Nitrogen in the Landscape

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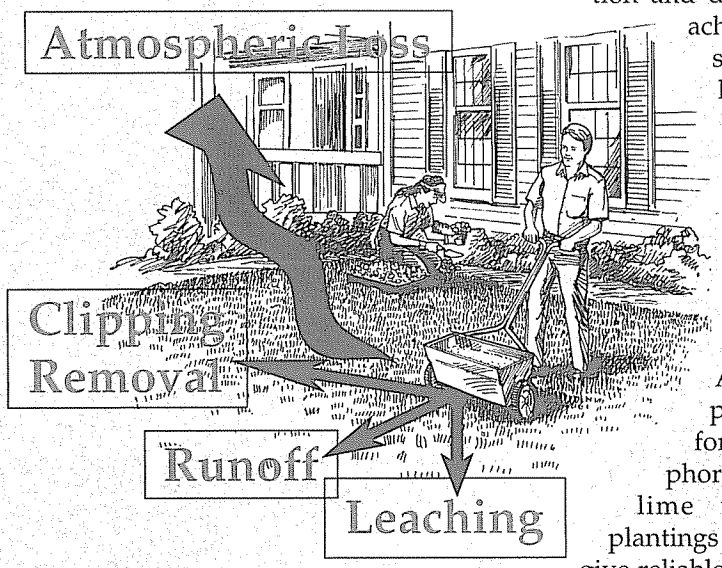

Nitrogen (N) is an essential element for all living things and the *mineral* element needed in the largest amounts by turf and ornamental plants. Although N is abundant in the air (about 80%) it is in limited supply in soils and only available to plants after it has been converted to nitrate (NO_3^-) or ammonium (NH_4^+) by microorganisms or industrial processes. In most cases, N fertilizer must be applied regularly to maintain high quality landscape plantings.

Although N fertilizer is required for healthy landscape plants, it can also contaminate ground and surface waters through leaching and runoff. Excessive N concentrations in drinking water are a health risk. Nitrogen movement into water can also accelerate degradation of lakes and estuaries through a process called eutrophication. Eutrophication refers to the addition of nutrients to surface waters, resulting in dense aquatic plant growth, depletion of oxygen, and in advanced stages - fish kills.

The goal of your N fertility program should be to optimize plant uptake while minimizing leaching, runoff, and other losses such as volatilization and denitrification. To achieve this goal, you should understand how N behaves in the environment and know the conditions which influence its fate.

Optimizing N use by plants

Although soil tests provide guidelines for how much phosphorus, potassium, and lime your landscape plantings need, they do not give reliable information on N requirements. The amount of N you should apply depends on the species you are attempting to maintain

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(and in some cases - the cultivar), the soil conditions at the site, level of management, and how the site is used.

Turfgrass and ornamental species differ in the amount of N required for optimum performance. Among the cool-season turfgrasses, Kentucky bluegrass and perennial ryegrass typically require 3-4 lbs N/1000 ft^2/yr, whereas the fine fescues and tall fescue respond best to about 2 lbs N/1000 ft^2/yr. If you only apply 1 or 2 lbs of N/1000 ft^2 to a Kentucky bluegrass turf, it will become yellow, thin, and susceptible to pest damage at sometime during the growing season. On the other hand, if you give a fine fescue turf the amount of N that Kentucky bluegrass needs (3-4 lbs N/1000 ft^2/yr), you will over stimulate it and make it susceptible to drought, heat stress, and some diseases.

Nitrogen fertilizer requirements of landscape plants also depend on soil quality. Plants growing in soils where much of the topsoil has been removed or in sandy soils, usually require more N fertilizer than plants growing in good quality topsoils. This is because poor soil has a low amount of organic-N and sandy soils often let N leach more easily. You can improve poor soils by adding organic amendments, such as good quality compost, which improves soil structure, adds nutrients, and improves nutrient retention, thus reducing N fertilizer needs.

Management practices, such as mowing and irrigation, can significantly influence the amount of fertilizer N needed by landscape plants. By returning grass clippings to your lawn you can reduce N fertilizer needs by up to one third. Lawns that are frequently irrigated during the summer months use more N than non-irrigated, semi-dormant turf.

How the site is used will also dictate how much N is needed for optimum plant performance. Athletic fields and other high traffic areas need more N than low traffic areas in order to recover from wear. On the other hand, wildflowers should receive little or no N fertilizer because they will out-compete many weeds when N fertilizer is scarce.

