THE POTENTIAL FOR GROWTH RETARDANTS AT LOW RATES TO MAINTAIN PASTURE QUALITY

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SUMMARY

Two plant growth regulators, amidochlor and mefluidide, were applied to swards of perennial ryegrass (*Lolium perenne*) in an attempt to maintain forage quality during spring growth. Although both chemicals depressed total dry matter yields, they also delayed the onset of reproductive development of plants. The maintenance of vegetative growth in treated swards resulted in higher green leaf yields. Accepting that the proportion of green leaf in a sward is very often the major factor in animal performance, then both chemicals proved to be successful in maintaining pasture quality.

INTRODUCTION

It is well established that forage quality generally declines as grass plants become reproductive (Raymond 1969). Traditionally, in situations where stocking rates are insufficient to prevent reproductive development of the sward, mechanical topping to remove stems and inflorescences has been the only management option. More recently however plant growth regulators (PGR's) which prevent reproductive development in grasses have been advocated for use in pasture situations to delay flowering and thus maintain the quality of the forage. Studies of the effect of such compounds on pastures have, to date, been largely restricted to investigations of total dry matter production and an array of *in vitro* chemical analyses of the forage (Glenn *et al* 1981; Haslemore *et al* 1984). Such assessments of PGR improvements in pasture situations may be misleading as non-nutritional factors of the sward, relating to the ease of grazing, are often of greater importance than the nutritive value of the grazed material (Poppi *et al* 1987). Any evaluation of PGR manipulation of pasture growth must therefore address these non-nutritional factors.

An intensive field trial was established at Lincoln College in spring 1986, investigating the potential for PGR's to maintain the forage quality of perennial ryegrass swards. Two PGR's with known seedhead suppression activity were selected and evaluated at rates designed to prevent reproductive development whilst minimising possible losses in total yield. Many aspects of the physiological response of the swards to these compounds were monitored and are reported elsewhere (Foreman and Field 1987; Foreman *et al* 1987). In this paper the effect of the PGR's on total yield and the non-nutritive components of yield are described.

METHOD

The experiment has been described elsewhere (Foreman *et al* 1987). The growth of a crop of ryegrass (*Lolium perenne* cv Grasslands Ruanui) was followed over a 100 day period from 1st September 1986. Prior to chemical application the swards received 80 units of nitrogen and were cut to 3 cm, leaving a residue of 700 kg DM/ha. Amidochlor (Limit) and mefluidide (Embark)(+0.25% Agral) were applied at 1.6 and 0.150 kg ai/ha respectively, sprayed in 250 litres/ha water using a backpack boom sprayer. Tiller apices were at double-ridge at the time of treatment. Five harvests of 2.54 m² quadrats were taken over the 100 days using a sickle bar mower cutting at a height of 3 cm. Subsamples from the quadrat cuts were taken to determine dry matter content and for dissection into green leaf, stem plus inflorescence, and dead material to obtain non-nutritional data. The trial was a randomised block with four replicate blocks and was analysed using ANOVA procedures in the SAS statistical package.

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Fig. 1: Total dry matter yields of untreated pasture and pasture treated with mefluidide and amidochlor.

[= Waller-Duncan L.S.D. k=100 for Green Leaf v Stem

Fig. 2: Components of yield of untreated pasture and pasture treated with mefluidide and amidochlor, expressed as percentage of total yield.

RESULTS and DISCUSSION

The growth of the untreated crop followed a recognised pattern: total dry matter production was sigmoidal with a ceiling yield of approximately 12,000 kg/ha (Fig. 1). As the crop developed the components of the total yield changed as the sward turned reproductive (Fig. 2). Ear emergence occurred in early November (30-40 d), by which time the stem plus inflorescence fraction constituted in excess of 60% of total yield (Fig. 2). At 100 days negligible green leaf was present in the sward which was itself severely lodged.

Both PGR's depressed total yield to a similar degree (Fig. 1). Depression of growth was greatest during the 40 days immediately following treatment. Thereafter absolute growth rates were close to that of the untreated control. The development of the PGR treated crops differed significantly compared with the untreated control and with each other (Fig. 2). The reproductive development of amidochlor treated swards was significantly delayed. Ear emergence was asynchronous and did not occur until late November/early December (80-90 d). This was evident by the maintenance of green leaf throughout the trial. Mefluidide treated swards displayed even greater suppression of reproductive development; at 100 days seedheads were sparsely distributed in the sward and green leaf remained at high levels. No lodging occurred in either of the PGR treatments.

The feed value of a sward is the product of the nutritive concentration of the forage ("digestibility") and the potential rate of forage uptake by animals, as determined by non-nutritional factors (Raymond 1969). Published work has already indicated that amidochlor and mefluidide treated pastures maintain high digestibilities (Glenn *et al* 1981; Foreman and Field 1987). This might be due to the maintenance of leaf production in such swards. With the onset of reproductive development leaf production at the tiller apex ceases (Langer 1979), hence the leaf population becomes progressively older as the sward nears flowering. There is a strong negative correlation between leaf age and digestibility (Raymond 1969). The maintenance of vegetative growth in amidochlor and mefluidide treated swards ensured continued leaf production, and accordingly resulted in a younger leaf population with a correspondingly higher digestibility.

Irrespective of the digestibility of the forage, the rate of forage intake is of greater significance to animal production: 70% of variation in animal performance can be accounted for in terms of voluntary intake (Ingalls *et al* 1965). The non-nutritional factors affecting forage intake are quite distinct from the digestibility and are essentially factors influencing ease of grazing. Poppi *et al* (1987) reviewed non-nutritional factors and concluded that the proportion and position of green leaf in the sward are the most significant components. Animals select out green leaf from stem and dead material, and are reluctant to penetrate through stem material to graze at lower herbage horizons. Both amidochlor and mefluidide maintained high proportions of green leaf throughout the trial. At 79 days green leaf in amidochlor and mefluidide swards was 2680 and 3396 kg DM/ha respectively, significantly higher ($p < 0.05$) than the untreated sward (1528 kg DM/ha). The distribution of green leaf was also improved in the PGR treated plots; the presence of reproductive stems in untreated swards effectively relegated the bulk of the green leaf to lower horizons. This was in marked contrast to the PGR treated swards where green leaf production continued in the top horizons of the vegetative plants. Data on animal performance on pasture treated with mefluidide at similar rates to those used in this paper have shown increased live weight gain (Robbb *et al* 1981; Goold *et al* 1982). It would be appropriate to establish if these gains resulted from increased voluntary intake arising from higher green leaf levels.

This trial demonstrates a real potential for PGR's to manipulate sward development, but there is a requirement for intensive research to fully realise the potential of this management option.

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