

## THE EFFECT OF PASTURE FEED ON OFFER IN SPRING ON PEST POPULATIONS AND PASTURE PRODUCTION

M. GRIMM<sup>A</sup>, M. HYDER<sup>B</sup>, P. DOYLE<sup>B</sup>, and P. MICHAEL<sup>C</sup>

<sup>A</sup>Entomology Branch, Dept of Agriculture, Albany, W.A. 6330

<sup>B</sup>Sheep Industries Branch, Dept of Agriculture, Albany, W.A. 6330

<sup>C</sup>Entomology Branch, Dept of Agriculture, South Perth, W.A. 6151

### SUMMARY

Grazing annual pastures to defined levels of feed on offer (FOO) through spring significantly reduced redlegged earthmite (RLEM, *Halotydeus destructor* Tucker) numbers compared to set stocked plots. Effects carried over to the break of season in the following year, presumably because fewer aestivating eggs were produced in the previous spring. Insecticides controlled RLEM for all grazing treatments, with significant increases in dry matter production only recorded for set stocked treatments. Spraying did not change "sheep grazing days" where pastures were maintained at FOO levels of 1400 and 2800 kg DM/ha through spring. These results indicate that grazing management offers a tool for managing RLEM on farms, with potential decreases in use of insecticides.

**Keywords:** redlegged earthmites, pests, grazing management.

### INTRODUCTION

Redlegged earthmite (RLEM, *Halotydeus destructor* Tucker) and lucerne flea (LF, *Sminthurus viridis* Linnaeus) have been recognized as pests of subterranean clover (SC, *Trifolium subterraneum* L.) since the 1930's (Norris 1944). Bluegreen aphid (BGA, *Acythosiphon kondoi* Shinji) has colonised the southern agricultural areas of Australia since 1979 and has become a major pest of pasture legumes including SC (Franzmann *et al.* 1979; Brennan and Grimm 1992). Losses in pasture production caused by these pests have been estimated at \$238 million annually (Sloane *et al.* 1988).

Most of the evidence for losses in dry matter (DM) production is from experiments where grazing animals were excluded from plots, and pests were controlled with insecticides. Wallace and Mahon (1963) concluded that heavy infestations of RLEM and LF cause significant losses in DM production, especially in spring, but that the value in lost animal production was questionable because many pastures are under-grazed at this time. We are not aware of published data that examines relationships between grazing practices and the population dynamics of RLEM, LF or BGA in annual SC based pastures. Grazing intensity has been shown to affect other pasture pests (Roberts and Morton 1985) and invertebrate fauna of grasslands (Hutchinson and King 1980). This paper presents results from the first year of an experiment investigating relationships between RLEM populations, pastures grazed to defined levels of feed on offer (FOO), pasture production and numbers of sheep carried through the spring.

### MATERIALS AND METHODS

The experiment commenced in 1992 on the Manurup Annexe of Mount Barker Research Station (34°34'S, 117°31'E). The climate is Mediterranean, average rainfall 620 mm, with 75% of rain falling between May and November. Pastures consisted of SC (predominantly cv. Trikkalla and cv. Esperance) with volunteer grasses (*Lolium rigidum* Gaudin, *Hordeum leporinum* Link, *Vulpia* spp., *Bromus* spp., *Poa annua* L.) and capeweed (*Arctotheca calendula* L. (Levyns)). The soils are forest sandy gravelly loams over clay. A maintenance dressing of 90 kg/ha superphosphate (9.1% P, 10% S, 24% Ca) was applied in 1992. The plots had been used for 3 years in supplementary feeding experiments and were stocked with 10 adult or 12 weaner sheep/ha over summer-autumn until 19 June 1992. All plots were destocked from 19 June to 24 July 1992.

Treatments were applied in 3 blocks and consisted of 3 grazing practices, with and without pest control (total of 18 plots). Grazing treatments were FOO maintained at 1400 kg DM/ha or 2800 kg DM/ha in spring (0.5 ha plots), and set stocking at the district average of 8 wethers/ha through spring (1 ha plots). Pests were either not controlled or insecticides applied to remove RLEM, LF and BGA. Within blocks, pest treatment plots were grouped together, with grazing treatments completely randomised over the plus and minus pest plots.

The FOO on each plot was assessed weekly from 14 July 1992 using the visual appraisal and calibration methods described by Thompson *et al.* (1994). On the basis of FOO measurements and estimates of weekly growth rates, non-experimental sheep were added or removed from plots to maintain

FOO at target values of 1400 and 2800 kg DM/ha through spring. Once pastures stopped growing at the end of spring, plots were set stocked at 8 sheep/ha through summer, autumn and winter. Differential grazing treatments were not applied in autumn or winter of 1993 because no pastures had grown to 1400 kg DM/ha during this period. Pasture growth rates were measured using exclosure cages shifted every 3-4 weeks, and total DM production calculated for the period between 4 August and 3 December.

