

THE EFFECT OF GRASS-SELECTIVE HERBICIDES AND GRAZING MANAGEMENT ON THE GROWTH AND CLOVER CONTENT OF HIGH RAINFALL PERENNIAL PASTURES

G. N. O'BRIEN

Ellinbank Dairy Research Institute, Dept of Food and Agriculture, Warragul, Vic. 3820.

SUMMARY

Grass-selective herbicides were applied to perennial pastures either once only or once per year over 3 years. The pastures were either frequently grazed or infrequently grazed by dairy cows. **Herbage** growth and botanical composition were measured.

The use of a single application of grass-selective herbicide to increase the clover content of pastures resulted in higher dry matter yields than those from unsprayed pasture or pastures that received repeated herbicide applications.

Over the 3 years of this experiment dry matter yield of pastures was not significantly affected by the grazing managements imposed. Infrequent grazing resulted in higher white clover content in pastures than frequent grazing.

A combination of grass-selective herbicide application and infrequent grazing increased the white clover content of perennial pastures and resulted in improved pasture production.

Keywords: white clover, herbicide, grazing, botanical composition, yield.

INTRODUCTION

It is desirable to have higher clover content in pastures, given the superior nutritive value of white clover to grass (Thompson 1979) and the fact that maximum dry matter yield of pasture occurs when clover content is approximately 50% (O'Brien 1987). The only method for reliably and rapidly increasing the clover content of established pasture to 50% or more is through the use of grass-selective herbicides. Short-term loss in pasture production is a consequence of this technique (O'Brien 1983).

Although the short term effects of the use of grass-selective herbicides on perennial ryegrass-white clover pasture is well understood there has been no long term study of the subsequent growth and compositional changes. It is obviously important to understand how the productivity of treated pasture compares with that of untreated pasture and whether subsequent production and composition is affected by grazing management. This experiment was designed to investigate these factors.

MATERIALS AND METHODS

Perennial pastures at Ellinbank, consisting of perennial ryegrass (*Lolium perenne*), cocksfoot (*Dactylis glomerata*), rough meadowgrass (*Poa trivialis*) and white clover (*Trifolium repens*) were treated with herbicides and grazed under 2 regimes. Individual plot size was 0.1 ha.

Herbicide treatments were: nil herbicide; single herbicide application (April 1987); repeated herbicide application (April 1987, September 1988 and August 1989). Herbicide was applied at low (400 mL/ha) or high (700 mL/ha) rate. In 1987 and 1988, 212 g active ingredient (a.i.)/L of the herbicide fusilade (fluazifop-butyl) was used. In 1989 there was an ingress of winter grass (*Poa annua*) which is resistant to fusilade, so the herbicide was changed to Gramoxone (paraquat) at 200 g a.i./L.

Two grazing treatments were imposed using dairy cows. These were frequent grazing, where pastures were grazed from an average pasture mass of approximately 2000 kg DM/ha to 1400 kg DM/ha, or infrequent grazing, where pastures were grazed concurrently at every second frequent grazing. At least 2 frequent and 1 infrequent grazing was applied in summer and winter, even if the target yield of 2000 kg DM/ha was not reached. Each block of pasture treatments was grazed within a 48-h period immediately after the cows grazed pasture of similar botanical composition. This strategy was adopted to minimise any differences that may have been due to nutrient cycling through the animal.

Botanical composition and dry matter production of the pastures were measured between April 1987 and January 1990. Pasture growth was determined by measuring pre- and post-grazing herbage mass using an Ellinbank rising plate meter (McGowan and Earle 1978). The relationship between pasture mass and pasture meter height reading was determined using quadrat cuts of pasture to ground level before and after each grazing. Botanical composition was determined on a dry matter basis by hand-sorting 1 sample per plot which comprised 50 random grab samples.

Soil fertility (0–10 cm; 20 cores per block) on 29 October, 1987 was measured as: Olsen P level 8.4 mg/L, Skene K level 300 mg/L and pH of 5.0 in water or 4.4 in CaCl₂. Pastures were fertilised at rates of 27 kg P/ha and 50 kg K/ha annually and 75 g Mo/ha in the first autumn.

