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Nutrient Management for Lawn Service Companies

James H. May, Research Associate, Crop and Soil Environmental Sciences, Virginia Tech
David R. Chalmers, Associate Professor and Extension Agronomist, Turfgrass Management, Virginia Tech
John R. Hall III, Professor and Extension Agronomist, Turfgrass Management, Virginia Tech

The public's interest in having high quality lawns has been the driving factor in the development of the lawn service industry. The idea of having someone else responsible for fertilization and pest control of the home lawn appeals to many of today's busy, two- job families.

Water quality, recycling, composting and nutrient/pesticide concerns are on the minds of consumers. These concerns are very real because many of our landfills are at capacity, our groundwater is at risk from chemical pollution and the need to utilize our yardwastes by backyard and municipal composting and recycling lawn clippings is becoming apparent.

One of the major environmental concerns on the minds of many Virginians is the protection and preservation of the Chesapeake Bay. This national treasure is in danger from pollutants entering the many streams and rivers that empty into it. Sources of pollution such as factories and water treatment plants are easily identifiable and can be regulated. Nonpoint sources, such as farms, nurseries and even home lawns, are more difficult to pinpoint as sources of pollution. These nonpoint sources, however, are potential contributors to Chesapeake Bay pollution. It is up to individuals to take it upon themselves to become aware of practices that are detrimental to the health of the Chesapeake Bay and to respond by changing those practices in order to be more environmentally sensitive.

This growing environmental consciousness is putting pressure on lawn service managers to be more attentive to legitimate consumer concerns. While research continues to evaluate the effectiveness of biological controls and organic lawn care, most lawn service companies still provide customers traditional fertilization and pest control programs. It is very important that lawn service managers implement good management practices that are the basis for environmentally sound lawn service programs.

Lawn service companies have the responsibility of satisfying their customers and providing the turf with the needed nutrients while minimizing the environmental impacts of their management practices. Maintaining healthy turf areas can be accomplished by utilizing common sense and adhering to classic agronomic management principles. Know your soils and apply fertilizer and pesticides correctly. Adopt environmentally sound lawn service programs that will reduce leaching, runoff and erosion and maximize the environmental benefits of quality turfgrass.

Environmental Benefits of Lawns

Lawns provide us with a number of environmental benefits, most of which we simply take for granted. These include:

- the cooling effect of an average size lawn is equal to about 9 tons of air conditioning, greater than a typical home's central air conditioning unit.
- turfgrass traps much of an estimated 12 million tons of dust and dirt released annually into the U.S. atmosphere.
- healthy, dense lawns can absorb rainfall six times more effectively than a wheat field and four times better than a hay field.
- up to 90 percent of the weight of a grass plant is in its roots, making it very efficient in stabilizing soil and preventing erosion.
- a turf area just 50 feet by 50 feet absorbs carbon dioxide, ozone, sulfur dioxide and other gases and releases enough oxygen for a family of four.
- athletic fields covered with natural turf have proven to be safer than artificial turfs.

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- a Gallup Survey reported 62 percent of all U.S. homeowners felt investment in lawns and landscaping was as good or better than other home improvements.

The Turfgrass Ecosystem

In recent years more attention than ever has focused on the environment and especially on protecting water sources from possible contamination. When improperly applied, nitrates from fertilizer sources can be a major pollutant of groundwater. But, when fertilized at the proper time and at the proper rate, a healthy, well maintained lawn can utilize fertilizer components and minimize their leaching. It can also intercept thousands of gallons of water from a heavy rain, recharging groundwater supplies while minimizing erosion. In addition, a healthy lawn can utilize and then break down pesticides into their basic components.

A healthy turf, with 1,000 or more plants per square foot, provides a large surface area to intercept pesticides, fertilizers and water. Any analysis of the potential for a pesticide or fertilizer to leach to the groundwater must take into account the amount of applied material that reaches the soil surface and the amount that actually moves down through the soil past the thatch layer and root zone. These areas are very chemically and biologically active and rapidly degrade most pesticides. Many pesticides are formulated as systemic materials designed to be absorbed by plant roots.

