UT Extension
W 302

Assessing the Potential for Nitrogen Leaching From Your Tennessee Soils

Forbes Walker, UT Extension environmental soils specialist
Shawn Hawkins, UT Extension waste management specialist
Department of Biosystems Engineering and Soil Sciences

Why Should I Be Concerned About Nitrate Leaching?

The Tennessee Natural Resources Conservation Service Nutrient Management 590 Practice Standard is designed to guide agricultural producers on how to best manage the amount (rate), source, placement (method of application), and application timing of plant nutrients and soil amendments. The practice standard requires that all producers working with NRCS conduct an NRCS-approved risk assessment for **nitrogen** on all sites. The leaching of nitrogen as nitrate from the soil profile poses a potential risk to groundwater quality in Tennessee. Losses of nitrate nitrogen also cost you money!

The **potential** for nitrate nitrogen to leach through an agricultural soil depends on several factors, including soil properties that affect rate of water movement through the soil and rate of surface runoff, rainfall, and the amount and type of nitrogen fertilizer being applied to the field. Soil infiltration rate, the ease with which water moves into and through the soil, is by far the best indicator of leaching potential. This permeability is determined by factors such as soil texture, soil structure, bulk density and depth to restrictive layers such as bedrock and fragipans (hard pans). Different soil map unit components have been categorized into different soil hydrologic groups, where soils with different runoff and infiltration potential are grouped into one of the following four groups:

- **Group A**. Well drained soils with a high infiltration rate and thus a high potential for leaching nitrate.
- **Group B**. Moderately well-drained soils with a moderate infiltration rate and thus a moderate potential for leaching nitrate.
- **Group C**. Somewhat poorly drained soils with a slow infiltration rate and thus a low potential for leaching nitrate.
- **Group D**. Poorly drained soils with a very slow infiltration rate and thus a very low potential for leaching nitrate.

Another important aspect to know is whether your field is in an area that has karst topography. Karst topography is formed in limestone, gypsum or other soluble rocks by dissolution. It is characterized by closed depressions, sinkholes, caves or underground drainage. Tennessee is well known for its areas of karst topography such as the Central Basin, the Highland Rim and the Cumberland Plateau. For assistance with determining if your field is in an area that has karst topography, contact your local NRCS or UT Extension office. If your field is in an area that potentially has karst topography, then the potential risk of nitrate leaching maybe higher.

Assessing Leaching Potential and Leaching Index Rating

In order to assess the potential for nitrate nitrogen to leach from a field on your Tennessee farm, follow the simple four-step process outlined below:

Step 1: Identify the dominant soil map unit in your field.

This information can be gathered from consulting a paper copy of your county's soil survey, usually available at your local NRCS or UT Extension office.

The soil survey also is available to Internet users through the Web Soil Survey[1], where you can visually find your soil and its associated properties. In 2014, the information provided by Web Soil Survey will include the Nitrogen Leaching Index rating for your selected field (steps 2, 3 and 4 below).

Step 2: Determine the soil leaching potential from the soil hydrologic group.

Once you have identified the dominant soil map unit in your field, next determine the soil hydrologic group (A, B, C or D). This information can also be gathered from consulting your local NRCS or UT Extension office.

Step 3: Find the Leaching Index Rating for the soil hydrologic group in your county

Your leaching index rating will depend on the rainfall in your area. Look up the county and soil hydrologic group in Table 1 to assess your rating.

Step 4: Interpreting your Nitrate Leaching Index Rating.

Your leaching index rating score (Table 1) will determine whether you have a high, medium or low risk of nitrate leaching from your field. Use the table below to determine whether you are at low, medium or high risk of nitrate leaching.

Index Rating	Risk of Leaching
< 10	Low
≥10 to 16	Medium
> 16	High

If your risk score is greater than 16 or your field has karst topography, you have a **high** risk of leaching nitrate. It is strongly recommended that you implement the best management practices that are appropriate for your planned field operations to minimize soil nitrate leaching losses.

Best Management Practices to Reduce Nitrate Leaching

For those soils where the risk of nitrate leaching is considered medium or high (risk score greater than or equal to 10), producers are advised to reduce the risk of nitrate potential by

1 http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

implementing some simple common-sense practices that will reduce the amount of nitrogen that could be leached as nitrate. It is recommended that at a minimum, producers implement practices 1 to 3 (see below).

For soils where the risk of nitrate leaching is considered **high** (risk score greater than 16), in addition to implementing practices 1 to 3, it is recommended that producers should implement one or more of practices 4 to 8 (see below).

