

Keeping Chemicals Out of Our Groundwater

Safe and sound turf fertilization and management practices

by Kevin Hattori



Excessive nitrate concentrations in water can accelerate algae and herbaceous plant growth in streams and lakes, resulting in oxygen depletion.

In an age where terms like “El Niño,” “global warming trend,” and “acid rain” are used with ever-increasing frequency, it is no wonder that today’s general populace is extremely concerned with the effects of fertilizers and chemicals on the environment. These issues are prevalent, as demonstrated by the recent release of the highly touted movie *A Civil Action* (based upon an actual court case against companies accused of practices which led to the chemical contamination of an entire city’s drinking water).

While a total ban on the use of fertilizers, fungicides, pesticides and

other chemicals is not at this time a viable option, regulations on their use are becoming increasingly stringent. An example of this can be seen clearly in California’s Marin County, where recently passed legislation now bans the use of all fungicides and pesticides. Such precedents serve to illustrate that the aforementioned issues are not simply going to disappear, and many green industry professionals have been left to ask exactly what steps can be taken to help eliminate—or at the very least, minimize—such problems.

The benefits of fertilizers are fairly evident. Even so, improper management

of plant nutrients can and does lead to excess amounts of nutrients leaching below the root zone and into groundwater. This can be a result of excessive application of nutrients through generalized fertilization recommendations, but other factors come into play as well. One must keep in mind that soluble nutrients available to plants are also subject to leaching, the natural process of the movement of materials dissolved in water. Once the plant has utilized what it can, remaining soluble nutrients may leach below the root zone, possibly contaminating the groundwater found there.

In soil, both organic and inorganic

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Nitrogen are converted to highly leachable nitrates, which are of particular concern because they can contaminate groundwater at low concentrations. Since they are not attached to soil particles, nitrates are able to move easily downward through the root zone with soil water to contaminate groundwater. They may also be dissolved and transported in runoff to contaminate surface water. Excessive nitrate concentrations in water can accelerate algae and herbaceous plant growth in streams and lakes, resulting in oxygen depletion. Nitrates can also be harmful to the health of some animals or human infants. Even non-toxic nitrate levels have been shown to lower human resistance to environmental stresses and normal metabolism.

Other easily leached nutrients (like Potassium) are seldom present in fertilized soils at levels currently considered to degrade groundwater quality. Some nutrients (like Phosphorus) have a low level of solubility, and therefore possess a risk of leaching into groundwater supplies. However, it is still possible for these nutrients to contaminate surface water if they are carried off-site in eroding soil.

It is important to be aware of existing conditions that constitute a high risk of leaching. Such factors include the over-application of Nitrogen; poor timing of fertilizer application (i.e. wherein the application does not coincide with optimum plant uptake); shallow root systems; shallow, unprotected groundwater; sandy, coarse or well-drained soils; and excess rainfall or irrigation. The common occurrence of the conditions on this list serves to underscore the critical need for the implementation of sound management techniques.

What can be done?

Although groundwater leaching cannot totally be eliminated, sound manage-



ment practices can greatly reduce the levels of resultant contamination from nitrates. Professionals in the green industry must realize that the implementation of responsible management practices can actually make a world of difference.

• Do Your Research

Test the soil and turf to determine their fertility levels. Testing can indicate the amounts of vital nutrients your soil already contains. Such a test will also determine the composition and pH level of your soil. A tissue analysis of your turfgrass should also be conducted in order to discern the levels of nutrients it is actually utilizing. The results of these tests can be invaluable with developing a fertilization program to maintain optimal nutrient levels for the turfgrass.

• Do More Research

Determine Nitrogen, Phosphorus and Potassium requirements. The aforementioned testing will help you to make these determinations. Though fertilizers with 4-1-2 or 4-1-3 ratios are commonly recommended for mature lawns (since they generally require more Nitrogen than Phosphorus and Potassium), there are in fact a myriad of factors that make each situation unique. Also, to avoid over-application of nutrients, an estimate about the amount of Nitrogen that will

be released through mineralization of organic Nitrogen sources (like manure, plant residues, and soil organic matter) should also be made.

