THE EFFECT OF ARGENTINE STEM WEEVIL ON COCKSFOOT AND TALL FESCUE WHEN SOWN WITH RYEGRASS

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SUMMARY

The effects of Argentine stem weevil (*Listronotus bonariensis*) on young cocksfoot (*Dactylis glomerata*) and tall fescue (*Festuca arundinacea*) sown with endophyte (*Acremonium loliae*)-infected and endophyte-free perennial ryegrass (*Lolium perenne*) were assessed. Adult stem weevils fed 8.5 times more on cocksfoot, and 1.5 times more on tall fescue than on endophyte-infected ryegrass, about equally on cocksfoot and endophyte-free ryegrass, but 7.1 times more on endophyte-free ryegrass than on tall fescue. Endophyte-infected ryegrass conferred no resistance against stem weevil attack to the companion grass species. These species acted as hosts for stem weevil with larvae transferring to infected ryegrass, causing considerable tiller death and poor herbage production.

INTRODUCTION

Farmers in ryegrass staggers prone areas are interested in escaping the Argentine stem weevil-endophyte-ryegrass staggers dilemma. Reducing the intake of toxin by stock grazing infected pastures is a useful management tool to reduce the severity of ryegrass staggers. Dilution of endophyte-infected ryegrasses with another grass or legume species may also be a useful way of reducing the intake of toxic ryegrass, and therefore, reducing the severity and duration of ryegrass staggers (Keogh 1986).

Over the last decade, a number of new grass cultivars have been released by Grasslands Division, DSIR. These grasses were bred to complement and to outproduce ryegrass at critical feed times, e.g. late summer-early autumn. Cocksfoot is the most widely sown grass after ryegrass (Sangakkara *et al* 1982) and is usually sown with ryegrass. Once established, 'Grasslands Wana' cocksfoot competes well with ryegrass and generally persists well under rotational grazing (Lancashire and Brock 1983). It has good summer and autumn production in drought prone regions and is reasonably tolerant of grass grub (*Costelytra zealandica*) attack. Cocksfoot seedlings are a highly favoured host of stem weevil (Barker *et al* 1984). 'Grasslands Roa' tall fescue is a most useful grass on peat soils where it has shown superior summer production to ryegrass. It is fairly tolerant of grass grub attack and shows considerable promise in areas with chronic grass grub problems (e.g. Volcanic Plateau, Taranaki). Barker *et al* (1984) recorded considerable tiller death due to stem weevil larvae, and large yield differences between insecticide treated (to remove stem weevil) and untreated plots of 'Grasslands Roa' tall fescue in the Waikato.

The objective of this study was to obtain information on the relative susceptibility of tall fescue and cocksfoot to stem weevil, and to determine whether the resistance of endophyte-infected ryegrass could protect companion grass species in small plot trials.

METHODS

i) Leaf comb tests

Alternate 30 mm length leaf segments of either 'Grasslands Roa' tall fescue or 'Grasslands Wana' cocksfoot with either endophyte-infected or endophyte-free 'Ellett' perennial ryegrass were presented to adult stem weevil in a leaf comb test in petri dishes with moist filter paper as described by Kain *et al* (1982). Ten adult stem weevils were enclosed in each dish at $18 \pm 2^\circ\text{C}$ and left to feed for 48 hours. The weevils were then

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removed and the feeding damage expressed as a feeding index (Prestidge *et al* 1985). There were 10 replicates of each treatment.

ii) Small plot studies

Swards of 'Grasslands Roa' tall fescue/endophyte-infected or endophyte-free 'Ellett' and 'Grasslands Wana' cocksfoot/endophyte-infected or endophyte-free 'Ellett' were established in 1 x 0.5 m plots (plastic troughs) of sieved Horotiu sandy loam soil at Ruakura on 13 September 1985. Seed was sown in alternate rows (row spacing 100 mm) of ryegrass (15 kg/ha) with either cocksfoot (10 kg/ha) or tall fescue (25 kg/ha). Endophyte-free 'Ellett' was obtained by using old seed. The swards were handweeded to ensure purity. At establishment all plots received 500 kg/ha of 30% potassic superphosphate and 50 kg N/ha of calcium ammonium nitrate. Thereafter plots received 25 kg N/ha of calcium ammonium nitrate after each production cut.

