INFECTION OF NINE WHITE CLOVER CULTIVARS BY *SCLEROTINIA TRIFOLIORUM* AND *DITYLENCHUS DIPSACI*

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SUMMARY

Four year old plots of nine cultivars of white clover (*Trifolium repens*) were evaluated with and without nematicide from August 1986. Clover rot by *Sclerotinia trifoliorum* was scored in July-September of 1986 and 1987. 'Grasslands Kopu' was the least affected cultivar in each season. In 1987 clover rot was more severe on the sub-plots which had received nematicide. *Ditylenchus dipsaci* damage was noted in early spring 1987. 'Kopu' was again the least affected cultivar, confirming earlier observations.

INTRODUCTION

Nine cultivars of white clover were established at Rukuhia, near Hamilton, in September 1982 to evaluate their agronomic performance under Waikato conditions. The trial was affected by stem nematode (*Ditylenchus dipsaci*) during spring 1983, when cv 'Grasslands Kopu' showed greatest tolerance (West and Steele 1986). In August 1986 half of each plot was treated with nematicide to control root feeding nematodes of clover. Clover rotting by *Sclerotinia trifoliorum* was observed in the late winter/early spring in 1986 and 1987. A further minor outbreak of stem nematode occurred on the untreated plots during spring 1987. Effects of these pathogens on pasture production or persistence of white clover have not been demonstrated in New Zealand although they are considered important in Europe (Cook *et al* 1984; Rhodes and Webb 1987). Observations of the effects of these infestations on different cultivars are presented in this paper.

METHODS

The trial on Horotiu sandy loam was maintained largely as described by West and Steele (1986), except that half of each plot was treated with nematicide giving subplots of 2 m × 3 m. Treatment included oxamyl (Vydate 24 EC) 5 kg/ha (15.8.86, 13.10.86, 19.3.87, 13.4.87, 11.9.87, 4.12.87) and fensulfothion (Dasanit 10 G) 12 kg/ha (18.8.86, 20.2.87, 20.8.87). Fensulfothion was applied to reduce populations of whitefringed weevil (*Graphognathus leucoloma*) and grass grub (*Costelytra zealandica*) which occurred at low densities at the commencement of treatment (28 and 8/m² on 17.7.86 respectively). Herbage production was assessed from the inner 1.5 m plot width using a rotary mower set to 35 mm. Cuts were taken every three weeks with less frequent cutting during winter and during summer drought. Foliar N and P levels were analysed from the herbage usually on alternate harvests. Maintenance dressings of P and K as 50% serpentine superphosphate were applied in spring and autumn. Seasonal incidence of a variety of weeds was usually removed by hand, although paraquat (Gramoxone) 140 g/ha was applied to two blocks at a time, 3 weeks apart from 16.7.87 to control *Compositae*, *Oxalis* spp. and *Sagina procumbens*.

Sclerotinia trifoliorum causes rotting foliage and sometimes stolons usually in late winter. *Sclerotinia* damage was scored (Table 1) by counting the circular, sometimes coalescing, damaged patches which were approximately 150 mm in diameter. All sub-plots were similarly scored for damage the following year.

Stem nematode was not evident in 1986, but appeared on non-treated sub-plots in September and October 1987. Affected patches of characteristic damage (isolated patches of clover showing shortening and thickening of leaves and petioles) were similar in size, and were scored in a similar manner to *Sclerotinia*.

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Data were analysed after a square root transformation. Raw data, and SED's from analysis of raw data (omitting values < 2), are presented as conclusions are essentially the same. The SED's given are only an average because these differ for different comparisons. In 1987 damage scores for *Sclerotinia* in untreated, and for *Ditylenchus* in treated sub-plots were nearly zero. Cultivar means are therefore given for treated *Sclerotinia* and untreated *Ditylenchus* sub-plots respectively.

RESULTS AND DISCUSSION

Sclerotinia rotting of foliage, and sometimes stolons, appeared in July 1986, increased until September and disappeared with the onset of active growth in October (Table 1), leaving some dead patches. In 1987 incidence of clover rot declined after application of paraquat and then became significantly greater on the sub-plots treated with nematicide ($P < 0.001$). Thus the lower infection which developed in 1987 in some cultivars, compared with 1986 (Fig. 1) may relate to the foliage burnoff and reduced humidity in the canopy after paraquat application in July. Reasons for the greater damage on nematicide treated plots are unclear. Herbage moisture levels were consistently higher on treated plots from soon after commencement of nematicide treatments ($P < 0.001$). This may have resulted from a reduction in root feeding nematodes (Wilcox-Lee and Loria 1987). A more dense sward on treated sub-plots which became apparent from summer 1986/87 may also have made moisture conditions more favourable for *Sclerotinia* within the canopy. Treated clover herbage, which contained higher levels of N or P during summer and autumn, may have favoured initiation of the disease (Williams and Haggard 1984).

TABLE 1: *Sclerotinia trifoliorum* damage scores on nine cultivars in 1986 and 1987 and *Ditylenchus dipsaci* damage scores in 1987¹.

