Stop #3

Lysimeters for Monitoring Environmental Fate of Fertilizers and Pesticides

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The turfgrass industry continues to receive considerable media attention focusing on the use of fertilizers and pesticides. This attention is usually of a negative nature and often concerns the risk of use of these materials to water supplies, humans, pets, and other non-target organisms. In order to better understand the risk of agrichemical use in turf management to groundwater, a project was initiated in 1989 to monitor leaching of agrichemicals in a realistic field setting.

A lysimeter is a device used to collect soil water. There are two principal types of lysimeters: container lysimeters or suction lysimeters. Container lysimeters are installed in the ground, usually made of metal with a bottom and sides, and are filled with soil. A drain at the bottom is used to collect soil water. The advantage of these is that they give quantitative results. When a known amount of fertilizer or pesticide is applied to the lysimeter, both the concentration and mass of the agrichemical in the leachate can be determined because the total volume of leachate per land area is known. Suction lysimeters are porous ceramic plates or cups which are buried in the soil and a vacuum is applied to the ceramic material which draws soil solution into a collection device. The advantages of suction lysimeters are that they are inexpensive to install and operate. The disadvantage is that the data will only give concentrations of pesticide or fertilizer in the soil water. Information on the mass of material leached is estimated based upon a determination of the quantity of water passing the suction lysimeter.

We decided to install container lysimeters holding an intact core of soil, because this technique is the closest to what actually occurs in the field. These lysimeters are cylindrical containers of undisturbed soil measuring 45 inches in diameter and 48 inches in depth. Intact cores of soil were captured by pushing open-ended cylinders down over excavated cores using a backhoe. During 1989 and 1990, two intact soil monolith lysimeters were constructed at the Hancock Turfgrass Research Center in order to facilitate the study of leaching potential of fertilizers and pesticides applied to turfgrass. Two additional lysimeters are currently under construction.

Two experiments which utilize the lysimeters are currently underway. The first of these is designed to determine the fate of applied fertilizer nitrogen and compare two different fertility schedules. Late fall fertilization produces favorable agronomic response, but there is some concern that late fall nitrogen applications will lead to increased nitrogen leaching. Both treatments include a total of 4 lb. N/M per year as urea, applied at a rate of 0.8 lb. N/M on each of five dates, spaced approximately 40 days apart. One treatment includes an early spring application (late April) utilizing ^{15}N labelled urea, and the other treatment includes a late fall application (early November), again utilizing ^{15}N labelled urea. The four remaining application dates are identical. Use of ^{15}N, a stable isotope of nitrogen, will allow for discrimination of that particular nitrogen application from the others. In addition to leaching, other fates of nitrogen will be monitored, including plant uptake, inorganic soil N, organic

soil N, and gaseous N loss. Soil samples will not be taken from the lysimeters, but from associated PVC microplots measuring 8 inches in diameter and 24 inches in depth. This is done to avoid disturbing the lysimeter soil core. Status of N in the system will be monitored regularly for a period of two years, with additional provisions for one long-term sample (3-5 years).

The second study involves monitoring pesticide movement through the soil. The Environmental Protection Agency has classified a number of agrichemicals as potential leachers, and other products are of concern because of high water solubility. Commonly used turfgrass pesticides which fall into one of these categories include 2,4-D, MCPP, chlorothalonil (Daconil 2787), isazofos (Triumph), fenarimol (Rubigan), triadimefon (Bayleton), propiconazole (Banner), and metalaxyl (Subdue). These products will be applied using common management practices and the leachate will be analyzed for each pesticide throughout the three years of this study. Support for these projects was provided by the Michigan State University Agricultural Experiment Station, Walter Wilkie, and the United States Golf Association.