There were five replicates of each treatment arranged in a randomised block design. Troughs were raised above the ground and were 200 mm apart with 1.5 m between the blocks.

On 30 October 1985, the plots were trimmed to 5 cm and 50 adult stem weevils (1.3♂:1♀) hand-netted from local Ruakura pastures were released onto each plot. The percentage of stem weevil killed tillers was estimated by counting the number of live and dead tillers in one 200 mm length of each row/plot. The number of stem weevil larvae was estimated by heat extracting larvae from 200 tillers of each grass species/plot.

Ten ryegrass tillers from each plot were selected at random, stained and examined for the presence of *A. loliae* endophyte in November 1985. The percentage infection was $95 \pm 2\%$ in infected plots and 0 in uninfected plots. 'Roa' tall fescue and 'Wana' cocksfoot are not known to contain endophytes harmful to stem weevil.

Herbage production was measured from 1 November 1985 to 30 April 1986, by cutting and bulking herbage of similar species within each plot (cutting height 3 cm). The swards were growing vigorously when the plots were seeded with insects and conditions were generally favourable for pasture growth throughout the period that herbage production was measured. A sprinkler irrigation system was used once in November 1985 to maintain soil moisture levels.

Fig. 1: Relative feeding damage in choice tests between cocksfoot/ryegrass and tall fescue/ryegrass. Note that the 4 tests are independent of each other. (+) endophyte-infected; (-) endophyte-free.

RESULTS

Leaf comb tests are a sensitive test for comparison of the susceptibility of grasses to adult stem weevil. Cocksfoot had 8.5 times more adult feeding than endophyte-infected ryegrass (Fig. 1) and about the same amount as endophyte-free ryegrass. Tall fescue had only 1.5 times more adult feeding than infected ryegrass. Adult damage on uninfected ryegrass was 7.1 times greater than on tall fescue. These results suggest that adult stem weevils feed on cocksfoot and uninfected ryegrass to the same degree, on tall fescue somewhat less and to a negligible degree on endophyte-infected ryegrass.

It has been estimated that stem weevil account for 90-95% of dead ryegrass tillers in infested pasture (Goldson, Pottinger, pers. comm.). In the small plot trial, the percentage of dead tillers increased through summer and autumn (Table 1). Tall fescue was the first grass to be significantly damaged by stem weevil larvae and on average nearly 40% tiller death was recorded by mid-December. By early April, virtually all tall fescue, cocksfoot and uninfected ryegrass, and about half of endophyte-infected ryegrass tillers, had been killed by stem weevil larvae. Stem weevil larval densities in mid-February (Table 1) reflected the relative proportion of dead tillers recorded at this time.

TABLE 1: The percentage of grass tillers killed by Argentine stem weevil larvae and the number of larvae per 200 grass tillers in mid-February in ryegrass/cocksfoot and ryegrass/tall fescue mixed swards.

Cultivar/treatment	% killed tillers				Larvae 10.2.86
	16.12.85	13.1.86	17.2.86	9.4.86	
Endophyte-infected ryegrass/ cocksfoot	5	21	37	48	4
	3	50	88	95	7
Endophyte-infected ryegrass/ tall fescue	5	11	28	52	3
	41	74	97	100	18
Endophyte-free ryegrass/ cocksfoot	12	49	85	90	10
	4	54	95	91	9
Endophyte-free ryegrass/ tall fescue	14	44	85	82	18
	38	78	98	97	16
SED	3.1	4.1	2.7	2.2	1.9

Fig. 2: Herbage production (kg DM/ha) in summer (1 Nov-31 Jan) and autumn (1 Feb-30 April) of cocksfoot/ryegrass and tall fescue/ryegrass mixed swards in small plots. (+) endophyte-infected; (-) endophyte-free.