The majority of the root systems in turfgrass occur within the top 4 to 6 inches of soil. In the case of fertilizers, this extensive, fibrous zone allows fertilizer components to adsorb onto organic matter or clay particles, thus giving the roots more time to utilize the nutrients. Thatch is also an important component of this turf biosystem. In an actively growing turf, the decay rate of the thatch should equal the rate of accumulation, thereby preventing buildup of thatch. A healthy population of soil fauna, including microorganisms and earthworms, helps to break down the thatch layer. This highly absorptive thatch layer minimizes runoff while tying up and encouraging the degradation of certain pesticides, thereby reducing leaching.

Other systems of natural degradation interact and help to prevent the vertical movement of pesticides. These include:

- Gaseous losses (volatilization)
- Microbial decay
- Photodegradation by ultraviolet light
- Hydrolysis (breakdown in water)
- Conversion to other compounds
- Adsorption to soil in unavailable forms

Thus, a healthy, dense, well managed turf can protect water quality by binding and degrading pesticides. Good management practices, such as proper mowing height and frequency, judicious use of pesticides and well-timed application of fertilizers can all contribute to the goal of protecting our water supplies.

Management to Minimize Nitrate Leaching

There are several related factors that the manager has control over that are important in determining the leaching potential of a fertilizer applied to turf. Leaching can be kept to a minimum while supplying the turf with the optimum amount of nutrients.

Source of nitrogen - A water-soluble source of nitrogen has a higher leaching potential than a slow-release source, especially when its application is followed by a large amount of water, either from rainfall or irrigation. If, however, water-soluble sources are applied in several split applications, rather than all at once, their pollution potential is reduced. Split applications will increase labor costs, however, so a slow-release fertilizer applied less often, may be cost effective.

Use of a slow-release nitrogen source is a good practice whenever possible. It offers the advantages of reducing labor costs, since the number of applications is reduced, as well as reducing the risk of foliar burn, providing a more even supply of nitrogen and reducing nitrogen leaching. However, it is important to understand differences that exist between slow-release sources. Some slow-release sources, especially ureaformaldehyde (UF) and natural organics, such as Milorganite, give only poor to moderate response in cool weather. The reason for this is that the water-insoluble-nitrogen (WIN) in these sources becomes available to the plant as a function of soilmicrobial activity. Other slow release sources, such as isobutylidene diurea (IBDU) and sulfur coated urea (SCU), are not as dependent on soil microbial action, therefore release rates are not significantly decreased in cold temperatures.

These sources can be more expensive than water-soluble sources and they are frequently applied in a dry form, which at times is inconvenient. There are, however, slow-release fertilizers in fine granular form and in sprayable micro-pelletized form.

Rate of application - The rate of application is affected by the source of nitrogen. If using a soluble source, apply it more frequently at a reduced

rate, either by split surface application or fertigation. On traditional Virginia soils, single nitrogen applications of water soluble-sources should not exceed 1.0 lb. N/1,000 square feet. In general, slow-release fertilizers can be applied at higher rates. On a yearly basis, no more than 3 to 4.5 lbs. of N/1,000 square feet should be applied.

Time of year - The total amount of nitrogen applied to warm or cool-season grasses and the timing of the application reflects differences in plant uptake and root growth. The best time to fertilize cool-season grasses is in the fall. In late fall to winter, cool-season grasses are beginning to develop their root systems and store carbohydrates. Extensive root systems will be developed in the spring along with earlier green up. On the other hand, warm-season grasses have the greatest rate of uptake in the spring after green up and throughout the summer.

Nitrogen applied as a fertilizer to turfgrass can be lost to the atmosphere as either ammonia (NH_3 volatilization) or as one of several nitrous oxide compounds (denitrification). Increases in soil temperature tend to increase the rates of volatilization of ammonia and the rate of denitrification of the nitrogen source. Urea is most prone to volatilization. In situations where urea is used, it should be watered in to minimize the potential for volatilization.

