

How to minimize nitrate movement from turfgrass

By DOUGLAS T. LINDE, Ph.D.

Various researchers have determined that nutrient transport (including nitrate) in surface runoff from turfgrasses is minimal. In addition, researchers found that nitrate in leachate water from a moderately fertilized turf, even grown in sand, was minimal.

Despite the evidence that little nitrate moves offsite in surface runoff or leachate from turfgrasses, you still have to manage nitrate and other forms of nitrogen to reduce the risk of pollution. Also, careless ni-

trogen management can waste money and decrease turf quality.

Surface runoff is water that flows over the soil surface. It occurs when rainfall exceeds the soil's infiltration rate. Surface runoff may enter streams and lakes or it may infiltrate the soil downslope.

Subsurface runoff is rainfall that infiltrates and moves laterally in soil. It often exits the soil and enters a stream or lake.

Leachate is water that has percolated below the root zone.

Nitrates can move

Nitrogen, like phosphorus, can contribute to eutrophication of water resources; that is both elements promote plant growth in and along the banks of streams, lakes and ponds. The U.S. Environmental Protection Agency considers the nitrate form of nitrogen a drinking water pollutant because of its potential to cause an uncommon condition in human babies and young animals called methemoglobinemia ("blue baby disease").

Nitrate is also highly soluble and can move readily in both surface runoff and leachate. It moves readily through soil because its negative charge prevents it from being held by the soil and it is actually more

prone to leaching into water resources than to moving offsite in surface runoff.

After applying nitrogen fertilizer, it is converted to plant-available nitrate in or on the soil. Any nitrate that has entered the soil cannot move offsite in surface runoff, but it can still enter surface water resources via subsurface runoff. If nitrate happens to be on the soil surface, it will infiltrate the soil as rainfall filters into the soil, until the soil is saturated. By the time runoff begins from turf, most, if not all, nitrate on the soil surface should have entered the soil.

What measures can you take to further minimize the potential of offsite movement of nitrogen and nitrate in surface runoff and leachate? Some of the following suggestions have been proven by research while others are common sense measures.

Promote healthy turf

Use recommended cultural practices that encourage a dense, actively growing turf. This includes proper mowing, irrigation, core cultivation, aeration and fertility. Nitrogen applied to a dense, actively growing turf is rapidly used by the turfgrass plants. The extensive mass of fibrous roots typical of actively growing turfgrasses can absorb available nitrogen at recommended rates. In general, turfgrasses are among the most efficient plants in using applied nutrients.

A dense, actively growing turf also reduces potential nutrient transport (including nitrate) simply because it actually reduces the amount of surface runoff. This was determined in a series of runoff studies



This large turf area shows how surface runoff occurs once the rainfall rate exceeds the soil's infiltration rate.

conducted over the past 10 years at Penn State University.

Water-in the fertilizer

"Watering-in" fertilizer generally refers to applying a light amount of water (0.1 to 0.3 inches) with irrigation soon after applying a granular fertilizer. This practice helps move the granules down into the turf canopy and on to the soil. The fertilizer, especially nitrogen, is then less likely to volatilize into the atmosphere, move offsite in runoff or be removed by mowing equipment. Also, nutrients contained in the fertilizer become available more quickly because water and microbes are more available to break down the nitrogen into the ammonium or nitrate form that plants can use.

Avoid excessive irrigation following fertilization because it can directly cause

runoff or leaching of water-soluble nitrogen fertilizers. Excessive irrigation can leave soils in a near-saturated condition, which increases the potential for surface runoff from additional irrigation or rainfall. Simply put, additional water applied to a water-saturated soil will either run off or pond on the surface.

Offsite movement of nitrogen can be influenced by the nitrogen source. Fertilizers with a higher percentage of water-soluble nitrogen (quick-release sources such as uncoated urea, ammonium nitrate, ammonium sulfate and short-chain methylene ureas) are more prone to offsite movement, compared to fertilizers with a high percentage of water insoluble nitrogen (slow-release sources such as IBDU, natural organics, coated ureas and long-chain methylene ureas).

Right time, right amount, right place

Timing, rate, placement and application method may have an influence on nitrogen movement. Applying soluble nitrogen when soils are nearly saturated, frozen or highly compacted directly increases the chance of nitrogen moving offsite simply because water runoff will be greater under any of those conditions. Apply nitrogen when the turf is actively growing to reduce your risks. Late fall, winter and early spring applications of soluble nitrogen are not recommended. If you want to apply nitrogen during those times, use slow-release sources to reduce potential movement. Also, avoid using fertilizer nitrogen to melt ice on roads, walkways and turf.