1. Follow UT Extension soil test recommendations and only apply nitrogen fertilizer based on the **realistic** yield goals for your crop. The **realistic yield goals** are to be established on historical yield data (minimum of 5 years).
2. Do not apply your nitrogen fertilizer until you are ready to plant, ideally within a few days of planting, or if possible, after germination and crop emergence.
3. Manure and litter applications should be based on UT Extension recommendations, with application rates based on soil test and manure analyses. Manure and litter should be applied as close to planting as is practical. Rather than applying based on crop nitrogen needs, it is preferred that manure and litter be applied based on crop phosphorus needs, and be supplemented with a commercial nitrogen fertilizer.
4. When applying urea or urea ammonium nitrate (UAN), consider using a fertilizer stabilizer that will reduce nitrogen losses for a few weeks after the fertilizer has been applied. Choose a fertilizer stabilizer that blocks the enzyme urease (which converts urea into the ammonium and nitrate forms that plants use). Delaying the conversion of urea means there will be more nitrogen available to the plant when it needs it and less will be lost.
5. If you are growing corn, split your nitrogen applications. Apply no more than 50 pounds of nitrogen per acre at planting, and side-dress the remainder of the recommended fertilizer. Side-dress application should be made once the corn has emerged and has at least four leaves.
6. If applying manures, use the pre-side-dress nitrate test (PSNT) to determine side-dress nitrogen application rates[2].
7. After harvest of the main crop, plant a winter cover crop such as cereal rye or winter wheat. These crops will not only reduce soil erosion over the winter but will also scavenge residual nitrogen.
8. The NRCS lists a number of other practices on their website[3] that will minimize nitrate losses. These practices include (but are not limited to) the following:
    - Nutrient Management (Conservation Standard 590)
    - Cover Crop (Conservation Standard 340)
    - Conservation Cover (Conservation Standard 327)
    - Conservation Crop Rotation (Conservation Standard 328)
    - Forage and Biomass Planting (Conservation Standard 512)
    - Irrigation Water Management (Conservation Standard 449)
    - Karst Sinkhole Treatment (Conservation Standard 527)

2 http://soilplantandpest.utk.edu/pdffiles/PSNTCinfosheet105.pdf

3 http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/?&cid=nrcs143_026849

Table 1: Tennessee Nitrogen Leaching Index Rating

County	Nitrogen Leaching Index by Hydrologic Group			
	A	B	C	D
Anderson		21	15	12
Bedford		18	13	10
Benton	27	19	14	11
Bledsoe		22	16	13
Blount	26	19	13	10
Bradley	28	20	15	12
Campbell		19	13	10
Cannon	29	21	15	12
Carroll		19	13	10
Carter	22	15	10	7.8
Cheatham		17	12	9.2
Chester		16	11	8.9
Clairborne	24	17	12	9
Clay	26	18	13	10
Cocke	19	13	8.5	6.2
Coffee	29	21	16	12
Crockett		18	13	9.9
Cumberland		22	17	13
Davidson		16	11	8.4
Decatur	27	20	14	11
DeKalb	28	20	15	11
Dickson		18	13	10
Dyer	24	17	12	9.1
Fayette	22	16	11	8.6
Fentress	27	19	14	11
Franklin	30	22	16	13
Gibson		19	13	10
Giles		17	12	9.7
Grainger		15	11	7.9
Greene	17	11	7.4	5.2
Grundy		25	19	15
Hamblin		12	8.2	5.9
Hamilton		21	15	12
Hancock		15	10	7.6
Hawkins		12	8.2	5.9
Hardeman	22	16	12	9
Hardin	24	17	13	10
Haywood		15	11	8.3
Henderson		17	12	9.1

County	Nitrogen Leaching Index by Hydrologic Group			
	A	B	C	D
Henry	26	19	13	10
Hickman	26	19	14	11
Houston	26	18	13	10
Humphreys		19	14	11
Jackson		19	14	11
Jefferson		13	8.5	6.2
Johnson		15	11	8
Knox		17	12	8.8
Lake	23	16	11	8.5
Lauderdale	23	16	11	8.6
Lawrence	28	21	15	12
Lewis	28	20	15	11
Lincoln		20	15	11
Loudon		19	13	10
Macon		19	14	11
Madison	21	15	11	8.4
Marion	31	23	17	14
Marshall		20	14	11
Maury		19	14	11
McMinn		21	15	12
McNairy		17	12	9.8
Meigs		20	15	11
Monroe		22	16	13
Montgomery		17	12	9.1
Moore		21	15	12
Morgan		21	15	12
Pickett	25	18	13	10
Obion		17	12	9.5
Overton	27	19	14	11
Perry	28	20	15	12
Polk		22	17	13
Putnam	29	22	15	12
Rhea		22	16	13
Roane		20	14	11
Robertson		16	11	8.7
Rutherford		19	14	11
Scott		19	14	11
Sequatchie		23	17	14
Sevier		17	12	9.6
Shelby	21	15	10	8.1
Smith		19	13	11

County	Nitrogen Leaching Index by Hydrologic Group			
	A	B	C	D
Stewart		18	13	9.9
Sullivan		11	7.4	5.2
Sumner			17	12
Tipton		21	15	10
Trousdale			18	13
Unicoi		22	16	11
Union			17	12
Van Buren		29	22	16
Warren		27	20	14
Washington		18	12	7.7
Wayne		29	21	16
Weakley			19	13
White		28	21	15
Williamson			18	13
Wilson			18	13

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