1993 TURF WEED CONTROL AND MANAGEMENT UPDATE

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Research conducted in 1993 covered a broad array of subjects from pesticide and nutrient fate to bentgrass breeding and genetics. Topics to be covered in this article include pesticide leaching, PGR's for growth regulation of annual bluegrass (*Poa annua*) and creeping bentgrass (*Agrostis palustris*), and Basamid® for soil sterilization to control *Poa annua* seeds. Other areas of research conducted during 1993 are reported in other articles in this volume.

Contamination of groundwater by pesticides has been one of the critical issues in agriculture during the past decade. The turfgrass industry has also felt the considerable heat generated by this topic. This research was initiated in 1991 with a grant from the United States Golf Association Green Section Research Committee. Four large, non-weighing lysimeters were constructed in 1990-91 and used to test for the leaching of pesticides. Eight pesticides were applied during 1991-2 according to the schedule outlined in Table 1.

Table 1. Application information and environmental data for pesticides applied to the lysimeters.

PESTICIDE	APP RATE (kg/ha)	APP DATE	SOIL $T_{1/2}$ (days)	WATER SOL (mg/L)	K_{OC}
isazophos	2.24	8/12/91	34	69	100
2,4-D	1.14	9/17/91	10	890	20
dicamba	0.12	9/17/91	14	400,000	2
chlorothalonil*	9.56	8/21/91	30	0.6	1380
propiconazole	2 oz prod/M	6/18/92	110	110	650
fenarimol	0.76	5/3/92	360	14	600
triadimefon	1.53	7/21/92	26	71.5	300
metalaxyl*	1.53	8/5/92	70	8400	50

* chlorothalonil was also applied to lysimeters 3 and 4 on 7/21,8/5,8/20, and 9/4/92. Metalaxyl was applied also to lysimeters 3 and 4 on 7/21, 8/13, and 9/4/92.

Pesticide applications were made with a standard research plot sprayer using flat fan nozzles. Pesticides were chosen based upon use patterns in turf and upon the chemical properties of the pesticides such that some, such as 2,4-D, dicamba, and metalaxyl, were considered quite likely to reach groundwater while others, e.g. chlorothalonil and fenarimol, were considered very unlikely to reach groundwater. Five of the eight pesticides chosen for this study were fungicides since they represent the most frequently used pesticides in turf. Lysimeter drainage was collected as indicated by the flow rate of each lysimeter. Typically, samples were collected every two weeks unless lysimeter flow was high enough to warrant more frequent sampling. All water samples were stored at 2 C until analysis by gas chromatography.

Results have so far shown very little movement to the bottom of the lysimeter of any of the applied pesticides. Of the eight pesticides applied, five have not yet been detected. Only dicamba and triadimefon have been detected with some frequency as 2,4-D has given only one detection since application. Levels of dicamba and triadimefon in the drainage water are shown in figures 1 and 2. Dicamba (Figure 1) was applied in mid-September and was first detected in November with subsequent detections in March and April. The largest detection was in late November when 3.1 PPM was detected in the leachate from one of the lysimeters. Further testing has not detected any other residues of dicamba.

Triadimefon (Figure 2) was detected on several occasions at much lower levels than dicamba. Triadimefon was applied on 7/21/92 and the highest level of detection was 31 PPB on 10/15/92. The leaching of triadimefon was surprising in light of its physico-chemical properties (table 1) which would lead one to suspect that triadimefon is not very mobile in soils or at the very least propiconazole and metalaxyl should be seen more frequently and at higher concentrations than triadimefon. That this does not occur requires further study and model refinement.

When considering the overall picture so far obtained from the pesticide leaching data, the overall tenor of the results are quite positive. Five out of eight pesticides have not been detected. Both 2,4-D and dicamba are known to be mobile in soils and there is no surprise in finding them in the lysimeter effluent although we expected to find higher levels and more frequent detections of 2,4-D. The finding of triadimefon is disturbing only in the light of our prediction that it would be the third most mobile of the five fungicides tested. Apparently the turfgrass system may drastically reduce the mobility of propiconazole and metalaxyl perhaps by rapid metabolism in the thatch layer.

Plant growth regulators (PGR's) have held considerable promise as a means to reduce the maintenance of turfgrasses. So far the promise has largely been unfulfilled. The introduction of a new PGR, Primo®, for use on fine turf and the recognition by the golf course industry of the value of PGR's for reduction in clipping volume has led to a resurgence of interest in these products. In 1993 a test was conducted to determine the relative growth suppression and influence on turf quality of Primo® on annual bluegrass and creeping bentgrass maintained at a 0.5" height of cut. Cutless®at 0.25 lbAI/A was included for comparison to the three rates of Primo® examined. The data (tables 2 &3) were somewhat compromised by the failure of an irrigation head which covered part of the bentgrass turf and caused growth to slow due to drought stress as well as the PGR. This is clear from the drop in clipping weights for the control plot from week 1 to week 2 (table 3). Primo® provides growth regulation comparable to that of Cutless® on creeping bentgrass. On annual bluegrass, Primo® seemed to cause less injury than did Cutless® and this may indicate that Primo® is not as effective in Poa conversion as is Cutless®. However, the clipping weight data would indicate that Primo® and Cutless® provide comparable growth suppression of annual bluegrass. Data on the effectiveness of PGR's for golf turf will continue to be an important area for future research.