Denitrification is a microbial process whereby NO_3- is converted to a volatile gas due to environmental influences such as high soil temperature, limited oxygen supply, microbial population and excessive moisture. While neither volatilization or denitrification has a direct effect on water contamination, they both are related to increases in atmospheric nitrogen and reduced fertilization efficiency.

Alternatives to nitrogen - Iron applications to turfgrass have been shown to increase chlorophyll content, carbohydrates and rooting while decreasing respiration rates. Mid-summer green up can be accomplished with iron instead of nitrogen. Late fall applications of iron with nitrogen on cool-season grasses have produced earlier spring green up and enhanced rooting.

Biostimulants containing cytokinins and other growth promoters show promise of promoting increased root growth and greening while reducing nitrogen requirements. Both iron and biostimulants can be used to reduce nitrogen fertilization rates.

Irrigation practices - Excessive irrigation can cause leaching of nitrates, especially from water-soluble sources, or if nitrogen is applied to turf in a dormant or semi-dormant period of limited plant uptake. There is seldom justification for wetting the soil deeper than the root system.

Soil type - Certain types of soils have a greater ability to hold nutrients than others. This is due to the amount of clay or organic matter in the soil, both of which have a negative charge, allowing them to hold, or adsorb, positively charged particles (cations), such as ammonium (NH_4+) or potassium (K+). Cation exchange capacity (CEC) of a soil is a measure of the ability of a soil to retain positively charged ions. Soils that are high in sand content have a low CEC and must be managed to reduce the risk of leaching. The use of slow-release N sources is recommended. However, if using a water-soluble source on a low CEC soil, more frequent, lighter applications may be necessary.

On sandy soils where CEC is low, the addition of an organic matter source such as peat, sawdust or compost will increase the CEC of the soil, allowing it to retain more nutrients.

Management of Minimum Resource Inputs

Grass selection - Some species and varieties of grass naturally require less nitrogen to maintain a good green color. Research continues on the development of these types of grasses. Select dark green varieties that perform well in your region to minimize the use of nitrogen to create green color.

Mowing height - Selection of mowing height is probably the most important decision in mowing. There is no doubt that mowing is a stress-creating management practice. Each species of turfgrass has a mowing tolerance range, at which it can exist over a broad range of climatic conditions with minimum stress and still be expected to provide a satisfactory turf. If the turf is mowed too short, it tends to become denser, but have less growth of roots and rhizomes. This also makes the turf less tolerant of environmental stresses, more disease prone, and more dependent on a carefully implemented cultural program. The smaller, shorter root system requires more water and fertilizer to compensate for its decreased ability to secure and hold moisture and nutrients from the soil. To avoid this stress, the turf manager must provide stress-reducing inputs such as irrigation, fungicides, herbicides and properly timed cultivation and fertilization.

Care must be taken when providing these inputs, however. If we are removing leaf area and reducing root

area, while applying pesticides, fertilizers and water to reduce stress, we are increasing the risk of these inputs leaching through the soil or running off and endangering our water supply. The best approach is to use the highest mowing height acceptable for the variety of grass and for the use being made of the turf.

Mowing frequency - This can have an extreme effect upon root growth especially when more than 40 percent of the existing foliage is removed. Time of mowing, pattern of mowing and even type of mowing equipment can influence turf quality. For example, mowing turfgrass areas that are too wet or under extreme heat or moisture stress can be detrimental to the turf. Stressing the turf can lead to the need for increased inputs. If the turf is too wet, clipping discharge can be affected, leading to clumps of clippings that shade turf which reduces turf quality. Mowing increases evapotranspiration, and when temperatures are high, water loss may be extreme, necessitating irrigation.

Returning clippings - This continues to be a controversial practice because it was thought to increase thatch buildup and possibly increase disease problems. Research has shown, however, that in healthy turf that is otherwise properly managed, returning clippings does not greatly increase thatch buildup. Work at the U.S. Department of Agriculture has demonstrated that clipping removal for eight years only reduced thatch buildup 12 percent in Kentucky bluegrass turf. Tall fescue shows less tendency to produce thatch than Kentucky bluegrass, therefore returning clippings to tall fescue lawns is even less likely to increase thatch buildup.

