

THE IMPACT OF PESTICIDE USE ON TURFGRASS MANAGEMENT PROGRAMS

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Pesticides are applied to turfs for a variety of purposes including weed control, disease prevention and reduction of destructive insect populations. Under some conditions, pesticide application may also result in observable turf-grass injury. However, deterioration of turf following pesticide use may not be easily traceable to a specific chemical unless causal relationships between specific pesticides and specific types of injury are clearly established. These relationships are frequently obscured in situations where injury only results following repeated use of a particular pesticide. For example, repeated applications of chlordane or dieldrin resulted in thatch development in an otherwise thatch-free Kentucky bluegrass turf (1). This was attributed to the earthworm inhibiting effects of the insecticides. A higher incidence of leaf spot (Helminthosporium vagans) disease was evident in the thatchy turfs during cool, wet periods in mid-spring. Mechanical removal of the thatch in one-half of each plot resulted in a substantially lower incidence of leaf spot in subsequent years. The contribution of thatch to the disease proneness of a turf is well documented; many disease-causing organisms can survive as saprophytes living off dead organic materials in the thatch, and then infect living plants when environmental conditions become favorable.

The herbicides, calcium arsenate and bandane, were also found to be thatch-inducing pesticides when applied annually for at least two years to Kentucky bluegrass (2). In addition to higher leaf spot disease incidence, the thatchy turfs were found to be more prone to wilting during mid-summer stress periods. This was due, at least in part, to the restriction of roots to the thatch layer. A test to determine earthworm populations in the soil revealed no earthworms in plots treated with the thatch-inducing herbicides while untreated plots averaged over 50 worms per square meter. Results from more recent studies of the effects of these herbicides on the activity of soil microorganisms suggest that the capacity of some microorganisms to produce enzymes for decomposing organic debris is reduced by calcium arsenate and bandane. Thus, the thatch-inducing effect of these herbicides may not be completely explained by their inhibition of earthworms; rather, they apparently inhibit the activity of an array of soil organisms that are important in decomposing organic debris and, thus, preventing thatch development.

Measurements were made to determine if the use of thatch-inducing herbicides indirectly affected soil physical properties. Field results showed that infiltration was substantially reduced in the thatchy turfs; however, this was not due to the hydrophobic properties of thatch or to the existence of an interface between the thatch and the soil. The physical condition of the soil under the thatch was different than that of the soil from the thatch-free plots. Presumably, this difference was due to the restriction of most root and rhizome growth to the thatch and the relative absence of these plant organs in the underlying soil compared to the untreated plots. Also, the absence of earthworm activity in the treated plots was probably related to the lower water infiltration rates measured.

Laboratory measurements of hydraulic conductivity also yielded lower values in soil cores from the calcium arsenate-treated plots. Bulk density was higher and shrinkage upon drying was less in soil cores from the calcium arsenate-treated plots. Results from these tests are consistent with the infiltration results in

that they clearly show that application of thatch inducing pesticides can indirectly affect soil physical properties. These effects increase the turfgrass manager's dependancy on irrigation, fertilization, cultivation and pesticide use in order to sustain the turf at an acceptable quality level during the growing season. Thus, a decision to implement a program of calcium arsenate application for controlling annual bluegrass or other pests should be carefully considered to determine if the anticipated results warrent subjecting the turf to the apparently detrimental effects determined from this study.

Literature Cited

1. Randell, R., J. D. Butler and T. D. Hughes. 1972. The effect of pesticides on thatch accumulation and earthworm populations in Kentucky bluegrass turf. *HortScience* 7(1):64-65.
2. Turgeon, A. J., R. P. Freeborg and W. N. Bruce. 1975. Thatch development and other effects of preemergence herbicides in Kentucky bluegrass turf. *Agronomy Journal* 67:563-565.