One area of research that we are excited about is the use of Basamid for soil sterilization. Basamid® is a granular product that releases a gas upon hydrolysis by water. The gas will kill weed seeds, fungi, insects, nematodes, etc. The product is similar in action to methyl bromide, the most commonly used soil fumigant, which will soon be banned from future use. Basamid® is applied as a granular and after watering, can be covered with a tarp or incorporated by cultivation into the soil. This flexibility in application conditions is an advantage over methyl bromide which is applied as a gas and must be tarped immediately.

This investigation was designed to examine the effectiveness of Basamid® in controlling *Poa annua* seed in the soil. Basamid® has been labeled for use in a variety of situations but has never received much turf use in the US. The price of the product is high and that may have inhibited the development of the product. However, for use on golf course tees and greens where the acreage is small, Basamid® could be an effective product to eliminate the reservoir of *Poa annua* seed in the soil.

This experiment studied the effect of Basamid® incorporation method, Basamid® rate, and the effect of tarping on the control of *Poa annua* seed in the soil. Four rates of Basamid® , 0, 5,25, and 100 ounces of product/ 1000 ft^2, were used. Soil incorporation was achieved by either hand raking, light vertical mowing, or attempting to seal the gas in with a heavy application of a paper mulch. Twelve treatment combinations (4 rates X 3

Control	113.2	21.0	17.5	16.3	39.6	102.5	101.3
LSD (P=0.05)	NS	6.8	3.3	4.0	12.2	NS	NS

Figure 1. Leaching of dicamba through monolith lysimeters

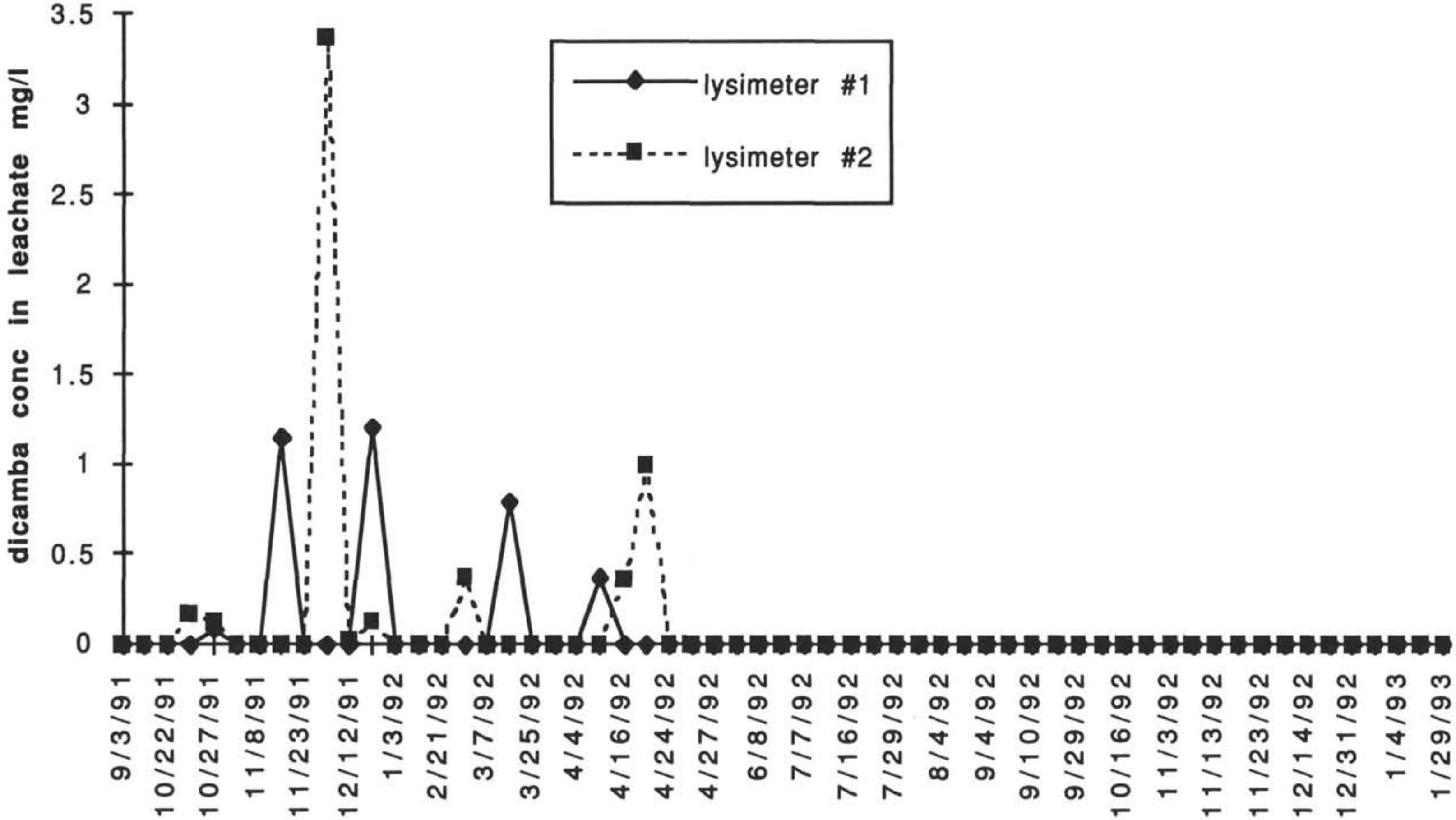

FIGURE 2. LEACHING OF TRIADIMEFON IN MONOLITH LYSIMETERS