MODE OF ACTION OF MEFLUIDIDE IN GROWTH AND SEEDHEAD SUPPRESSION OF GRASSES

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Mefluidide, N-[2,4 dimethyl-5-[[(trifluoromethyl)sulfonyl]amino]phenyl]acetamide, the active ingredient of Embark PGR, was discovered by the 3M Company over 10 years ago. The primary commercial use of mefluidide is to retard vegetative growth and suppress seedheads in grasses. The mechanism of action of this molecule at the molecular level is not known. However, the uptake, translocation, and physiological effects of mefluidide have been studied, making it possible to form a model of its mode of action in the suppression of seedheads in Poa annua.

Although mefluidide is absorbed by roots as well as leaves or stems, rapid metabolism by soil microoganisms usually limits its substantial uptake to the above ground portions of plants under normal field conditions. Foliar uptake and translocation of mefluidide is greatly influenced by the physiological state of the plants, temperature, relative humidity, and adjuvants (1,2). A higher temperature and a high relative humidity permit greater uptake and translocation of mefluidide. Adjuvants speed up penetration of mefluidide as well as causing greater uptake and translocation. They are especially effective under suboptimal environmental conditions. Depending on the plant species, as much as 70% of applied mefluidide may be taken up, although 25% to 50% uptake is more common. Less than 25% of the absorbed mefluidide is translocated to other above ground grass tissues and less than 8% appears in the roots (2,3). Such low accumulation of mefluidide in roots may explain why mefluidide does not inhibit root growth at normal use rates.

Movement of mefluidide in grasses is rapid, judging from C^{14}-mefluidide translocation studies (1,2,3) and observations of the onset of growth retardation after melfluidide treatment. In greenhouse experiments using seedling Kentucky bluegrass, noticeable inhibition of growth occurs within five hours after treatment with mefluidide and reaches near maximum levels within 48 hours if an adjuvant is included (5). However, it has been observed both in greenhouse studies and field tests that it takes four to seven days, depending on the grass species and the environmental conditions for maximum growth retardation to occur (3,5). Removing treated leaf blades earlier will reduce the amount of mefluidide that can reach the apical meristem. Within the plant, mefluidide appears to move both in the xylem and in the phloem, although one might expect translocation out of the treated leaves to be preferentially via the phloem. This conclusion is based on data collected for 3M studies on the movement of C-mefluidide in grasses (1,2,3) and on observations that hydroponic feeding of low doses (less than 1 mg/liter) of mefluidide leads to shoot inhibition without adverse effects on root growth (unpublished data).

As the concentration of mefluidide increases with time in growing tissues of grasses, the most noticeable first effect of mefluidide is a reduction in cell elongation. If higher levels of mefluidide accumulate, cell division may also be inhibited both in the apical and intercalary meristems. At low rates of mefluidide or as the inhibitory effects begin to wear off, it is not unusual to find a thickening and twisting of the crown and leaf bases of grasses indicating continued or resurgent cell division without much if any

cell elongation. At very low concentration, 1 mM *in vitro* or less than 70-g/ha., mefluidide may stimulate growth and tillering in grasses (6 and unpublished data). Dolamore and Field have observed that mefluidide induces gross distortions in reproductive apices by initiating uncontrolled cell division which results in no stem extension or seedhead production in grasses (4). This condition, however, would be expected to occur only if mefluidide were applied prior to or during the early stages of formation of floral primordia in grass apices and if the concentration of mefluidide in the reproductive apices was low enough to allow cell division to take place but high enough to cause retardation of cell elongation. If mefluidide is applied after floral primorida have formed and started to differentiate, one might expect to find treated seedheads arrested at various developmental stages. The later mefluidide is applied, the more advanced developmentally, and thus more visible, will be the seedheads. Since it takes two or more days for mefluidide concentrations to reach inhibitory levels in the reproductive apices, it is important to apply Embark several days before emergence of seedheads is anticipated. Close observations of seedhead formation may be necessary for optimal results. Since *Poa annua* seedhead numbers per unit area increase gradually and reach a peak in May, it may be possible to determine the optimal time of application on the basis of the number of seedheads present in April.

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