Between 24 July and 5 August 1992, 1-year-old non-experimental wethers grazed set stocked plots at 8 sheep/ha and 1400 and 2800 kg DM/ha plots at differential rates depending on the FOO present. On 5 August, 1-year-old merino wethers (experimental sheep  $n = 8/\text{plot}$ ) which had been stratified on a liveweight (LW) basis were randomly allocated to plots. Sheep of similar age were used to maintain target FOO levels. The numbers of sheep grazing each plot at any time were recorded and “sheep grazing days” between 24 July and 19 November were calculated. Experimental sheep were removed from all treatments when pastures were thought to have stopped growing on 19 November, after which non-experimental sheep grazed each plot at 8 wethers/ha until spring 1993. New weaners replaced the 1992 animals at shearing in March 1993.

Dimethoate (Rogor® 400 g a.i./lE.C.) was applied at 100 mL/ha of product in 100 L/ha spray volume on 2 and 26 June 1992. Insecticide was re-applied on 10 and 24 July 1992, 10 November 1992 and 8 June 1993 using dimethoate (Roxion® 400 g a.i./L) at a rate of 300 mL/ha product in 100 L/ha spray volume. A tractor mounted spray boom fitted with flat fan nozzles was used each time. Insects and mites were collected from pasture into vials containing 70% ethanol using a suction machine based on the design of Wallace (1972). An area of 227 cm<sup>2</sup> (17 cm diameter) was sampled at each placement of the machine. Samples were taken randomly while walking a “W” shaped transect across each plot, and were spaced to adequately cover the plot area. Samples were taken on 22 September 1992 ( $n = 30$  samples/plot), 6 November 1992, ( $n = 25$  samples/plot), 7 December 1992 ( $n = 50$  samples/plot) and 26 May 1993 and 14 June 1993 ( $n = 20$  samples/plot). Bulk samples from each plot were counted under a stereo microscope.

Analysis of variance of a block design using plot means was used to test for significance of differences between treatments.

**Table 1. Effects of grazing treatment (feed on offer, kg DM/ha) and insecticide (+ with mites; – sprayed) on numbers of redlegged earthmite (RLEM, number/m<sup>2</sup>) for 5 dates of sampling**

|            | Grazing practice |      |         |      |           |           | s.e.d. |
|------------|------------------|------|---------|------|-----------|-----------|--------|
|            | 1400             | 1400 | 2800    | 2800 | Set stock | Set stock |        |
|            | Insects          |      | Insects |      | Insects   |           |        |
|            | +                | –    | +       | –    | +         | –         |        |
| 22 Sep 92  | 375              | 167  | 5489    | 316  | 14177     | 1230      | 2788   |
| 6 Nov 92   | 27               | 10   | 2625    | 45   | 46220     | 1642      | 2737   |
| 7 Dec 92   | 60               | 0    | 2610    | 1    | 2875      | 3         | 1252   |
| 26 May 93  | 46               | 0    | 26      | 0    | 94        | 2         | 54     |
| 14 June 93 | 2203             | 0    | 4464    | 0    | 10295     | 2         | 1670   |

### RESULTS

Insecticide applications reduced ( $P < 0.05$  or  $0.001$ ) RLEM numbers at all dates except 26 May 1993 (Table 1). Grazing to 1400 or 2800 kg DM/ha decreased ( $P < 0.05$  or  $0.01$ ) RLEM numbers on 22 September and 6 November 1992 and 14 June 1993 compared to set stocking. There were no significant differences due to grazing treatments on 7 December 1992 and 26 May 1993. On all dates where there were significant effects due to both insecticide and grazing treatments, the insecticide x grazing treatment interaction was significant ( $P < 0.05$  or  $0.001$ ). There were no significant effects of blocks on RLEM populations. In 1992, FOO on set stocked plots changed ( $P < \mathbf{0.001}$ ) with time (Figure 1), and while the only significant ( $P < 0.05$ ) effect of insects was on 23 November, the insect x time interaction was significant ( $P < 0.001$ ). This indicates that late in spring FOO tended to be less in unsprayed set stocked plots (Figure 1). Weekly adjustments of sheep numbers to maintain FOO at 1400 or 2800 kg DM/ha precluded any differences in FOO due to insects,.

The total DM produced in spring was affected by grazing treatment ( $P < 0.001$ ) and by insects ( $P < 0.05$ ) (Table 2), and the interaction of grazing treatment x insects was not significant. There were significant differences ( $P < 0.01$ ) between grazing days for the 1400 and 2800 kg DM/ha (Table 2), but the effects of insects and the interaction between grazing treatment and insects were not significant.

