RYEGRASS CONTENT, *ACREMONIUM* ENDOPHYTE AND ARGENTINE STEM WEEVIL IN PASTURES IN THE VOLCANIC PLATEAU

R.A. PRESTIDGE, M.E. DI MENNA, S. VAN DER ZIJPP,
D. BADAN

Ruakura Soil & Plant Research Station, MAF, Private Bag, Hamilton

SUMMARY

A survey in March/April 1984 of 40 perennial ryegrass (*Lolium perenne*) pastures on the yellow brown pumice soils of the central North Island revealed that the ryegrass content in the sward declined from 90-95% at establishment to an average of 35% after 3 years. Almost all the ryegrasses surviving for more than 4-6 years were infected by the endophyte *Acremonium loliae*. Pastures with a high proportion of *A. loliae*-infected ryegrass had low populations of Argentine stem weevil (*Listronotus bonariensis*) and suffered little stem weevil damage. The decline in the ryegrass content of pastures and the increase in the relative proportion of *A. loliae* infection is interpreted as being due to sowing low *A. loliae*-infected ryegrass seedlines and to Argentine stem weevil selectively killing the *A. loliae*-free ryegrasses.

INTRODUCTION

In recent years, the value of endophyte-infected ryegrass in increasing summer and autumn ryegrass yield and persistence in the volcanic plateau has become apparent and, as a result, the associated Argentine stem weevil control is now an important aspect of management by farmers involved in pasture renovation. In spite of this however, many farmers persist in using perennial ryegrass seed that has a low rate of infection with viable endophyte. This may comprise seed with a low initial endophyte incidence (eg. 'Grasslands Ruanui') and /or seed that has been in storage for a number of years since harvest. The endophyte may die if seed is kept in storage for greater than 12-15 months at ambient temperatures (Lloyd 1959).

While *Acremonium loliae* suppresses stem weevil activity and maintains low populations (Prestidge *et al* 1982; Barker *et al* 1983, 1984a & b) the fungus also appears to be responsible for ryegrass staggers, particularly during late summer and autumn (Mortimer *et al* 1984).

With the above characteristics in mind a survey of 40 pastures to the north and north east of Lake Taupo in the central North Island of New Zealand was carried out in March/April 1984. Among the objectives of the survey were:

- (1) To assess the ryegrass content in differently aged pastures.
- (2) To estimate Argentine stem weevil populations and damage to ryegrass.
- (3) To estimate the proportion of ryegrass plants infected with *A. loliae*.

Furthermore, a supplied questionnaire asked the farmer to indicate the age of the pasture, the original cultivar sown and whether or not ryegrass staggers had been observed on that particular paddock.

This contribution summarises the findings of the survey.

METHODS

The area concerned was restricted to pastures on yellow brown pumice soils primarily because they are drought-prone and because Argentine stem weevil has been observed to be an important pasture pest in this region (Prestidge *et al* 1984). The survey was designed to include a range of soil fertilities and management classes. The age distribution of the pastures surveyed reflected a bias towards younger pastures which are more favourable to stem weevil than older pastures.

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In March/April 1984 each site (paddock) was subdivided into 4 for the purposes of sample replication. From each quarter of the paddock the pasture composition was estimated using point analysis with 10 frames of 10 points taken at 10 m spacings.

Argentine stem weevil populations were estimated by taking twenty 7.5 cm diam. soil cores from each quarter paddock and extracting adults and soil stages by wet sieving and flotation procedures (Barker and Prestidge, unpublished). The few late developing larvae and pupae that were also extracted using this technique have been added to the numbers of adults to give a total stem weevil population estimate. Twenty 5 cm diam. soil cores/quarter paddock were also taken to record the number of ryegrass tillers killed and the total number of ryegrass and other grass tillers present. The number of killed ryegrass tillers were also found to give an indirect check of the adult stem weevil population estimation.

The proportion of ryegrass plants infected by *A. loliae* was estimated by examination of a leaf sheath from one tiller from each of 10 plants/quarter paddock. Sheaths were stained by heating in lacto-phenol-cotton blue for 5-10 min. and were scanned at 400 x magnification for the presence of the septate, parallel, strongly staining hyphae of *A. loliae*. A second endophyte, characterised by weakly staining and very branched hyphae, was also seen but its incidence was low.

Fig. 1: The relationship between the year of sowing and the ryegrass content in the sward.

Fig. 2: The relationship between the year of sowing and the percentage of ryegrass infected by *A. loliae*.

Fig. 3: The relationship between the percentage of ryegrass infected with *A. loliae* and Argentine stem weevil density.

Fig. 4: The relationship between the percentage of ryegrass infected with *A. loliae* and the percentage of ryegrass tillers killed by Argentine stem weevil.

