THE EFFECT OF ARGENTINE STEM WEEVIL ON ANNUAL RYEGRASS SOWN IN FEBRUARY IN NORTHERN NEW ZEALAND

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SUMMARY

A screenhouse pot trial and two field trials were conducted in 1991 and 1992 to determine the susceptibility of early autumn (February) sowings of annual ryegrass (*Lolium multiflorum*) to Argentine stem weevil (*Listronotus bonariensis*) attack. Adult population densities of 35/m² reduced annual ryegrass seedling survival and dry matter yield by 33.1% and 31%, respectively, after 28 days compared to 22.6% and 26.3% for perennial ryegrass (*L. perenne*). Most seedling mortality occurred within the first 7 days after germination. In the field trials, herbage yields up to the first grazing were increased by 29% and 30% in 1991 and 1992, respectively, on insecticide treated areas. The increased yield on insecticide treated plots was attributed to a complex of soil dwelling pests at densities below individually recognised threshold levels. In 1991, February sowings resulted in an extra 2000 kg DM/ha by early June compared to sowing in early March, but there was no similar advantage in 1992.

Keywords: pasture pests, annual ryegrass, damage assessment

INTRODUCTION

Argentine stem weevil (*Listronotus bonariensis* (Kuschel)) can be particularly damaging to annual ryegrass (*Lolium multiflorum* Lam.) (eg. Prestidge 1991). In newly sown annual ryegrass, damage to seedlings can be caused by adults and larvae from the previous sward and/or by immigrating adults which feed and oviposit on the new seedlings. A recommended technique for avoiding Argentine stem weevil larvae damage is to delay sowing annual ryegrasses until the egg laying period has passed. The cessation of egg laying, which is mediated by photoperiod (Goldson and Penman 1979) is usually finished by early March.

The most appropriate time to sow new pastures in the Waikato is in the autumn (March/April). However, occasionally there may be opportunity to sow in February and thereby extend the period of autumn growth. The risk of Argentine stem weevil damage to February sowings of annual ryegrass in the Waikato dairying region is unknown. The large flights that allow Argentine stem weevil to rapidly colonise new areas, such as occurs in Canterbury, are absent in the Waikato (Barker *et al.* 1988). Thus, the greater risk is likely to be from Argentine stem weevil resident in the pasture at the time of renovation.

This paper describes experiments which evaluates the effects of Argentine stem weevil on annual ryegrass seedlings, and which evaluates the impact of Argentine stem weevil in early sowings of annual ryegrass in the Waikato region of New Zealand.

METHODS

Pot trial

Seeds of *L. multiflorum* cv. Concord and *L. perenne* cv. Ellett (98% infected with the endophyte *Acremonium lolii*) were planted into 17 cm² pots containing sterilized potting mix in mid-February 1991. Pots were maintained in an insectary at the Ruakura Agricultural Research Centre and were watered as required. At 6 days (Concord) and

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8 days (Ellett) after planting, seedlings were counted and Argentine stem weevil adults, collected from local pastures the previous evening, were released at six densities (0–519/m², Fig 1) onto the pots. Adults were confined to the pots with fine mesh netting. Each density was replicated six times and the pots were located as randomised blocks within the screenhouse. The mesh netting was carefully removed at 7, 14 and 21 days and live and dead seedlings were counted. All seedlings were harvested after 28 days, by cutting herbage to the level of the potting mix, oven drying the herbage at 60°C for 48 h and weighing. Results were analysed by ANOVA.

Field trials

The first field trial in 1991 was conducted at the Ruakura Agricultural Research Centre on three adjacent 0.25 ha paddocks. Soils were silt or clay loams. A split plot experimental design was used with three main plot treatments located at random within six block replicates. Main plots (each 8 x 50 m) were sown on (i) 8 February 1991; (ii) 26 February; (iii) 14 March. Sub plots were insecticide treated or untreated. About 1 week before sowing each area was sprayed with glyphosate (1.08 kg/ha). The herbicide treated area was grazed 5 days after spraying and immediately before sowing, to a herbage residual of about 900 kg DM/ha after which annual ryegrass cv. Concord was cross-drilled (10 kg/ha each way). Subplots (8 x 25 m) were sprayed with 0.5 kg/ha of oxamyl (Vydate) insecticide 1 day before glyphosate treatment and were also treated with 3 kg/ha isazophos (Miral 5G) at sowing to eliminate both above and below ground invertebrates. After the first grazing the plots were managed as part of the normal farm rotation.

Herbage mass on each subplot was estimated with a capacitance pasture probe before grazing. Twenty probe readings were made per subplot and a seasonal calibration equation (L'Huillier and Thomson 1988) was used to calculate herbage mass.