Clippings do have significant nutrient value. They normally contain 3 to 4 percent nitrogen, 0.3 to 0.5 percent phosphorus and about 2 to 3 percent potassium. Being fairly high in nitrogen, they will decompose rapidly and return nitrogen to the soil, reducing the need for nitrogen fertilizer as much as one-third.

Collecting and bagging clippings to be sent to the landfill is a job no one likes and is also a waste of landfill space. Returning clippings is not only an environmentally sound practice, it can save the homeowner money in fertilizer costs.

Composting - Many homeowners are getting involved in backyard composting as a means of recycling leaves, grass clippings and kitchen scraps. The finished compost can then be incorporated into the soil in a vegetable or flower garden and serve as an excellent soil amendment. Lawn service companies should encourage backyard composting, especially to those homeowners who collect grass clippings and bag leaves for landfill pick up. Recently, some companies have started providing compost bin construction service, and then landscaping around the bin to allow it to blend in with its surroundings.

Maintain a Healthy Soil - The soil itself can help to keep many diseases in check. In a healthy soil, disease pathogens are vastly outnumbered by non-pathogenic microorganisms (amoeba, bacteria, fungi, actinomycetes and nematodes), and macroorganisms (including insects and earthworms). This soil ecosystem usually thrives, but things such as stress can cause an imbalance in the system. This stress can be a natural one such as drought, heat or cold. It can also be an outside stress such as a pesticide application. A well-timed application of a pesticide to treat a specific problem is the least damaging to the natural soil population, but remember that pesticides not only kill pathogens, weeds and insects, they can also kill harmless soil inhabitants.

Earthworms are particularly beneficial soil inhabitants. Their castings are rich in organic matter and nutrients. They aerate the soil and can bring nutrients that had leached back to the surface. Their populations can be reduced greatly by pesticide applications. Insecticides are especially damaging to earthworms, but even some fungicides, such as Benomyl, have been found to reduce earthworm populations by 60 percent (Buxton, Ky Turfgrass Research Progress Report, 1988). The same research found insecticides such as Carbaryl, Ethoprop and Bendiocarb to have killed 90 percent or more of the earthworms in a population.

Aeration - Developing good soil structure under a turf is possible if the soil has desirable “topsoil”-like characteristics and no traffic. However, traffic on a turf area compacts the soil and destroys soil structure. In poor soils or those receiving excessive traffic, core aerification can be extremely beneficial in increasing air exchange, water infiltration rates, water retention, nutrient penetration, root development and thatch decomposition. It also decreases runoff and therefore increases water use efficiency, reducing total irrigation requirements. Heavily trafficked cool-season grasses should be aerified spring and fall during periods of active foliage growth, although mid-summer aerification can be beneficial if irrigation is available and temperatures are favorable. Warm-season grasses can be beneficially aerated from the time they totally green up until about 6 weeks before they go dormant in the fall.

Integrated Pest Management (IPM)

Integrated pest management is the use of a variety of management practices or techniques to reduce or control pests. IPM offers the possibility of improving the efficiency of plant production while minimizing environmental impacts. Developing these concepts for turf areas is important in maintaining high quality turf while minimizing damage to our water resources.

Pesticides are valuable components of a turfgrass cultural program, but pest management includes more than simply applying the right pesticides to control specific organisms. It also includes selecting turfgrasses that are well adapted and maintaining the health of the turf through good management practices. Damage from insects and other pests is often greater in turf that is improperly established or managed.

Many pesticides can leach through the soil or runoff into water supplies if applied incorrectly or at the wrong time. Soil charac teristics also have an effect on pesticide leaching. Highly modified sand based soils, for example, leach pesticides more easily than a soil with organic matter or a thatch layer.

While the potential environmental hazard associated with most turfgrass pesticides appears to be minimal, it is still a good practice to employ integrated pest management in turf areas. If pesticide use is necessary, some of the suggested IPM practices include:

Spot treat - Scout for and treat only areas of specific pest damage instead of treating large areas on a preventive basis.

