

GRASS GRUB: COPING WITHOUT CHEMICAL CONTROL

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Abstract

A field experiment lasting four years in the Carew district of mid-Canterbury, investigated the recovery of ryegrass pasture severely damaged by grass grub. Overdrilling with grasses was unsuccessful, in this instance being done too late in spring. The time course of recovery of damaged pasture without and with insecticide was compared against resowing after a barley crop with either Ruanui or Nui ryegrasses, Maru phalaris or Matua prairie grass.

Recovery of ground cover from damaged pasture was through infill by weed grasses and white clover. Insecticide maintained more ryegrass herbage. Yields from renovated pasture in autumn were considerably lower than those from renewed pasture. However, the renewed pasture was again generally severely damaged by grass grub within two years. The exception was Maru phalaris which was tolerant of grass grub. Yield of herbage from Maru in autumn was however lower than from more severely damaged Matua pasture.

Successful experience elsewhere with overdrilling Nui ryegrass into grass grub-damaged pasture is mentioned when such pasture was heavily stocked under wet soil conditions in early winter, then overdrilled in late winter.

Keywords: Grass grub, pasture renovation, renewal, overdrilling, tolerant grasses, biological control

INTRODUCTION

In the Carew district of mid-Canterbury, grass grub (*Costelytra zealandica* White) attack of pasture is considered a major problem by farmers. Farming is predominantly livestock pastoral with some cereal cropping largely necessitated by the need to renew grass grub damaged pasture. Insecticide has traditionally been the main method for grass grub control, but because of escalating costs of insecticide and grass grubs developing resistance to some of the chemicals (Trought & Brumley, 1978), reappraisal of control methods was requested by the farming community.

Our particular approach arose from considering the effects of a long term cultivation trial that had initially created different levels of grass grub mortality (French - unpublished data). Through deep ploughing in October, grub numbers were significantly reduced in the following year, but were little affected if ploughing occurred any later than early November. Pasture that was sown that autumn into the later-ploughed plots was severely damaged. However, over a subsequent 4 year period this pasture self-repaired to an acceptable level of pasture production and composition. Over the same time pasture sown on the October-ploughed plots became badly damaged.

Self-repair is seldom considered by farmers because the visual damage seems too great to consider this option as feasible. However, false-colour infra-red photography of this trial as well as other grass grub damaged pasture in Canterbury, indicated that the area of undamaged pasture was usually considerably under-estimated by eye appraisal. (Pearson 1979)

In investigating the possibilities for self-repair, practical questions to consider were:- the time taken for satisfactory repair, the composition of the repaired pasture, and whether or not assistance such as overdrilling grass was required. This needed to be compared with the standard district procedure of cultivation, cropping and resowing.

MATERIALS AND METHODS

The experiment was conducted on a ryegrass pasture sown in autumn 1975, to which lindane had been applied in June 1976, but was severely damaged by grass grub in winter 1978. Part of the trial area was ploughed in spring 1978 and sown with barley, The remainder was periodically grazed until March 1979 when it was treated as follows: (hereafter renovated treatments)

Renovation

- (a) Control (Fig. 1) -- nothing done
- (b) Insecticide recovery. Granular fensulfothion applied in autumn 1979 and annually thereafter (renovate in Fig. 1).
- (c) Overdrilled in spring 1979 with a mixture of 'Grasslands Nui' ryegrass and 'Grasslands Maru' phalaris.
- (d) Overdrilled in spring 1979 as in (c) into plots which had fensulfothion applied the previous autumn and annually thereafter.

The rate of fensulfothion was 2 kg a.i./ha applied in early April. The grass mixture (20 kg/ha of Nui and 4 kg/ha of Maru) was overdrilled with a triple disc drill in mid-October 1979.

Following a barley crop, grasses were drilled with 3 kg/ha of white clover into cultivated soil in autumn 1979 -- (hereafter renewal treatments):

Renewal

- (e) Ruanui ryegrass -- 20 kg/ha
- (f) Nui ryegrass -- 20 kg/ha
- (g) Maru phalaris -- 4 kg/ha
- (h) Matua prairie grass -- 20 kg/ha
- (i) Mixture of Nui and Maru -- (20 kg/ha and 4 kg/ha)

All treatments were drilled with 1 kg a.i./ha of diazinon granular insecticide. No insecticide was applied in the years thereafter.