Runoff

When N is applied to the landscape there is a possibility that some of it may runoff into surface water. Runoff is the portion of water that runs over the surface down slope. The rate of runoff is determined by the amount and rate of precipitation, slope, infiltration capacity of soil, vegetation cover, and cultural practices.

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Runoff is likely to occur following sudden, heavy rainstorms on soils with poor infiltration characteristics and that have little or no vegetation. The most significant runoff threat, however, is from impervious surfaces such as sidewalks, driveways, roads, and frozen soils. Runoff from impervious surfaces can be carried into storm sewers and find its way into surface or ground water.

Research conducted at Penn State has shown that where a dense, well established turf exists, the amount of N removed from the site via runoff is very low - provided the soil allows good infiltration. The dense cover of leaves, stems, and thatch of turf slows the rate of surface flow, allowing water and nutrients to infiltrate into the soil.

Leaching

Leaching occurs when irrigation or rainfall carries N, primarily in the nitrate (NO_3^-) form, downward through the soil profile. If NO_3^- moves past the plant roots, there is little to stop its downward movement and it can end up in ground water.

The amount of N leached from a landscape site depends on the soil type; the amount of precipitation; and the N source, rate, and timing of application. The greatest potential for leaching is when you apply quickly-available N at a high rate, on a sandy soil, during wet weather or excessive irrigation. Leaching can be reduced by using slow-release N fertilizer on high sand content soils or by using several low rate applications of quickly available N fertilizer. Limiting N applications when plants are not actively growing and/or during extremely wet periods of the year can also reduce leaching. Since leaching of N can occur even in loam soils, be sure to follow good fertility and irrigation practices at all times.

Atmospheric losses

Atmospheric losses of N fertilizer can occur due to volatilization and denitrification. Although these losses are not a health or pollution hazard, they can reduce the efficiency of N fertilizer applications, resulting in greater costs and reduced quality of landscape plants. Volatilization occurs when N is converted to ammonia gas (NH_3). It is more likely to occur following surface applications of urea or ammonium-containing fertilizers. Losses are favored by high soil pH, high temperatures, sandy soils, and thatch. Watering-in applications of urea and ammonium-containing fertilizers will reduce volatilization in turfgrass stands.

Denitrification occurs in saturated soils when anaerobic bacteria (bacteria that survive in the absence of oxygen from air) convert NO_3^- to N_2, a gaseous form of N which escapes into the atmosphere.Turf that survives in poorly-drained soils often turns yellow in wet weather due to denitrification. Improved drainage at these sites will reduce N_2 losses.

Summary

The goal of your N fertility program should be to optimize plant uptake while minimizing losses. Be sure to apply the right amount of N at the proper time of year for the plant species you are managing. Also, consider the soil type, management, and use of the site before designing your program. Never let fertilizer remain on sidewalks, roadways, frozen soil, or other impervious surfaces, and try to water-in your fertilizer application to avoid volatilization ■

10 tips for getting the most out of your N fertilizer

The following are suggestions for maximizing the efficiency of your N fertilizer program, while minimizing losses to leaching, runoff, and the atmosphere.

1. **Soil test.** Applications of phosphorus, potassium, and lime according to soil test recommendations allow more efficient use of N-fertilizer by landscape plants.

2. **Apply N only in amounts needed** by the species you are trying to maintain - more is not necessarily better.

3. **On turf, apply several applications** of N fertilizer over the growing season so as to meet the needs of the plants- usually mid to late spring, late summer, and late fall.

4. **Returning clippings** to lawns can cut N fertilizer use by up to one third.

5. **Don't over water** - too much water can leach N below root system and into ground water.

6. **Use slow-release fertilizers** when making infrequent, high rate applications in areas where soils are prone to leaching.

7. **Keep N fertilizer on the lawn** and not on pavement. Shut off your spreader when moving across driveways or maintenance roads or sweep-up granules from pavement. In small lawns enclosed by sidewalks and driveways, use a drop spreader or a liquid application for greater accuracy.

8. **Do not apply N fertilizer** to lawns experiencing summer dormancy or on frozen surfaces in winter.

9. **Water-in urea** or ammonium-fertilizers, especially when applications are made in warm weather.

10. **Fill and empty fertilizer spreaders** in an area where spills are easily cleaned-up. Use your spilled fertilizer -don't wash it into the street or storm sewer.