The initial production cut (30 October) showed uniform grass production, with the individual grass components differing between plots by less than 15% of the mean. The high tiller death was reflected in poor summer production, especially in grasses without endophyte (Fig. 2). Tall fescue production was extremely low probably because stem weevil had on average killed 40% of available tillers by the first production cut and over 75% by the second cut (mid-January) (Table 1). Cocksfoot and endophyte-free ryegrass production was also reduced in summer relative to infected ryegrass but production was not as severely affected as tall fescue. Autumn production of cocksfoot and endophyte-free ryegrass was very low because on average 82-95% of the grass tillers had been killed by stem weevil larvae (Table 1). Herbage production of endophyte-infected ryegrass in Autumn was less than in summer with 50% of tillers killed by stem weevil larvae by early April.

DISCUSSION

The present results confirm that young swards of cocksfoot and tall fescue are particularly susceptible to Argentine stem weevil attack. In the small plot trial, larval damage on tall fescue was initially greater than either endophyte-free ryegrasses or cocksfoot which may suggest that larvae prefer to feed on tall fescue or that tall fescue was unable to tolerate larval damage as well as ryegrass and cocksfoot. Tall fescue is known to establish slowly in its first 12 months and the inability to tiller rapidly may make this grass prone to stem weevil attack and difficult to establish in the field. Cocksfoot/perennial ryegrass mixtures are currently being advocated by farm advisors and seed merchants. The results of this study and experience at attempting to establish cocksfoot/white clover swards without insecticide protection in the central North Island and Waikato regions (Prestidge unpubl. data) would suggest that very few cocksfoot plants survive past the first year. A better economic option for the farmer would be to sow endophyte-infected ryegrass/white clover mixtures.

A major agronomic feature which emerged from the present study was the high percentage of endophyte-infected ryegrass tillers killed by stem weevil larvae. About 95% of tillers were infected by endophyte so there were not enough endophyte-free tillers to account for the amount of damage recorded on this treatment. Clearly, endophyte-infected ryegrasses in the seedling stage do not deter stem weevil larvae which reinforces the importance of adult deterrence as the primary source of endophyte related resistance. Prestidge and Gallagher (1985, unpubl. data) have reported the presence of larval toxins and growth retardants in endophyte-infected ryegrass. Retarded larval growth may actually exacerbate plant damage as a larva would require more endophyte-infected tillers to complete development than one feeding on uninfected ryegrass.

The number of stem weevil introduced into plots in the present study (100 weevils/m²) represents a realistic density commonly found in spring populations in susceptible areas in the Waikato and central North Island. Sowing endophyte-infected ryegrasses with other susceptible grasses in regions recognised as major stem weevil "hot-spots" may only enhance the stem weevil population build-up, leading to a depletion of ryegrass as larvae transfer from susceptible grasses to feed on endophyte-infected ryegrasses. Such a pasture grass mix may therefore lead to a weaker and less productive pasture after stem weevil attack, than if an endophyte-infected ryegrass/white clover pasture was sown.

Grasses like cocksfoot and tall fescue may be useful in diluting stock intake of endophyte-infected ryegrass and thereby reducing ryegrass staggers if establishment and persistence could be improved. Results from pure pasture species trials evaluated in the Waikato (Barker *et al* 1984) and central North Island (Prestidge unpubl. data) have shown that virtually all endophyte-free grasses are susceptible to stem weevil attack as 1 year old plants. Even 3 and 4 year old plants of cocksfoot and tall fescue are regularly attacked by stem weevil. Their lack of persistence may also be associated with the presence of annual weed grasses especially *Poa annua* which is a very favourable host of stem weevil. Damage is accentuated when combined with drought stress at the time of stem weevil attack. The only agronomically useful grass that has shown considerable

tolerance of stem weevil attack is 'Grasslands Matua' prairie grass (*Bromus willdenowii*).

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