There were 2 replicates of all treatments, but because the overdrilling treatments (c) and (d) failed they were included in the data analysis as extra duplicates of treatments (a) and (b).

Plot size was 23 m x 20 m for renovated and 15 m x 20 m for renewal. The treatments were periodically grazed at suitable intervals to encourage good growth and/or recovery of the pasture. The only pasture measurements taken were herbage yields for the period when autumn spelled, following first autumn rains, up to either May or June. Yield was calculated from cutting four 0.25m² quadrats per plot. To assess number of grass grubs, ten spade-square samples/plot were dug in May, five from visibly damaged and five from undamaged areas. In August, a false-colour infrared aerial photograph was taken to determine the % area damaged by grass grub in each plot (Pearson 1979). Grass grub numbers given in Fig. 1 were weighted as follows:

$$\text{grass grubs/m}^2 = \frac{\bar{x} \text{ number/m}^2 \text{ in damaged area} \times \% \text{ area damaged}}{100} \\ + \frac{\bar{x} \text{ number/m}^2 \text{ in undamaged area} \times \% \text{ area undamaged}}{100}$$

RESULTS AND DISCUSSION

(a) Renovated Treatments

The overdrilling of treatments (c) and (d) was unsuccessful because it was done too late in spring (mid-October). Repeat overdrillings in early September 1980 and August 1981 were also not successful because of the now considerable competition towards establishing seedlings from browntop, hairgrass and goose-grass. On the basis of successful grass establishment from overdrilling in trials carried out elsewhere in Canterbury (French - unpublished data), we now consider that overdrilling should be done in late July — early August. It is also necessary that any weed grasses in damaged pasture be removed by herbicides or by heavy stocking prior to overdrilling.

Fig. 1 shows the area of pasture damaged, dropped from 56% in 1979 to 18% in 1982. The use of insecticide obviously prevented further pasture damage in the early stages, but by 1982 its effect was only marginally better. The grass grub population decreased dramatically from 1979 to 1980 in the control plots. An increase in population in 1981, although to similar overall density as for 1979, caused less pasture damage because the larvae were clumped into a smaller damaged area. In the following year the population collapsed resulting in slight reduction in area damaged but more notably in reduction in grub numbers from 334/m² to 110/m².

Research carried out by Trought et al (1982) on an adjacent paddock reported the bacterium (tentatively identified as *Hafnia alvei*) was associated with a dramatic collapse of the grass grub population in that paddock. It has been our inherent belief that a factor in the natural or assisted repair of damaged pasture is through such natural regulators as bacteria remaining undisturbed and apparently effective by not cultivating grass grub-damaged pasture. In the trial area-only 2% of the grass grubs in 1982 were so diseased (T. Jackson, pers. comm). The low numbers of grass grubs in that year could have been a reflection of the severe and protracted drought in 1982.

Fensulfothion kept grass grub low throughout the trial period, but significantly did not get rid of all the grubs.

Pasture yields in autumn from the control treatment were low, not exceeding 600 kg DM/ha. Yields in the protracted autumn drought of 1982 were not measured. The failure to gain any marked difference in autumn herbage yield with insecticide treatment in 1979 despite marked reduction in grub numbers and subsequently in area damaged, reflected the initial high level of damage in both treatments. Damage to ryegrass, without insecticide treatment, continued beyond the time of that yield measurement in autumn 1979. In subsequent years the difference in herbage yields between control and insecticide treatments in autumn were wider, although area damaged did not differ as much as in 1979. This reflects higher yield from ryegrass on the insecticide treatment compared to the 'infill' of lower yielding grasses on the control treatment.