Soil invertebrate populations on each subplot were estimated before and 3–4 weeks after sowing by soil coring, wet sieving and flotation in saturated MgSO₄ solution. Invertebrates from ten soil cores (15 cm diam) were extracted per subplot. Densities of Argentine stem weevil larvae were estimated by heat extraction from 200 randomly selected ryegrass tillers cut at ground level per subplot.

A second field trial in 1992 used different paddocks to those used in 1991. Experimental design, site preparation, sowing rates and assessments were similar to Trial 2. Oxamyl insecticide was not applied in 1992. The sowing dates were (i) 13 February 1992; (ii) 29 February; (iii) 19 March.

Results were analysed by ANOVA. Means of invertebrate counts were binomially transformed before analysis.

Figure 1: The percentage of live Concord (A) and Ellett (B) ryegrass seedlings after 21 days at a range of adult Argentine stem weevil (ASW) densities.

RESULTS

Pot trial

Argentine stem weevil adults had a major effect on the survival of seedling ryegrasses (Fig. 1) with more than 90% Concord and 45% Ellett seedlings killed after 21 days at densities of 519/m². All seedling death was caused by adults biting into the primary leaf of the grasses or shredding at the base of the primary leaf. The trial was halted after 21 days because the surviving seedlings had started to initiate new tillers, there were only a few live weevils observed and the mesh netting was interfering with plant growth. The greatest effect on seedling survival occurred in the first 7 days after germination. Dry matter yields reflected seedling survival (Fig 2).

Figure 2: Yield (g DM/pot) of Concord and Ellett ryegrass seedlings after 28 days at a range of adult Argentine stem weevil (ASW) densities. (SED = standard error difference of the mean, $P \leq 0.05$).

Field trials

In the 1991 trial herbage yield from sowing to the first grazing (47 to 53 days growth) and then from the first grazing to 7 June are presented in Table 1. February sowings had accumulated approximately 2000 kg DM/ha more than the March sowings (Table 1) by 7 June.

TABLE 1: Herbage yields (kg DM/ha) of annual ryegrass cv. Concord from sowing to the first grazing (Period I) and from the first grazing to 7 June 1991 (Period II, and with (T) and without (U) insecticide.

Sowing Date	Herbage yield					
	T	Period I		Period II		U
8.02.91	2118		1774	2366		2403
26.02.9	2583		1820	1992		2034
14.03.91	1357		711	1142		1055
SED Sowing date		113***			223 ***	
SED Insecticide		55***			107 NS	
SED Interaction		132*			180 NS	

NS Not significant at $P = 0.05$; ** $P < 0.05$; *** $P < 0.001$

Insecticide treatment increased herbage yield only during the first growth period by approximately 600 kg DM/ha. The significant interaction between sowing date and insecticide treatment is primarily due to the low yields measured on the 14 March sowing date.

Autumn 1992 was drier than autumn 1991 (rainfall Feb to May 1991, 258 mm; 1992, 187 mm) and herbage growth was slower (Table 2), such that the February sowings did not yield any advantage over the March sowing. Insecticide treatment increased herbage yield by 30.4% during period I but there was no insecticide effect during period II (Table 2). There was no interaction between sowing date and insecticide treatment in 1992.

Argentine stem weevil populations immediately prior to insecticide treatment were 13, 6 and 17/m² (1991) and 6, 9 and 5/m² (1992) on the early February, late February and March sowings, respectively. Populations of other recognised pasture pests (*Heteronychus arator* F.; *Graphognathus leucomela* Boheman; *Costelytra zealandica* White; *Inopus rubriceps* MacQuart) occurred at low densities and these were not consistently reduced by insecticide application. However, insecticide application significantly reduced ($P < 0.001$) total pest density in 1991 (Table 3). The reduction in total pest density in 1992 due to insecticide treatment was not significant at ($P < 0.05$) primarily because of low numbers.

TABLE 2: Herbage yields (kg DM/ha) of annual ryegrass cv. Concord from sowing to the first grazing (Period I) and from first grazing to 29 July 1992 (Period II), and with (T) and without (U) insecticide.

Sowing Date	Herbage yield			
	T	Period I U	Period II T	Period II U
13.02.92	1566	1030	2376	2476
29.02.92	1020	606	2861	2841
19.03.92	1304	1073	2825	2726
SED Sowing date		91 ***		273 NS
SED Insecticide		85 ***		82 NS
SED Interaction		138 NS		291 NS

NS Not significant at $P = 0.05$; *** $P < 0.001$;

TABLE 3: Densities (No./m²) of soil dwelling invertebrate pests on plots sown at different times with (T) and without (U) insecticide. (Sowing dates 8.2.91, 26.2.91, 14.3.91; 13.2.92, 29.2.93, 19.3.92).