Cultivars ²	<i>Sclerotinia trifoliorum</i>					<i>Ditylenchus</i>			
	1986					1987			
	12 Jul	15 Aug	4 Sept	24 Sept	2 Jul	10 Sept	24 Sept	10 Sept	1 Oct
Kopu (NZ)	0.0	1.3	1.8	0.0	1.0	2.0	1.5	0.5	1.5
Aran (I)	0.0	2.5	8.5	2.3	1.0	2.8	2.8	0.3	9.0
Blanca (B)	0.3	4.5	13.5	3.3	3.5	3.3	7.3	2.8	5.0
Donna (UK)	0.5	8.8	18.5	2.5	5.5	5.3	10.0	1.3	4.3
Sabeda (F)	1.8	13.8	24.0	4.5	13.5	12.3	26.8	0.8	6.3
Huia (NZ)	2.5	20.0	35.3	4.3	11.0	5.5	10.3	3.3	9.0
Nesta (UK)	2.3	21.5	44.0	2.3	6.5	8.8	12.0	2.5	7.8
Menna (UK)	2.8	13.5	31.0	5.3	12.5	7.5	12.3	2.8	9.8
Pitau (NZ)	6.5	32.0	46.5	2.8	11.5	5.0	9.5	2.5	16.3
SED	2.9	8.3	11.6	2.6	6.2	3.1	5.4	1.1	4.4
Nematicide									
Treated					7.3	5.8	10.3	0.1	0.0
Untreated					4.7	0.6	0.7	1.8	7.6

¹ Raw data. 1987 scores based on nematicide treated (*Sclerotinia*) and non-treated sub-plots (*Ditylenchus*). Scores represent the number of patches about 150 mm diameter affected by each pathogen.

² Country of origin Belgium (B), France (F), Ireland (I), New Zealand (NZ), United Kingdom (UK).

'Grasslands Kopu' was least affected by *Sclerotinia* in both seasons (Fig. 1). Relative infection of the remaining cultivars, with the exception of 'Aran', was consistent with British susceptibility ratings taken over a number of years (NIAB 1973-86). 'Aran' was least affected after 'Kopu' at Rukuhia, compared with a most susceptible 'D' rating given it since its inclusion in British trials in 1981/82. The difference may be due to its greater winter growth activity, shared with 'Kopu', in the Waikato. Grasslands cultivars 'Pitau' and 'Huia', as well as 'Sabeda', were among the

most heavily infected at Rukuhia, consistent with their "D" ratings in Britain. 'Blanca' has shown some resistance to *Sclerotinia* in Britain (B rating since 1972/3) while 'Nesta' (C-D), 'Donna' and 'Menna' (both B-D) have shown greater variability. By contrast, a Dutch cultivar 'Retor' has been consistently "A" rated in Britain, showing that cultivars with high levels of resistance to *Sclerotinia* are available.

In cultivars in which there was a wide range in *Sclerotinia* incidence between plots at Rukuhia e.g. 'Pitau', 'Menna' and 'Nesta', there was a direct relationship between *Sclerotinia* score and herbage yield during the period of the outbreak (Fig. 3), when yields on the most heavily infected plots were reduced by half. Clover rot occurs widely in New Zealand pasture and can also cause losses in red clover (*T. pratense*) (Ledgard *et al* 1987). It may pass unnoticed, however, since its visible symptoms occur when clover is usually a minor component of the sward. Its effects may therefore be underestimated since clover defoliation and stolon death occur at a time of greatest competition from grass, which would lead to a longer term suppression of the clover in mixed swards.

Ditylenchus symptoms appeared in September 1987, but the infection did not cause plant death and disappeared during October. The outbreak was almost completely controlled by the nematicide treatment (Table 1). Cultivar susceptibility was in broad agreement with the results of West and Steele (1986) for the same trial (Fig. 2). 'Kopu' was selected in an environment of high *Ditylenchus* populations (Van den Bosch *et al* 1986). Resistant lines of 'Pitau' have also been selected (Cooper and Williams 1983), although not commercially released (W.M. Williams pers. comm.). The remaining cultivars showed generally similar susceptibility rankings as those in screening trials of Cook and Evans (1988).

Fig. 1: Mean damage scores for *Sclerotinia trifoliorum* in 1986 and 1987 in nine white clover cultivars (omitting July 1987 — 2 blocks scored only).

Fig. 2: Cumulative damage scores for *Ditylenchus* in 1987 compared with % area affected in 1983 (West and Steele 1986) in nine white clover cultivars.

Stem nematode is not easily observed in northern pastures and damage is probably more visible in establishing clover. It appears to proliferate in pure or spaced plantings of clover (Williams and Barclay 1972; Cooper and Williams 1983; Cook *et al* 1984). The effect of *Ditylenchus* in mixed pasture is probably similar to that of *Sclerotinia* rot, with a reduction in competitive vigour of clover in early spring (Cook *et al* 1984).

Whatever their effects on pasture productivity in New Zealand, both *Sclerotinia*

and *Ditylenchus* are considered to significantly reduce clover persistence in Europe and plant breeding programmes are underway to develop resistance (Rhodes and Webb 1987; Cook and Evans 1988). It will become a necessity for New Zealand breeders to include resistance to these pests, as is evident in 'Grasslands Kopu', in order to remain competitive in international seed markets.

Fig. 3: Effect of *Sclerotinia trifoliorum* on yield of individual 'Pitau' plots during winter/spring, 1986. Vertical bars represent range in values for 'Kopu' (■ = nematicide treated, ● = non-treated.)

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