**PASTURE GRASSES AND WHITE CLOVER UNAFFECTED BY
AN INUNDATIVE APPLICATION OF *SCLEROTINIA*
*SCLEROTIORUM***

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SUMMARY

A sheep-grazed pasture in Canterbury was treated in the spring of 1992 with either a mycelium-on-wheat formulation of the fungus *Sclerotinia sclerotiorum* at 500 kg/ha or MCPA at 1.5 kg/ha. The response of the pasture species to these two treatments was assessed on four occasions. MCPA reduced the yield of white clover by 85%, 90%, 74% and 71% at 23, 65, 118 and 168 days after treatment respectively. By contrast there was no evidence that the *Sclerotinia* mycoherbicide had any effect on either the grasses or the clovers.

Keywords: *Sclerotinia sclerotiorum*, white clover, ryegrass, MCPA, tolerance

INTRODUCTION

The fungus *Sclerotinia sclerotiorum* has been shown to be pathogenic on pasture weeds such as Californian thistle (*Cirsium arvense*) (Bourdôt *et al.* 1993), giant buttercup (*Ranunculus acris*) (Green *et al.* 1993), ragwort (*Senecio jacobaea*), Scotch thistle (*Cirsium vulgare*), winged thistle (*Carduus tenuiflorus*) and nodding thistle (*Carduus nutans*) (Waipara and Harvey 1993). This pathogen has been the subject of field evaluation as a potential mycoherbicide for use in the control of some of these species in pasture.

Perennial ryegrass (*Lolium perenne*) and white clover (*Trifolium repens*) are the dominant species present in much of the high-producing grassland in New Zealand. For *S. sclerotiorum* to be acceptable as a mycoherbicide in pastures it must be demonstrated that such pasture species are tolerant of the fungus at herbicidal application rates. There are no records of *S. sclerotiorum* being a pathogen of either ryegrass or white clover. Observations in the glasshouse at Lincoln showed that *S. sclerotiorum* had no effect on ryegrass and caused only transitory foliage lesions on white clover.

The herbicide MCPA is currently recommended for the control of thistles and buttercups in pasture at rates of 1.1 to 2.25 kg/ha, with at least 1.5 kg/ha needed to control Californian thistle. Ragwort can be controlled by 2,4-D at rates of 1.5 kg/ha or more. Both of these herbicides damage clovers. Thompson (1956) showed that mortality of seedling clover plants was greater than 50% with applications of 1.1 kg/ha of MCPA. Maclean (1957) and Meeklah (1958) showed reductions in clover productivity of 30% to 80% with MCPA at an application rate of 1.1 kg/ha. The effects may persist for 9 months after spring and autumn applications (Meeklah and Mitchell 1984; Honore *et al.* 1980).

This experiment sought to compare the pasture tolerance of an inundative application of *S. sclerotiorum* in a weed-free perennial ryegrass and white clover pasture, with that of MCPA at its recommended application rate.

METHODS

The experiment was conducted on border-dyke irrigated pasture on a Templeton silt loam at the Templeton Research Farm, in Canterbury. The pasture was a 12 year

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old perennial ryegrass (cv. Ellett) and white clover (cv. Huia) sward which was free of Californian thistle.

The treatments were MCPA applied at 1.5 kg/ha (IWD MCPA, 375 g/litre), and a mycelium-on-wheat preparation of *S. sclerotiorum* applied at 500 kg/ha. An untreated control was also included. The experimental mycoherbicide utilised a wild strain of *S. sclerotiorum* (S9) collected from Californian thistle in Canterbury in the summer of 1990. When plated on potato dextrose agar at the time of field application the preparation had approximately 15000 colony-forming units per gram. Plots were 2 m wide extending across the 10 m width of a border replicated six times in a randomised block layout.

Treatments were applied in the morning of 2 November 1992 to pasture which was damp after morning fog. The *S. sclerotiorum* preparation was applied at 500 kg/ha using a 1 m wide granule applicator. MCPA was applied with a nitrogen-gas powered precision sprayer delivering 200 litres/ha through Teejet 8002 nozzles at 210 kPa.