(b) Renewed Pasture

Fig. 1 shows that the renewed pastures were being slightly infested by grass

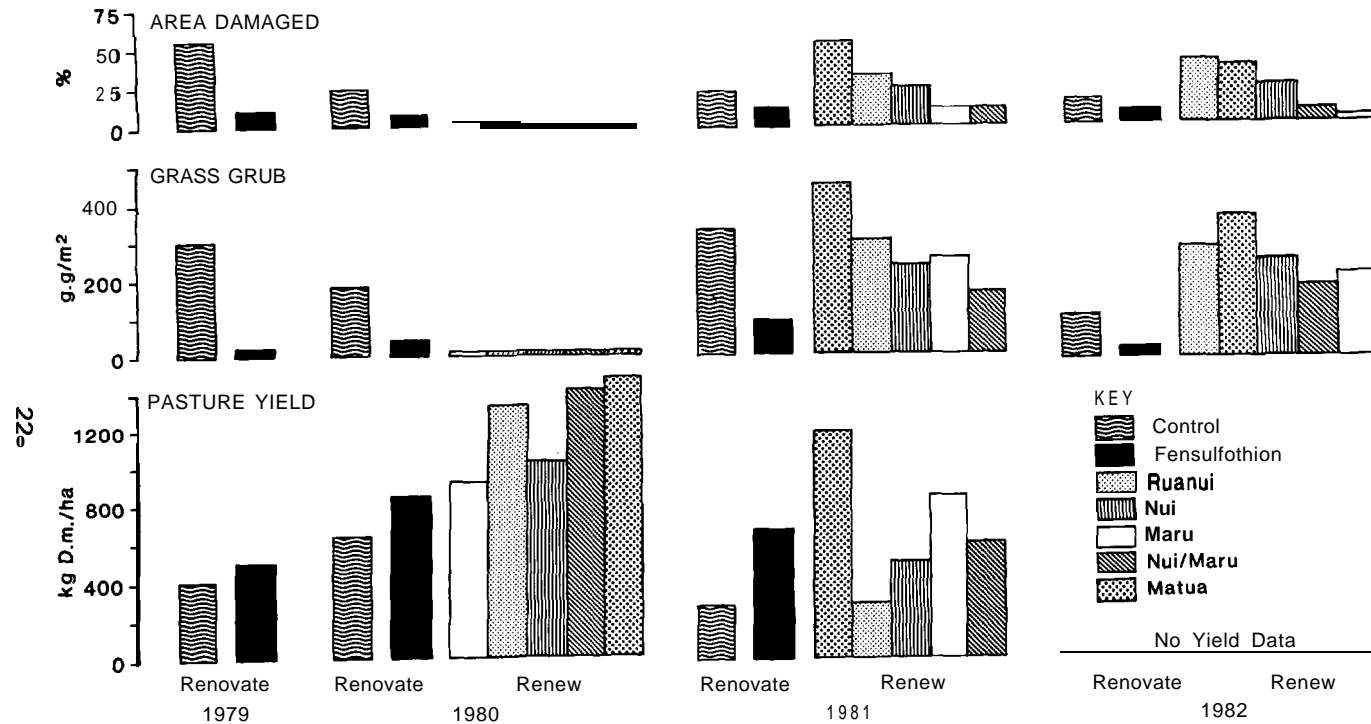


Fig 1. Renovation and renewal of pasture severely damaged by grass grub; area damaged in July, peak grub numbers in May, pasture yield in autumn.

grub within a year from sowing and markedly in the second year with the area damaged ranging from 14-60%, low values being for Maru and Nui/Maru mixtures. Kain et al (1979) showed tolerance of Maru per se to grass grub attack, but not in association with white clover. There was little white clover growth over summer and autumn on the present trial site. Although Matua plots had highest grub numbers and greatest area damage they gave highest pasture yield, considerably exceeding that from renovated pasture. The grub tolerant Maru does not appeal as a dryland pasture grass unless persistence is the absolute requirement and the trial period was too short to determine this.

(c) General

Unaided repair of severely damaged pasture over four years, although regaining ground cover, did not give high enough pasture yield compared to the alternative of cropping and pasture resowing. Thus, successful overdrilling of grasses is a necessary requirement.

An example of successful renovation was demonstrated on a paddock close to the trial site. The severely damaged pasture was overdrilled with Nui ryegrass in late winter 1980. In May 1982, the population of grass grubs was down to 152/m² (370/m² in May 1980) and about 10% were disease infected (T.Jackson, pers. comm). It is hoped this level of disease will permit only a low population of grass grub over the next three years at least.

It is stressed that with overdrilling renovation, the pasture should be regarded by the farmer as a new sowing, requiring appropriate grazing practice. Set-stocking with a few killers or cull ewes is not appropriate.

As an alternative means of grass grub control to cropping; resowing, and insecticide use, the aim may now be to encourage and maintain a low population of grubs with their associated diseases. This approach could be the fore-runner to the practical control of grass grubs by pathogens and other biological control agents (Jackson & Trought 1982). Or, as another alternative the use of grass grub-tolerant Roa tall fescue (East et al/ 1979) requires investigation both under dry-land and irrigated conditions.

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