SOME ASPECTS OF THE EFFECT OF THE GROWTH RETARDANT WL83801 ON THE PHYSIOLOGY OF *LOLIUM PERENNE*

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SUMMARY

The experimental growth regulator WL83801 was shown to possess high biological activity rapidly suppressing the growth of perennial ryegrass (*Lolium perenne*). The treated plants displayed a very characteristic appearance, being greatly reduced in size but bearing a large number of small tillers with equally small leaves. The significance of these changes are considered in a sward context.

INTRODUCTION

Since the mid-1960's several growth regulating compounds with retardant activity on grasses have undergone extensive investigation for controlling turf growth in amenity and non-agricultural grasslands (Shearing and Batch 1982). The criteria for a successful turf retardant are however exacting (Shearing and Batch 1982) and at present no compound has proven a commercial success. Furthermore, from recent reappraisal of the amenity grassland market it is now evident that it is an extremely heterogeneous market and that the use of growth retardants for controlling turf growth may be limited (Shearing and Batch 1982). An alternative use for growth retardants in sward management may exist however in exploiting their effect upon the growth form of sward components.

Continuity of sward management maintains stability and any change away from that practice induces instability which can lead to compositional changes in the sward towards a new equilibrium (Harper 1971). The use of herbicides to kill sward components selectively has been advocated to destabilise swards rapidly to achieve a new, desired botanical composition (Hagger and Squires 1979). Similarly, by chemically retarding a sward, instability may be induced by changes in the growth and development of selective sward components. In the present paper the effect of the growth regulator WL83801 on the growth of ryegrass is reviewed and discussed with respect to potential manipulation of grassland composition. WL83801 is an experimental growth retardant produced by Shell Research Ltd and its mode of action is loosely described as an antagonist of normal gibberellin activity.

MATERIALS AND METHODS

Seedlings of perennial ryegrass cv. S23 were planted individually into 11 cm pots containing John Innes No. 1 potting compost (with Perlite substituting for peat) and raised in a heated glasshouse (minimum day and night temperatures of 18 and 16°C respectively) with supplementary lighting to give a 16 h photoperiod. WL83801 was applied at 3.0 kg ai/ha, as an EC formulation in a 20 ml root drench, at the appearance of the sixth main-shoot leaf. Control plants received water only. Sixty days after treatment, plants were harvested and their total dry weight, number of tillers and length of leaves were assessed. In a second experiment plants were harvested 45 days after treatment with the shoot being harvested from successive 10 cm horizons. Six replicate plants were taken in all cases.

RESULTS AND DISCUSSION

Application of WL83801 to young vegetative ryegrass plants caused a dramatic change in plant form. The retarded plants displayed a very characteristic appearance,

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TABLE 1: Total plant dry weight, leaf length and tiller number in perennial ryegrass 60 days after treatment.

	Total plant dry weight g	Average leaf length mm	Total tiller number
Control	16.8	300	28
WL83801	9.9	64	67

All values significantly different at $P < 0.05$.

being reduced in overall size but possessing a large number of small tillers bearing small leaves (Table 1). Furthermore, resulting from the reduced leaf length and greatly increased tiller number, the distribution of plant dry weight showed a change to a prostrate, rosette growth habit; there was little shoot growth above 10 cm, contrasting with the normal erect habit of ryegrass (Fig. 1).

Fig. 1: Dry weight distribution in perennial ryegrass (expressed as % of total shoot or root dry weight) 45 days after treatment.

This significant change in growth form suggests that fundamental alterations in endogenous growth regulation occurs on application of WL83801. The growth form of the plant reflects the degree of dominance exerted by the shoot apex over the growth and development of sub-apical meristems. In the grass plant growing under sub-optimal conditions, quiescent sub-apical meristems (tiller buds) accumulate (Jewiss 1966). Application of WL83801 stimulates such quiescent tiller buds to develop (Foreman 1984), leading to the appearance of larger numbers of higher order tillers and in doing so reduces the normal dominance of the shoot apex. Such a response is consistent with the proposed antagonistic action of WL83801 on gibberellin activity; gibberellins are generally considered as promoters of apical dominance in grasses, suppressing tiller bud development (Jewiss 1972; Clifford 1977).

In field trials using single species and mixed species swards it was observed that swards retarded with WL83801 were less susceptible to ingress by unsown species (Foreman 1984). It is suggested that this is due primarily to the change in plant form following treatment with WL83801. The tightly bunched tiller pattern of retarded plants reduced the bare ground within the treated sward and thus suppressed opportunistic ingress by other plants (Foreman 1984). The converse situation was also found to be true. In the same trial, where the turf retardant maleic hydrazide was applied, tillering declined and the resulting sward became sparse. Such swards were found to be readily open to ingress by unsown species. In this way regulation of sown species persistence may be possible.

A second important consideration resulting from the change in plant form is the effect of retardation on tiller density. Although the potential for growth retardants to manipulate tiller populations in seed crops is now established (Hampton and Hebblethwaite 1984), their possible use in herbage production is unknown. It is generally agreed that herbage production is determined by tiller density and weight (Nelson and Zarrouh 1981), both of which appear to be readily manipulated by growth regulators. Although a temporary suppression of growth must be accounted for, it is conceivable that growth retardants which promote tillering could be useful tools for achieving full cover earlier during sward establishment and to increase tiller density in mature swards.

The potential for manipulation of tiller density and botanical composition in swards through the use of growth retardants exists. There is now a need to quantify their practical application in sward establishment and maintenance.

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