netting to mark the positions of the seeds. Emerged seedlings were counted regularly and removed for up to 35 days.

An additional experiment with the same treatments was carried out in a growth room at constant temperature of 20°C, 70-75% humidity and 14 hours day length maintained by artificial light.

A light meter, Lambda LI-170, and two sensors were used to measure radiations: a quantum sensor LI-190S for wave lengths 400-700 nm and a near infra red sensor LI-220S for wave lengths around 780 nm. Radiation in the glasshouse was measured on 29.4.81 under a sunny and clear sky.

34th Proc. N.Z. Weed and Pest Control Conf.

Pasture Weeds

RESULTS AND DISCUSSION

Effects of vegetation cover on germination are shown in Table 1. Short vegetation significantly reduced germination in nodding thistle, Californian thistle and ragwort while long vegetation reduced germination in those species and also in Scotch thistle, variegated thistle, giant buttercup and stinking mayweed. The effect of long vegetation on germination was greater than that of short vegetation in Scotch thistle, variegated thistle and giant buttercup. Compared with germination on bare ground, the long vegetation reduced germination by about 90% in nodding thistle and giant buttercup but the same canopy only reduced germination by 30% in Scotch thistle. In gorse, germination was greater under long vegetation than on bare ground.

TABLE 1: Percentage germination at 35 days after sowing in the glasshouse experiment.

Species	Bare ground	Short pasture	Long pasture	LSD (5% level)	Date
Scotch thistle	68.6	60.6	49.3	18.6	Jul-Aug 80
Scotch thistle†	62.0	57.5	42.0	7.3	Aug-Sep 80
Nodding thistle	38.3	12.0	4.5	24.4	Jul-Aug 80
Nodding thistle†	46.0	5.0	1.0	8.9	Aug-Sep 80
Gorse	86.2	92.8	98.3	10.8	Jul-Aug 80
Gorse†*	4.5	6.5	13.0	5.6	Aug-Sep 80
Variegated thistle	36.0	28.4	13.6	12.8	Jan-Feb 81
Giant buttercup	50.8	34.4	3.6	18.3	Jan-Feb 81
Stinking mayweed	37.6	26.0	12.8	13.5	Jan-Feb 81
Californian thistle	78.8	36.4	22.0	17.8	Mar-Apr 81
Ragwort	30.8	14.4	15.2	9.6	Mar-Apr 81

† Results from a repeat experiment, at 29 days after sowing.

* Seeds collected from soil under gorse canopy, no heat treatment applied.

The incidence of red and far-red light under the different experimental conditions is shown in Table 2. Red light was strongly absorbed by the vegetation and the long pasture absorbed more than the short pasture. Far-red light was also absorbed, but to a much lesser extent. The ratio of red to far-red light was therefore lower under long vegetation than under short vegetation and much lower in both cases than in the absence of vegetation.

TABLE 2: Incidence (watt/m²) of red (400-700 nm) and far-red light (780 nm) at the soil surface.

	Bare ground	Short pasture	Long pasture
<i>Glasshouse</i>			
Red	344	15	3.7
Far-red	12.8	8.1	7.0
Red/Far-red ratio	26.9	1.9	0.5
<i>Growth room</i>			
Red	10.5	4.9	0.9
Far-red	0.8	0.6	0.4
Red/Far-red ratio	13.1	8.2	2.3

Pasture Weeds

TABLE 3: Percentage germination at 30 days after sowing in the growth room experiment.

Species	Bare ground	Short pasture	Long pasture	LSD (5% level)
Scotch thistle	60.4	49.6	49.6	19.9
Nodding thistle	72.0	57.2	23.6	19.5
Gorse	34.0	53.2	58.4	17.5

In the growth room experiment, short vegetation reduced germination of Scotch and nodding thistle, but not significantly (Table 3). Long vegetation reduced nodding thistle germination by 67% but did not significantly reduce Scotch thistle germination. Again gorse seed germination was greater under long vegetation than on bare ground.

The effect of a leaf canopy in reducing germination in some species is well-known (Silvertown 1980) and can be attributed to a decrease in the red/far-red ratio in the transmitted light affecting the phytochrome system in imbibed seeds. Such a mechanism prevents a seed from germinating under conditions which may make seedling establishment difficult. An additional factor which could operate is the response of seeds to diurnal fluctuations of temperature, which are likely to be greater on bare ground than beneath a vegetation cover, and which can stimulate the germination of seeds of some species. However, at least with nodding thistle, presence of a pasture canopy affected germination even at constant temperature.

In practical terms the actual mechanism which causes reduced germination beneath a pasture canopy is unimportant. Good pasture cover inhibited germination of many of the pasture weeds studied here and can be seen as a major factor in preventing weed invasion.

ACKNOWLEDGMENT

The authors are grateful to Mr D.K. Edmonds and Miss L.A. Lyttle for their assistance.

REFERENCES

- Gorski, T., Gorska, K. and Rybicki, J. 1978. Studies on the germination of seeds under leaf canopy. *Flora* 167: 289-299.
- Silvertown, J., 1980. Leaf-canopy-induced seed dormancy in a grassland flora. *New Phytol.* 85: 109-118.