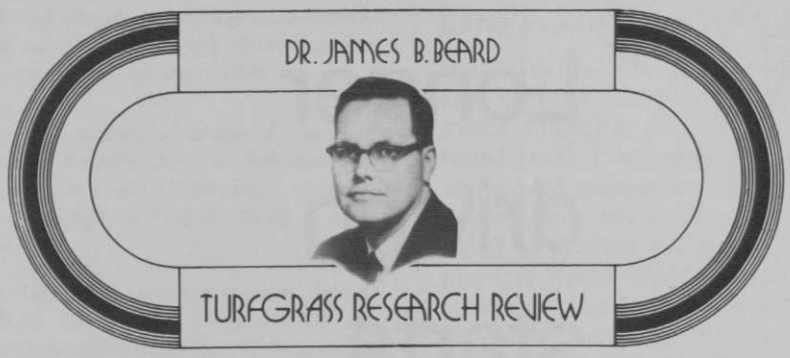

ENDOTHALL CONTROL OF POA ANNUA

The role of 7-oxabicyclo (2.2.1) heptane-2, 3-dicarboxulic acid (endothall) in annual bluegrass* (Poa annua *L.*) *control in turf.* A.J. Turgeon. 1971. Ph. D thesis, Michigan State University. pp. 1-101. (from the Department of Crop and Soil Sciences, Michigan State University, E. Lansing, Mich. 48823).

The objective of this investigation was to determine the basis for the selectivity of endothall in Kentucky bluegrass and bentgrass turfs and the potential of endothall as a control for annual bluegrass. Field, greenhouse and growth chamber studies were conducted over a period of three years.

Results of these extensive experiments can be summarized as follows. Foliar applications of endothall made under controlled greenhouse conditions caused a distinct suppression of annual bluegrass without discoloration or browning of Kentucky bluegrass or creeping bentgrass. However, the responses to foliar endothal applications in five field experiments were quite varied in terms of selectivity. Annual bluegrass control was achieved but with a distinct discoloration of the desirable Kentucky bluegrass and creeping bentgrass species. The variability in selectivity was attributed to variations in the physiological condition of the plant and the season of year in which the endothall was applied. Although the desirable species exhibited distinct foliar necrosis, they were able to recover rather rapidly, whereas annual bluegrass was more seriously effected; recuperation was delayed for a much longer period of time. The visual responses were supported by net photosynthetic measurements, which showed a reduction from endothall applications in both Kentucky bluegrass and creeping bentgrass. It lasted for 48 hours after application. In the case of annual bluegrass, the reduction in net photosynthesis lasted for a substantially longer period of time following treatment.

The author indicated that endothall has potential for reducing annual bluegrass infestations in Kentucky bluegrass and creeping bentgrass turfgrass communities when applied as a foliar spray in late summer. This may involve a gradual transition resulting from the superior competitive ability of the desirable species caused by the endothall inhibition of annual bluegrass, rather than quick eradication. The effectiveness of endothall was enhanced by (a) the addition of a surfactant and (b) the use of relatively large spray volumes. The author warns, however, that a temporary discoloration or browning of the desirable species is frequently associated with foliar endothall applications. Late summer and early fall applications were more effective in annual bluegrass control than spring applications.

Studies concerning root applications of endothall using a granular carrier resulted in greater selectivity between annual bluegrass and the perennial turfgrass species than was obtained with foliar applications. These responses were confirmed by both greenhouse and field experiments. Root absorption studies revealed that the quantity of endothall absorbed by annual bluegrass was

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much greater than that for Kentucky bluegrass or creeping bentgrass. The greater selectivity was also evident in the photosynthetic measurements. A transpiration rate study revealed significant reductions which were much greater in annual bluegrass than in Kentucky bluegrass and creeping bentgrass. This effect resulted from root applications, but not from foliar applications.