Understand damage thresholds - The presence of a few spots on leaves or a few insects in the turf does not always require the use of a pesticide. It is only when the pest populations develop sufficiently to cause damage that a pesticide should be applied.

Preventive vs Curative approach - Some pest problems, such as crabgrass, occur so routinely and cause so much damage that a preventive approach is necessary. For most turfgrass problems, however, pesticide application should probably be withheld until scouting or monitoring indicates that unacceptable damage will occur if a pesticide is not used. This is called a curative approach.

Selecting Pesticides

In selecting pesticides, the turf manager wants products that will be effective in controlling the pest problem, while minimizing environmental impacts. Many pesticides are organic compounds that interfere with some physiological process in the pest organism. There are several compound-related factors to consider when selecting pesticides.

Mobility - In general, highly water-soluble chemicals leach faster then the less soluble ones, although high solubility alone does not imply that a chemical will contaminate groundwater.

Adsorption - Depending on their composition, most compounds are more or less strongly adsorbed on soil organic matter, the thatch layer and clay. Adsorbed chemicals do not move in bulk with the water, but are retained while the water moves toward the groundwater saturated zone. Adsorbed compounds are more prone to microbiological attack and the metabolites can be gradually released back into the soil solution where they are broken down.

Persistence - Chemicals persist in the soil for varying amounts of time. Most modern chemicals are moderately persistent or non-persistent. Persistence is reported as half-life, that is, the time it takes for about half of a given amount to break down.

None of the above factors, taken by itself, should be used to condemn a pesticide. However, a pesticide with high mobility, low adsorption and moderate to high persistence would be more prone to contaminate surface or groundwater than one with low mobility, high adsorption and low persistence.

Calibration of Spreading and Spraying Equipment

All equipment that is used to spread or spray nutrients and pesticides should be calibrated frequently to insure accurate delivery and placement of materials. Over applying can cause injury to turf, humans or our water supplies. Insufficient amounts could result in poor or ineffective control and result in the need to reapply a pesticide.

Sprayer Calibration

Calibration should be done on terrain and at speeds similar to the actual spraying conditions. The following pre-calibration checks should be made.

- Insure that the sprayer is properly mounted
- Rinse the sprayer with clear water before calibrating
- Remove, clean and replace all nozzles and screens
- Check for leaks and insure that nozzles uniformly distribute spray

Refer to Virginia Extension Publication 442-034 for complete calibration instructions.

Spreader Calibration

The two main items to consider when calibrating a spreader are 1) the distribution pattern of the spreader and 2) the product application rate.

The distribution pattern is the pattern the product makes as it settles on the ground after it is thrown out by the spreader's impeller. The application rate will differ for each product. Over-application can be expensive and wasteful and also damage our water resources.

Some basic tips for pre-calibrating a spreader:

- Check the spreader discharge holes with the lever in the closed position. The holes should be well sealed.
- Empty the spreader after each use. Wash the spreader and allow it to dry. Spray moving parts with a light oil. Keep the impeller clean.
- Operate the spreader at a constant speed.
- Store the spreader in a cool, dry place with no material in it.

Refer to Virginia Extension Publication 427-010 for details on granular spreader care and calibration.

Pest Identification

It is imperative to properly identify pest problems before applying pesticides. The "shotgun approach" is simply not an option. Proper identification will result in a higher efficiency rate in quickly eradicating the pest. In addition, money can be saved by applying the right pesticide for the pest. And last, but certainly not least, the impact on the environment, especially to our water resources, will be minimal.

Turfgrass management is a complex combination of science and art. Professional lawn service companies must insure that their programs maximize the environmental benefits of turfgrass and minimize the potential for environmental harm.

Reviewed by Mike Goatley, Extension specialist, Crop and Soil Environmental Sciences.

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Virginia Cooperative Extension would like to remind you that what we do to the lawn and landscape impacts local water quality and that of the Chesapeake Bay.