Pasture productivity was assessed by electronic probe calibrated by herbage cuts from two 0.2 m² quadrats per plot (Crosbie *et al.* 1987), on 25/11/92, 6/1/93, 1/3/93 and 20/4/93. The fresh herbage was dissected into grass, clover, weed and dead matter and oven dried at 80°C. Following each harvest the plots were mob-stocked with sheep then machine mown to a uniform height after stock were removed.

Data were subjected to analysis of variance. Dry matter yields of ryegrass and clover were logarithm ($\log_{10}$) transformed prior to analysis (Fig. 1). Weed and dead matter yields were not transformed (Fig. 2). In Weed dry matter in this Figure, the LSD can only be used for comparing untreated with the *S. sclerotiorum* treatment. The MCPA treatment was omitted from the analysis because there were no weeds in several plots.

Figure 1: The effect of *Sclerotinia sclerotiorum* and MCPA on the productivity of ryegrass and clover on four occasions after treatment. Yields given as backtransformed means of the logarithms ($\log_{10}$) of the data. Values above each group of three treatments are the Least Significant Ratios ($P < 0.05$). Treatment means are significantly different if the ratio between them is greater than the LSR (eg. for the first occasion, one clover dry matter mean differs significantly from another mean if it is 1.8 times greater).

RESULTS

The dry matter yields of white clover and ryegrass on the four harvest occasions are given in Figure 1. The yield of white clover was greatly reduced by MCPA at each of the four harvests. The percentage reductions were 85%, 90%, 74% and 71% at 23, 65, 118 and 168 DAT respectively. *S. sclerotiorum* reduced the clover yields at 65 and 118 DAT but these reductions were not significant. Neither MCPA nor *S. sclerotiorum* reduced ryegrass yields but MCPA increased them by 22% at 65 DAT and 20% at 118 DAT.

The dry matter yields of weeds and dead plant material are given in Figure 2. The population density of weeds on the experimental site was low; the dominant species was dandelion (*Taraxacum officinale*) and there were scattered plants of broad-leaved dock (*Rumex obtusifolius*), narrow-leaved plantain (*Plantago lanceolata*) and catsear (*Hypochaeris radicata*). The combined dry matter yield of these weeds was markedly reduced by MCPA but *S. sclerotiorum* had no effect. Dead matter was unaffected by the treatments.

Figure 2: The effect of *Sclerotinia sclerotiorum* and MCPA on the productivity of weeds (see text for species) and dead matter on four occasions after treatment. The vertical bars are the LSD ($P < 0.05$) values for comparing untreated and *S. sclerotiorum* in the case of weeds and for comparing all three treatments in the case of dead matter.

DISCUSSION

This experiment again demonstrated the severe effects of MCPA on pasture composition, because it depressed the productivity of white clover. This effect was both immediate and persistent, lasting for almost an entire growing season. Previous research has attempted to determine the effect on livestock production. For example, Hartley and Thomson (1982) reported that repeat applications of MCPA at 1 kg/ha, reducing clover cover by 37%, caused an 18% reduction in liveweight gain in young dairy cattle. Lewis (1956) showed that a single application of MCPA at 1.1 kg/ha gave approximately 75% reduction in clover productivity resulting in a 15% reduction in liveweight gain in pre-weaned lambs during the month immediately following treatment.

Concurrent experiments using the mycoherbicide in the same field as the current experiment, showed that *S. sclerotiorum* was highly pathogenic towards Californian thistle indicating that conditions were conducive for the fungus at the experimental site. Despite this, there was no evidence from the experiment that *S. sclerotiorum* affected the productivity of white clover. However the lower mean dry matter yields at 65 and 118 DAT, although not significant, suggest that there may have been a transient effect. Further experimentation is required to verify this. Any real effect of *S. sclerotiorum* on white clover is insignificant in comparison to the marked and persistent damage caused by MCPA.

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