Avoid using excessive nitrogen rates per application. The plant can use only so

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much at one time. What is "excessive" depends on the soil type and condition, the turfgrass species and the climate. Any nitrogen that has been converted to nitrate but has not been absorbed by the plants is prone to leaching. "Spoon feeding" the turf with low rates of nitrogen on a more frequent basis (0.05 to 0.20 lbs. N/1000 sq.ft. per week) helps keep nitrogen levels more uniform throughout the season and improves their efficiency of use.

The placement of any nitrogen fertilizer on impervious surfaces increases the chance of nitrogen entering surface or subsurface water resources. Therefore, avoid applying granules or spray directly onto sidewalks, roads and driveways. You may need to

Choose an appropriate granule size for turf density to help granules move into the canopy.

use a drop spreader on turf areas next to these surfaces or remove any granules using a broom or a blower. Also, avoid applying fertilizer directly into any surface water such as streams, lakes or temporarily ponded water.

Foliar application of soluble nitrogen fertilizers may reduce movement of nitrogen in runoff and leachate compared to granular application. However, volatilization losses will be higher when using a sprayer or fertigation system. Soluble nitrogen granules, like uncoated urea, which remain on top of the turf canopy after application, have a greater risk of moving offsite in runoff compared to granules that have moved into the turf canopy by gravity or water.

Choosing an appropriate granule size for the canopy density will help granules move into the canopy. For example, on golf greens, smaller granules should be used so they can more easily move down into the highly dense canopy. Large or small granules can be used on lawn or athletic fields because the turf on those areas has a canopy that is less dense and more open than a golf green.

Although turfgrasses naturally do a great job of minimizing offsite movement of nitrate and other forms of nitrogen, there are certain management practices that can be used to even further reduce the chance for movement. The suggested practices are inexpensive to implement and should not decrease turf quality. Actually, some may even improve turf quality.

Educating yourself, fellow turf managers and your customers on this issue should give everyone a little more peace of mind when it comes to nitrate movement from turfgrass. **LM**

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Events

JANUARY

20 Landscape Contractors, Turfgrass Managers & Grounds Maintenance Conference with Trade Show

Jamil Shrine Temple, Columbia, SC. Call SC Landscape & Turfgrass Association 803/772-9380

25-27: Central Environmental Nursery Trade Show (CENTS)

Greater Columbus Convention Center, OH. Call 800/825-5062, fax 888/665-2329

26-31 National Arborist Association Winter Management Conference

Weston Caesar Park, Cancun, Mexico. Contact Carol Crossland 800/733-2622, fax 603/672-2613, www.natlarb.com

27-29 Midwest Turf Expo

Indiana Convention Center, Indianapolis. Contact Bev Bratton 765/494-8039, fax 765/496-2926, www.purdue.edu

28-30 New England Grows!

Hynes Convention Center, Boston. Call 508/653-3009, fax 508/653-4112.

28-30 Gulf States Horticultural Expo

Mobile Convention Center, Mobile, AL. Call Linda VanDyke 334/502-7777.

FEBRUARY

1-26 University of Guelph, Annual Turf Managers' Course

Holiday Inn, Guelph,

Ontario. Call 519/767-5000, fax 519/767-1114.

2 OSU Extension

Annual School Tom's Country Place, Avon, OH. Contact Charles Behnke 440/322-0127

3-5 Turfgrass Producers International Midwinter Conference & Expo

The Hyatt Regency Tampa, FL. Call 800/405-8873 or 847/705-9898

4-6 PLCAA Management Conference

Embassy Suites, Orlando, FL. Contact Heath Moore 800/458-3466, fax 770/578-6071, www.plcaa.org

4-7 American Nursery & Landscape Association Management Clinic

Galt House, Louisville, KY. Call 202/789-2900, fax 202/789-1893, www.anla.org

7-10 Fertilizer Institute annual meeting

Wyndham Annatole Hotel, Dallas. Contact Linda McAbbee 202/675-8250, fax 202/544-8123, www.tfi.org

10 JOB FAIR (Stockbridge School of Agriculture & the Univ. of Mass.)

Campus Center Auditorium, Amherst, MA. Call 413/545-2222.

12-14 GCSAA International Conference & Show

Orange County Convention Center, Orlando, FL. Call 800/472-7878, www.gcsaa.org