• Apply Carefully

Monitor your placement and timing of fertilizer. Fertilizer should be applied where the turfgrass can most effectively take it up. Spray feeding provides dual efficiency, since both foliar and root absorption of nutrients occur. In fact, just one pound of Nitrogen applied to the leaf of a plant provides the same amount of Nitrogen as three pounds applied to the root. Slow release liquid Nitrogen also has the added benefit of being better able to adhere to soil particles and leaf surfaces. Of course, this means that there are significantly less nitrates available to leach into existing groundwater supplies.

Applications should be scheduled so that adequate Nitrogen is available during peak plant demand. Slow release Nitrogen (SRN) sources are often preferable for this task, since they release nutrients over extended periods of time and can be applied less frequently than quickly available Nitrogen sources. Also, they are less susceptible to leaching, and are therefore much preferred for use on sandy soil types (which are prone to leaching).

Application of any fertilizer material on non-turf areas (driveways, roads or bare soil) should always be avoided since it will likely lead to run-off and adversely affect water supplies.

Properly timing your application of fertilizer can also play a strong factor in your disease management program. For example, excessive spring application of Nitrogen on cool-season grasses (like Kentucky bluegrass, tall fescue, perennial ryegrass, and fine fescue) leads to excessive leaf growth at the expense of stored food reserves and root growth, increasing injury to grass from summer disease and drought. Healthier plants are also far less susceptible to disease and drought, making you less dependent on the use of harsh and potentially dangerous chemical fungicides, pesticides, and herbicides.

• Add Water

Proper irrigation can improve plant health and Nitrogen uptake. Excessive or poorly timed irrigation can be a major cause of nitrates leaching below the root zone. Keep in mind that the main catalyst in the leaching process is water, and too much of it—whether from your irrigation system or from natural precipitation—will push the nutrients past the root zone of the plants they are intended for and into the groundwater below.

• Handle With Care

Blend and store your materials in a safe place away from water supplies, and check frequently to ensure that application equipment is properly calibrated and maintained. Care should also be taken when cleaning equipment and disposing of excess fertilizers, containers and wash water.

What about synthetics?

Of course, water contamination problems can also occur with the application of synthetic pesticides, herbicides and fungicides. Since it is extremely rare for such products to possess any sticky qualities on their own, “stickers” must be added to give them at least some ability of adhering to soil particles and leaf sur-



faces. Stickers generally fall into two categories. The first, known as a chemical sticker (or as a Cation surfactant), gives its host product a positive charge, therefore causing it to adhere to the negatively charged plant surface. The second type of sticker is a “physical sticker.” This is much like glue added to the solution in question. Upon drying, it literally sticks to the surface of the plant. Still, where such synthetic chemicals are concerned, the potential for groundwater leaching is a major one. They can be extremely toxic, even in small amounts.

If synthetic chemicals must be used, keep in mind that they may often be used at reduced rates with stellar results. For instance, in testing done at Rutgers University, half rates of synthetic chemical fungicides like Daconil Ultrex (ISK Biosciences) and Heritage (Zeneca) used along with the biological microbial inoculant Companion (Growth Products, Ltd.) had better efficacy (96 percent control) against summer patch (*Magnaporthe poae*) than did the same

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synthetic chemical fungicides utilized alone at full rates.

Dr. Bruce Clarke, director of the Rutgers Center for Turfgrass Science, says that the future of biologicals “is really about lowering the rates of synthetic fungicides and extending the intervals between applications. Marrying the two (biologicals and chemicals) is very positive, and turf managers really need to give this serious thought because it is the future of what we’re doing.”

Many in the professional turf market agree wholeheartedly with Clarke, and are working actively to ensure that the future he alludes to remains intact. “We all have to do our part to be environmentally sensitive. For years, golf courses have been viewed as the guys in the black hats, but that’s not true with a lot of us,” says Pete Bibber, superintendent at Delmonte Golf Course in Monterey, Calif. “By utilizing best management programs, and using high quality fertilizers and effective biological controls, we’ve seen a drastic reduction in our dependence on chemical fungicides. Best of all, we’re not sacrificing quality. This past year was our best with greens ever, and everyone—no exaggeration—is thoroughly amazed at the health and overall appearance of our turf.”

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