RESULTS

Of the 40 pastures surveyed, 19 (47%) were less than 2 years old, 12 (30%) were 3-6 years old and 9 (23%) were 10 years or older.

The proportion of ryegrass in the swards declined as the age of the pasture increased (Fig. 1). After an initial rapid decline over a 2-3 year period the proportion of ryegrass was fairly constant at about 35% of the sward (range 3-56%). However even in some 1 and 2 year pastures the ryegrass content was less than 50% (range 28-98%).

Two species of endophytic fungi were recorded. *Acremonium loliae* was present at infection levels from 4-98% (Fig. 2). *Gliocladium* sp was present at less than 5% incidence (except in one paddock at 43%). Apart from some first and second year old pastures, *A. loliae* incidence was high with variability decreasing with increasing age of the pasture. The number of 1 to 2 year pastures with a high *A. loliae* incidence reflect the impact of Ellett ryegrass to this district whilst there was still a small number of farmers who had sown cvs Ruanui and Nui seed (over the last 3 years) and/or who had stored seed for 12 months or more before sowing.

As expected stem weevil population density was negatively correlated with the incidence of *A. loliae* (Fig. 3) (Prestidge *et al* 1982) although populations were generally lower in 1983/84 than previous years (eg. Prestidge *et al* 1985). Even with *A. loliae* incidence of 70-95%, sufficient feeding sites were available on uninfected ryegrass and other grass species to support stem weevil populations of up to 170/m² (Fig. 3).

The number of ryegrass tillers killed by stem weevil larvae was also found to be negatively correlated with the incidence of *A. loliae* (Fig. 4) and the correlation between stem weevil density and the percentage of ryegrass tillers killed was strongly positive, $Y = 0.1X + 3.3$; $r = 0.76$ ($P < 0.001$) where $Y = \%$ ryegrass tillers killed and $X =$ stem weevil/m².

DISCUSSION

Poor ryegrass persistence in the volcanic plateau may be caused by a number of factors acting together or by a single major factor within adequate limits of soil fertility, grazing pressure, droughts and insect damage. From the present survey which concentrated on the effects of Argentine stem weevil, it can be deduced that the overall ryegrass content in the swards examined had decreased from 90-95% in the year of establishment to an average of 35% some 2 to 3 years later; from thereon ryegrass content remained at, or slowly declined from this level. Furthermore almost all of the surviving ryegrasses were found to be infected by *A. loliae*. Pastures with a high proportion of *A. loliae*-infected ryegrass had low populations of Argentine stem weevil and consequently suffered little stem weevil damage; conversely pastures with low proportions of *A. loliae*-infected ryegrass suffered significant ryegrass tiller damage in summer and early autumn. Stem weevil had selectively killed the *A. loliae*-free ryegrasses and this had reduced the ryegrass content and increased the relative proportion of infected ryegrass in the pastures.

Although the data are not presented according to the original ryegrass cultivar sown, analyses on ryegrass content, *A. loliae* infection and stem weevil populations and damage on cv. Nui showed similar trends to the analyses on bulked cultivars. In the literature there is no evidence to suggest that *A. loliae*-free perennial ryegrass cultivars differ in susceptibility to stem weevil. The major point is whether or not ryegrasses are infected by *A. loliae*. If they are free from *A. loliae* then pastures are at risk from stem weevil attack. To this effect the consistent incidence of *A. loliae* in freshly harvested Ellett was probably one of the reasons why 80% of perennial ryegrass seed sold in the volcanic plateau area in 1984 was Ellett (R. Prestidge, unpublished data). Moreover, although the seasonal and annual yield differences between cv. Nui and Ellett grown under similar conditions with similar *A. loliae* infections are minor (Goold 1982) commercial seedlines of cv. Nui have been found to have a variable incidence of *A. loliae* infection (Scott 1983).

Most farmers were aware of ryegrass staggers and some have reported instances of young stock being affected on recently sown Ellett and some Nui pastures. Ryegrass staggers on older pastures has not been reported widely probably because until recently

there has been a relatively low ryegrass content in the sward after about 2-3 years. However now that most seed sown in this region is highly infected with *A. loliae* it is likely that the incidence of ryegrass staggers in stock will increase. In spite of this most farmers surveyed were still found to consider the combined advantages of increased summer and autumn ryegrass production and increased ryegrass persistence to be more important than ryegrass staggers in deciding the ryegrass seedline to sow.

To increase ryegrass yield and persistence in the volcanic plateau farmers must use recently harvested seed of cv. Nui, Ellett or local "ecotype" perennial ryegrasses. Only by sowing these seedlines with a high incidence of *A. loliae* infection will they effect stem weevil control and increase ryegrass persistence.

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