Studies to protect groundwater quality

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The national concern over chemicals in the environment has seldom been higher.

The recent episodes of Alar in apples and cyanide in grapes are cases in point. A segment of chemical users receiving even more pressure are non-food-producing groups such as the turfgrass industry.

Protecting the nation's drinking water supply is a key environmental issue. With about 50 percent of the nation's drinking water coming from groundwater supplies, protecting groundwater quality is a crucial national issue.

Nitrates from fertilizers and pesticides are two potential contaminants of groundwater most often associated with turfgrass culture.

The nitrogen question

In the past decade a wealth of knowledge has been generated on the fate of nitrogen applied to turfgrass. Considerable information exists on nitrate leaching from sandy sites, but little or none exists from finer textured soils. A study was initiated for this purpose in 1987 at the Cornell University Long Island Horticultural Research Station, Riverhead, N.Y.

The study, supported by member companies of The Fertilizer Institute, evaluated the leaching potential of 9 different nitrogen sources (ureaform, methylene urea, two sulfur-coated ureas, urea, calcium nitrate, two polymer-coated ureas and Milorganite) applied as a "typical lawn" program.

Preliminary results indicate that the amount of fertilizer nitrogen leaching past the rootzone ranged from 0 to 5 percent, with most at 1 percent or less.

The amount of fertilizer nitrogen removed in the clippings of Kentucky bluegrass was found to range between 3 and 21 percent of fertilizer applied.

This study will continue until the spring of 1990 and provide additional information needed to develop a model to describe the fate of nitrogen applied to turfgrass.

Options available

The options available to manage nitrate leaching are: nitrogen source selection and rate of application, season of application, irrigation management and possibly amendments of sandy soil.

Amending sand for putting green or high-use athletic field construction may prove to be a valuable means of reducing nitrate leaching. Sand, by nature, does not absorb nutrients (low cation exchange capacity), especially the inorganic forms of nitrogen (ammonium and nitrate) as well as potassium.

Because leaching data is not needed in order to receive pesticide registration, there is a limited amount of information available on the subject.

Most sources of nitrogen fertilizers generally go through a conversion from ammonium to nitrate (nutrification). Ammonium, being a cation (+ charge), is held in soils having a high cation exchange capacity (not sand). Nitrate, on the other hand, is an anion (− charge) and is not held in soil, so it is easily leached if water is passing through the soil.

The ideal amendment would stop nitrogen from leaching, but still allow the green to have the physical properties of good drainage and aeration, and to resist compaction.

Clay has good cation holding properties but would destroy the physical properties of the green.

Natural zeolite

One material potentially meets both criteria—natural zeolite. One natural zeolite, called clinoptilolite, is a secondary mineral with a high silica content formed from volcanic rock. Major deposits of clinoptilolite are found in the western U.S.

Clinoptilolite can be crushed and screened to sand-sized particles with good physical properties and a cation exchange capacity like clay. Initial studies have shown that the physical properties of sand mixtures containing 5 percent clinoptilolite are maintained at the same time that the clinoptilolite protects the ammonium from being converted to nitrate.

Large scale field testing is now under way to determine to what extent clinoptilolite-amended sand will resist nitrate leaching. Organic amendments will also be evaluated.

There is limited information on the leaching potential of pesticides applied to turfgrass. Generally, this is a result of the fact that even though leaching data is needed for pesticide registration, little has been done related to turfgrass. Furthermore, the information available on pesticide leaching may not be applicable for the turfgrass ecosystem for the following reasons:

- The turfgrass sward has a very high surface canopy compared to row crops. This could relate to greater interception of the pesticide, resulting in the potential for more plant uptake, photodegradation and volatilization.
- The turfgrass ecosystem often has a thatch layer associated with it. The thatch can absorb some of the pesticide and provide conditions that favor both more volatilization and enhanced microbial degradation.
- Under turfgrass conditions, the surface soil contains substantially more roots than most other cropping systems. This could relate to more root uptake or other aspects that could tie up more pesticide.

Establishing models

Numerous pesticide leaching models can predict the leaching potential of a given pesticide. Work being done this year at Cornell University will examine the usefulness of four pesticide leaching models in predicting the leaching from turf of at least two pesticides (Sevin and Daconil 2787).

The study at the A.R.E.S.T.S. facility will involve three soil types (sandy, sandy loam and slit loam) and two irrigation approaches (light, frequent versus heavy, infrequent).

Protecting our nations resources, such as groundwater, should be a concern of every landscape manager. Research of this nature can provide the information necessary to protect the environment while allowing turfgrasses to have the quality desired. **LM**