Sowing Date	Pest density			
	T	1991 U	1992 T	1992 U
Early February	31	66	9	18
Late February	53	69	10	12
March	38	66	15	18
SED Sowing date		7.5 NS		3.6 NS
SED Insecticide		6.2 ***		2.9 NS
SED Interaction		10.7 NS		5.1 NS

NS Not significant at $P < 0.05$; *** $P < 0.001$

DISCUSSION

Small populations of adult Argentine stem weevil had an adverse effect on the survival and yield of annual and perennial ryegrass during the first 3–4 weeks growth (Fig. 1, 2). The greatest effect was within the first 7 days after germination. More than 30% of Concord and only 12% of Ellett seedlings were killed by populations of 35/m² confirming the susceptibility of Concord to Argentine stem weevil. All seedling death was caused by adults biting into the primary leaf of the grasses or shredding at the base of the primary leaf. There was no seedling mortality attributable to larval feeding. The inability of the endophyte fungus *A. lolii*, to protect perennial ryegrass seedlings from adult Argentine stem weevil during the first 7 days after emergence was demonstrated (Fig. 1) and confirms the results of Stewart (1985).

By early June in 1991 the February sowings had produced approximately 2000 kg DM/ha more than the March sowing. This extra production was at a time of the year when farmers attempt to conserve feed for grazing in winter and early spring. The increased autumn production from the February sowings did not increase annual herbage production, as spring grass growth was lower, compared to that from the March sowings. There was no production gain from February sowings in 1992 possibly because of low rainfall which delayed germination and reduced seedling growth.

Insecticide treatment significantly increased the yield up to the first grazing at all sowing dates. This effect was not apparent in subsequent grazing periods. This may reflect short term effects of the insecticide or that invertebrate feeding had ceased with the start of winter (as in the case of black beetle), or that the grasses had grown sufficiently large to tolerate a degree of invertebrate feeding. No individual insect species was identified as responsible for the loss of yield from these trials. Argentine stem weevil populations were too low (5–17/m²) to cause the difference in yields between insecticide treated and untreated areas. However, as is common with pastures in the northern North Island, a complex of pasture pests occurred. Most plots had soil dwelling pests at densities below recognised damage threshold levels. However it is possible, particularly in 1991, that the combined pest complex was high enough to cause significant yield depressions in seedling ryegrass. Soil rhizosphere microorganisms and plant feeding nematodes were not involved in the observed yield increases in 1991 (Prestidge *et al.* 1993).

The potential risk of Argentine stem weevil damage to February sowings in the Waikato region of New Zealand is largely from populations resident in the pastures at sowing. When the adult population exceeded 35/m² in pot trials the damage to annual ryegrass was approximately 30% with the greatest amount of damage occurring in the first 7 days after emergence. When initial seedling growth is slow due to low soil moisture levels, sowings in February maybe at considerable risk from moderately low pasture pest densities. However with adequate soil moisture levels, sowings in February may provide a significant advantage in yield over later sowings.

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REFERENCES

- Barker, G.M., Prestidge, R.A. and Pottinger, R.P., 1985. Strategies for Argentine stem weevil control: Effects of drought and endophyte. *Proc. N.Z. Grassl. Assoc.* 47: 107–114.
- Barker, G.M., Prestidge, R.A. and Pottinger, R.P., 1988. Reproductive phenology of *Listronotus bonariensis* (Kuschel) (Coleoptera: Curculionidae) in northern New Zealand pastures. *Bull. Ent. Res.* 78: 659–668.
- Goldson, S.L. and Penman, D.R., 1979. Effect of time of sowing on Argentine stem weevil (*Hyperodes bonariensis* (Kuschel)) damage in autumn-sown Tama ryegrass. *N.Z. J. Agric. Res.* 22: 367–371.

- L'Huillier, P.J. and Thomson, N.A., 1988. Estimation of herbage mass in ryegrass/white clover dairy pastures. *Proc. N.Z. Grassl. Ass.* 49: 117-122.
- Prestidge, R.A., 1991. Susceptibility of annual ryegrasses (*Lolium multiflorum* Lam.) to Argentine stem weevil (*Listronotus bonariensis* (Kuschel)) feeding and oviposition. *N.Z. J. Agric. Res.* 34: 119-125.
- Prestidge, R.A., Watson, R.N. and Thom, E.R. 1993. Invertebrate pests associated with Italian ryegrasses in northern New Zealand. *Proc. XVII Int. Grassl. Congress*: 934-935.
- Stewart, A.V., 1985. Perennial ryegrass seedling resistance to Argentine stem weevil. *N.Z. J. Agric. Res.* 28: 403-407.