The effectiveness of granular applications (root absorption) varied in field experiments depending on the soil type and irrigation practices. The best annual bluegrass control and the highest selectivity occurred (a) on soils low in clay and organic matter and (b) with turfs that had been maintained under a frequent irrigation schedule that avoids plant moisture stress.

Investigations concerning the basis of selective control of annual bluegrass revealed that differential absorption accounted for about 50 per cent of the selectivity with foliar applications and 20 per cent from root applications. The rates of endothall translocation and metabolism were not significantly different. However, the relative sensitivity of the physiological system, particularly respiration and photosynthesis, to endothall was significantly different and contributed significantly to the selectivity along with the absorption differentials.

Finally, the investigator observed intraspecies variability in sensitivity to endothall. The annual, noncreeping, prolific seedforming types were killed at a substantially lower rate of endothall application than the perennial, creeping types. Thus, the rate required for control of annual bluegrass in a given situation will vary not only with the season of year, physiological condition of the plant, soil type and irrigation practices, but also with the particular type of annual bluegrass that exists within the turfgrass community.

Comments: Endothall is not a new herbicide. It has been evaluated for annual bluegrass control many times over the past 12 to 15 years. The results from previous studies can be summarized as somewhat erratic annual bluegrass control with a high potential for injury to the desirable turfgrass species. Results from this investigation reveal some of the potential reasons for the erratic performance of endothall in past experiments.

Herbicide selectivity is defined as the control of weeds within a turfgrass community without killing or no more than slightly effecting the desirable turfgrass species, such as creeping bentgrass and Kentucky bluegrass. Selectivity is relative and can be achieved in a number of different ways and at several different times during application, absorption and translocation of the herbicide.

Selectivity and the degree of control is greater from late summer or fall applications than from spring applications, although some variability can probably be anticipated even within this period. The variability in response to environmental and cultural factors can be explained in relation to the basis of

selectivity. The studies reveal that endothall activity is primarily the result of differential rates of endothall absorption and the physiological effects on the photosynthetic and respiration processes within a given species.

A particularly interesting conclusion resulting from these studies was that selectivity was much greater if the endothall herbicide is absorbed through the root system rather than the foliage. The possibility of granular endothall applications to the soil is quite attractive in terms of the increased selectivity.

The main problem with foliar applications is the variability that can be anticipated. There is a high potential for discoloration and browning of the desirable turfgrass species. This is certainly objectionable even though it may only be a temporary effect with the desirable species recovering rapidly while the annual bluegrass is being eliminated. Perhaps additional studies can more clearly delineate the environmental and cultural conditions under which endothall could be applied foliarly for effective control of annual bluegrass without injury to the desirable turfgrass species.

The use of a material such an endothall is particularly attractive because it is a relatively simple structure that has a rapid rate of biodegradability. This is a desirable feature for herbicides used in modern turfgrass culture because the environmental pollution issue is of such great concern. The use of short-lived herbicides such as endothall is particularly attractive for this reason.

The short-lived herbicide is also beneficial to the turfgrass species from the standpoint of no long-term detrimental effects on the desirable turfgrass species. This is in contrast to most of the available preemergence herbicides used for annual bluegrass control which do have certain detrimental effects on the turfgrass root system as well as inhibiting certain physiological growth processses.

The results of this investigation at Michigan State have stimulated a renewed interest in endothall as a potential herbicide for the control of annual bluegrass. Perhaps increased research efforts with this herbicide at other state experiment stations will provide the professional turfman with sufficient information so that it can be incorporated as one of the herbicides available to the turfman for annual bluegrass control.

Finally, the variability in effectiveness of control within the annual bluegrass species is a very significant finding. The perennial, creeping types required higher rates of endothall to achieve control. This may be one of the major reasons for the diversity in the degree of annual bluegrass control obtained from experiments with various herbicides conducted in states throughout the country. Thus, when assessing the annual bluegrass control data for a given herbicide it is important to know whether an annual, bunch type or perennial, creeping type of annual bluegrass was used. The professional turfman must also determine which type or combination of annual bluegrass types exist on his own golf course. □