The experiment was conducted as a randomised complete block design using 4 blocks with 10 plots per block, and the data were examined by analysis of variance.

RESULTS

Clover content

In all cases the use of herbicide increased the clover content of pasture. A single application of herbicide in April 1987 increased clover content above that of nil herbicide for up to 21 months. Repeated use of herbicide at the high rate resulted in the highest clover content. The effect of single and repeated herbicide application on clover content, for infrequent grazing and high herbicide rate, is shown in Fig. 1.

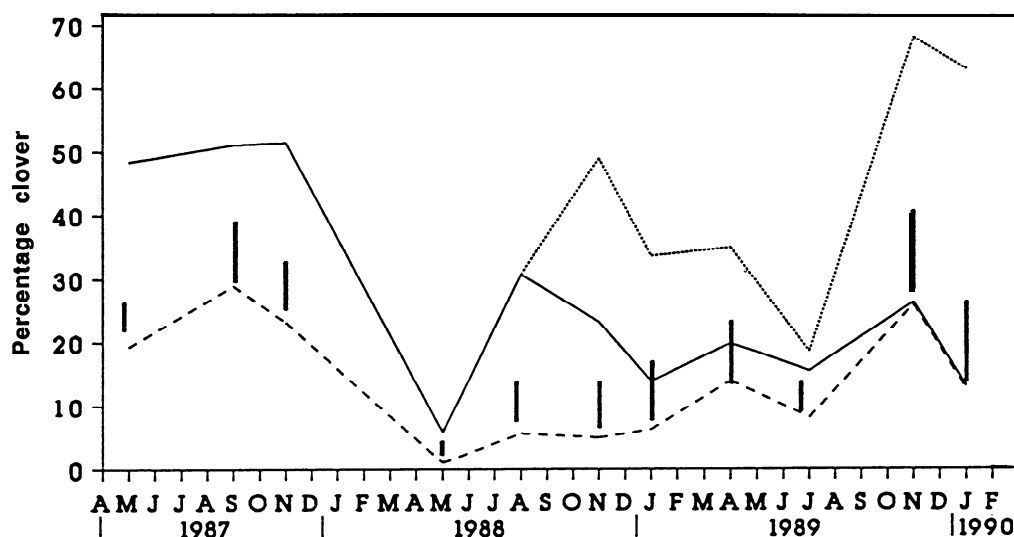


Fig. 1. Comparative white clover content of pastures grazed infrequently by dairy cattle from approximately 2600 kg DM/ha to 1300 kg DM/ha following nil herbicide (---), single (—) or repeated (···) grass selective herbicide application. Vertical bars indicate 1 s.d. at $P=0.05$.

Infrequent grazing developed and maintained a higher clover content in pastures than frequent grazing (Fig. 2). There were some statistical interactions between grazing frequency and herbicide application but these were restricted to the harvest following the initial herbicide application and the final 2 botanical composition assessments. In all 3 cases, infrequent grazing combined with a high herbicide rate gave the highest clover content.

Dry matter yield

Total annual yield data were used to summarise the effect of treatments on dry matter yield, which was less consistent between harvests than the effect of treatments on clover content.

In 1987, a significantly ($P<0.05$) lower yield was recorded on the nil herbicide, frequent grazing treatment (8450 kg DM/ha) than on the high herbicide, frequent grazing treatment (11350 kg DM/ha). Other treatments were intermediate and significantly ($P<0.05$) different to both these treatments.

There was no difference in the effect of the 2 grazing regimes on total dry matter yield in 1988. Pastures which had received a single herbicide application in 1987 produced significantly ($P<0.05$) more dry matter in 1988 than the nil herbicide pastures and those that received a repeated herbicide application in 1988 (10250, 9050 and 9100 kg DM/ha respectively).