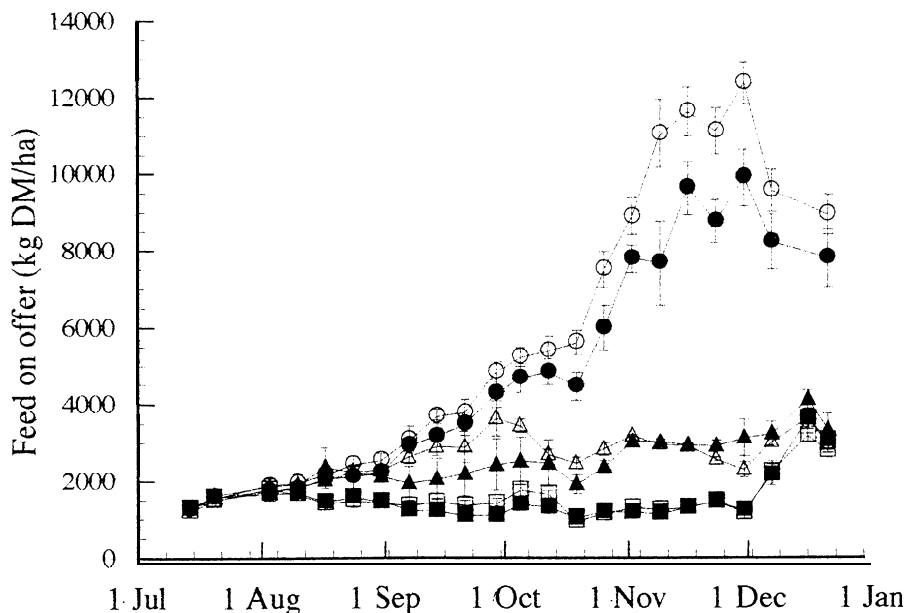


Figure 1. Changes in feed on offer (FOO, kg DM/ha) between 14 July and 22 December 1992 for grazing practice and insecticide treatment (+ no insecticide; - insecticide applied). Bars are the standard error of the mean for the 3 plots of each grazing treatment (1400 kg DM/ha FOO +, closed squares; 1400-, open squares; 2800+, closed triangles; 2800-, open triangles; set stocked +, closed circles; set stocked -, open circles)

## DISCUSSION

Grazing pastures to 1400 and 2800 kg DM/ha in spring significantly reduced RLEM populations over the grazing period, compared to set stocked plots (Table 1). The lack of a significant difference for the December 1992 count coincides with senescence and death of pastures, and the decline of mites before summer. The RLEM populations in the following autumn showed that the spring grazing effects were carried over into the following year. The non-significant differences for the first count in May 1993 coincided with the onset of mite hatching. By 14 June 1993, hatching was complete, and the effects of grazing practices in the previous spring on RLEM populations were again significant. The mechanism by which increased grazing pressure reduced RLEM populations is not clear, but may be due to factors such as incidental predation of mites and eggs by sheep, disturbance of mite feeding, or habitat modification leading to desiccation of mites. Insecticide sprays reduced RLEM densities to very low numbers, with repeated applications needed to control mites migrating into plots from adjacent untreated areas and to control other pests. Either grazing to low FOO or insecticide treatment reduced mite populations to levels at which they caused no significant loss in plant growth, and therefore no differences in sheep grazing days. Mite populations increased to damaging levels under set stocking where grazing pressure was low and FOO was high (Figure 1). This supports the conclusion of Wallace and Mahon (1963) that high numbers of RLEM can cause significant dry matter losses in spring when pastures are undergrazed.

We conclude that grazing to defined levels of FOO in spring can control RLEM and reduce the risk

**Table 2. Effects of grazing treatment (feed on offer, kg DM/ha) and insects on pasture production in spring (PP, kg DM/ha) and on grazing days (GD)**

|                                                                          | Grazing practice |      |         |      |             |             | s.e.d.           |
|--------------------------------------------------------------------------|------------------|------|---------|------|-------------|-------------|------------------|
|                                                                          | 1400             | 1400 | 2800    | 2800 | Set stocked | Set stocked |                  |
|                                                                          | Insects          |      | Insects |      | Insects     |             |                  |
|                                                                          | +                | −    | +       | −    | +           | −           |                  |
| PP                                                                       | 6890             | 7270 | 5660    | 6240 | 7930        | 11450       | 958              |
| GD                                                                       | 4210             | 4600 | 2900    | 3240 | 950         | 950         | 480 <sup>A</sup> |
| <sup>A</sup> Applies to the comparison between 1400 and 2800 treatments. |                  |      |         |      |             |             |                  |

of pasture dry matter losses. The same effect may occur under set stocking in seasons where growing conditions or higher set stocking rates limit FOO accumulation. We cannot say from our data whether the effects on mite populations are due to grazing *per se*, or to the absolute amount of FOO. The results imply that to adequately interpret RLEM population changes in field studies, it may be necessary to define pasture conditions in terms of FOO, plant growth rate and plant consumption rate. The results further indicate prospects for use of grazing management on farms to manage RLEM's and reduce the use of insecticides. However, grazing to low FOO during flowering and seed set will reduce legume and grass seed production (Thompson A.N. unpublished data), indicating that such practices may not be used year-in year-out on the same paddock.

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