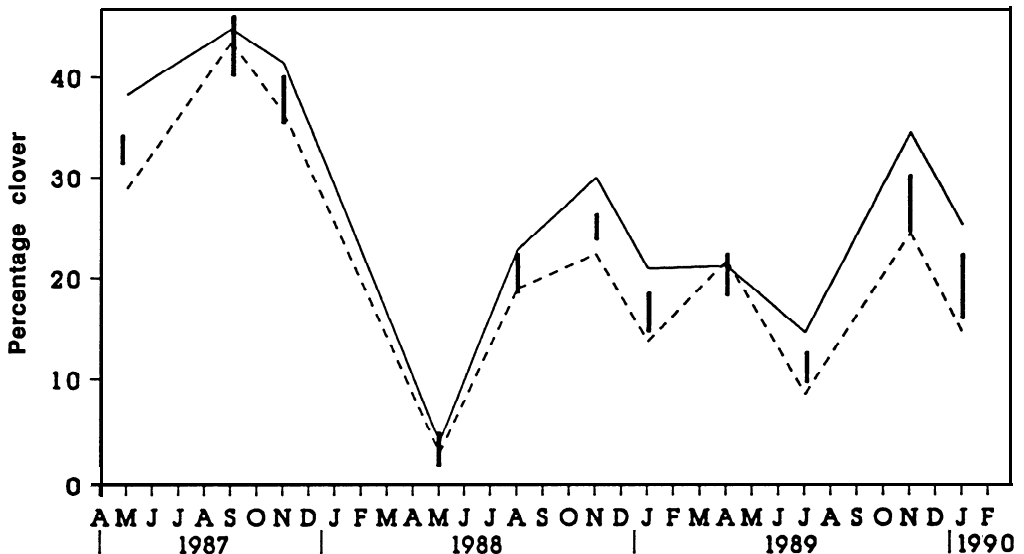


Fig. 2. The effect of infrequent grazing (—) and frequent grazing (---) by dairy cattle on white clover content of perennial pastures. Vertical bars indicate l.s.d. at $P=0.05$.

In 1989, the pastures grazed infrequently produced significantly ($P<0.05$) more dry matter than the frequently grazed pastures (8350 and 7350 kg DM/ha respectively). The pastures that received repeat herbicide applications produced significantly less ($P<0.05$) dry matter than the nil herbicide and single herbicide application treatments (7250, 8450 and 8100 kg DM/ha respectively).

DISCUSSION

This experiment has demonstrated that pastures with a high white clover content can be developed and maintained over a period of at least 3 years. Although the combination of repeated selective herbicide application at the higher rate and infrequent grazing consistently gave the highest clover content for the longest period of time, other strategies were able to improve the clover content.

A single application of herbicide was sufficient to increase the white clover content for a period of about one and a half years. However it appears that repeat applications are necessary if clover contents approaching 50% are to be maintained under currently practised grazing strategies.

The finding that infrequent grazing favours higher clover content in pastures is consistent with the finding of Stewart and Whitson (1986) where pastures under lax summer grazing contained a substantially higher clover content than pastures under intense summer grazing. It is generally considered that the more frequently or intensively a pasture is grazed the more white clover will be encouraged. While this may be true for winter and spring (Harris 1987), it appears that for environments where summer moisture deficits occur, infrequent grazing over the summer period may have a long lasting and over-riding beneficial effect on clover content of pastures.

While pastures with higher clover contents are desirable, they must also maintain productivity if they are to be useful to commercial farmers. Over the 3 years of this experiment, the productivity of experimental pastures was not reduced by either herbicide or grazing management. However, whilst a single application of herbicide increased dry matter yields, repeated application of herbicide resulted in more variable results, including a decrease in annual dry matter yield in 1989.

In 1989 the clover content of pastures at the time of spraying was lower (12%) than in 1988 (21%) or 1987 (30%) and grass content was higher. Following the use of herbicide, the loss of grass content was higher. The ability of the smaller white clover base to compensate for the suppressed grasses would have been less in 1989 and hence recovery of pasture growth after spraying would be slower. The change in herbicide from fluazifop-butyl to paraquat in 1989 could have caused a slightly higher suppression in yield immediately after spraying (O'Brien unpublished data), but this alone is unlikely to account for the differences in yield. A better understanding of the factors causing variation in the growth of pasture after herbicide application may assist in avoiding the depression of pasture growth.

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