

What's Cropping Up?

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Introduction

The Nitrate Leaching Index (LI) is an estimate of the average annual percolation expressed in inches for a particular location. The LI is based on the concept that a soil's leaching potential increases as rainfall increases. The extent of the increase depends on soil drainage characteristics. For a given annual rainfall amount, excessively well drained soils such as Howard, Adams, Hoosic, Suncook and Tunkhannock, or even the well drained soils such as Bath, Madrid, Honeoye and Ontario have a significantly greater leaching potential than poorly drained soils such as Vergennes, Swanton, Rhinebeck, Lordstown or Volusia (Figure 1).

The New York Nitrate Leaching Index

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How to calculate?¹

The current LI rates leaching potential based on soil hydrologic group and rainfall data from weather stations around NY. The Nitrate Leaching Index is a multiplication of the Percolation Index and the Seasonal Index:

$$LI = \text{Percolation Index} * \text{Seasonal Index}$$

The Percolation Index (PI) is a function of the annual average precipitation (PA) and hydrologic soil group (Table 1). Soils with a hydrologic code "A" have the greatest percolation while soils of hydrologic code "D" have the least percolation and therefore are least conducive to leaching.



Figure 1: The Nitrate Leaching Index is designed to identify fields that are susceptible to nitrate leaching due to high percolation capacity.

Table 1: Calculation of Percolation Indices. PA is the county-based annual average precipitation in inches (see Table 2).

| Hydrologic Code | Percolation Index (PI) |
|-----------------|---------------------------------|
| A | $(PA - 10.28)^2 / (PA + 15.43)$ |
| B | $(PA - 15.05)^2 / (PA + 22.57)$ |
| C | $(PA - 19.53)^2 / (PA + 29.29)$ |
| D | $(PA - 22.67)^2 / (PA + 34.00)$ |

For soils with a hydrologic code that consists of more than one letter (e.g. "A/B", "B/C", "C/D"), its hydrologic code is determined by the presence or absence of adequate artificial drainage. If the field is artificially drained (Artificial

¹The Leaching Index equations were supplied by E.S. Hesketh, USDA-NRCS, Amherst, MA.

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Drainage = "adequate" or "excellent") the hydrologic group moves to the first of the two classes. If the field is inadequately drained or not drained at all, (Artificial Drainage = "none" or "inadequate"), the second of the two classes is assigned. For example, a Halcott soil has a hydrologic class of "C/D". If this soil has adequate or excellent artificial drainage, the hydrologic code used is "C". If the soil is not

or inadequately artificially drained, the hydrologic code "D" is assigned. For soils with a single hydrologic code, the artificial drainage does not have an impact on the hydrologic code used.

The Seasonal Index (SI) is determined by the annual precipitation (PA in inches) and the sum of the fall and

Table 2: County precipitation and runoff.

| County | Precipitation | | County | Precipitation | |
|-------------|-----------------------------|--------------------------------|-------------|-----------------------------|--------------------------------|
| | Annual ¹ (PA) | Oct-March ² (PW) | | Annual ¹ (PA) | Oct-March ² (PW) |
| Albany | 41.9 | 19.2 | Onondaga | 34.5 | 15.0 |
| Allegany | 37.8 | 16.7 | Ontario | 34.5 | 15.0 |
| Bronx | 41.9 | 19.2 | Orange | 41.9 | 19.2 |
| Broome | 41.5 | 19.0 | Orleans | 37.6 | 17.8 |
| Cattaraugus | 37.8 | 16.7 | Oswego | 37.6 | 17.8 |
| Cayuga | 34.5 | 15.0 | Otsego | 41.5 | 19.0 |
| Chautauqua | 37.6 | 17.8 | Putnam | 41.9 | 19.2 |
| Chemung | 37.8 | 16.7 | Queens | 46.0 | 23.0 |
| Chenango | 41.5 | 19.0 | Rensselaer | 41.9 | 19.2 |
| Clinton | 33.6 | 14.8 | Richmond | 46.0 | 23.0 |
| Columbia | 41.9 | 19.2 | Rockland | 41.9 | 19.2 |
| Cortland | 41.5 | 19.0 | St Lawrence | 36.0 | 16.0 |
| Delaware | 41.5 | 19.0 | Saratoga | 41.9 | 19.2 |
| Dutchess | 41.9 | 19.2 | Schenectady | 41.9 | 19.2 |
| Erie | 37.6 | 17.8 | Schoharie | 41.5 | 19.0 |
| Essex | 33.6 | 14.8 | Schuyler | 34.5 | 15.0 |
| Franklin | 36.0 | 16.0 | Seneca | 34.5 | 15.0 |
| Fulton | 44.3 | 20.5 | Steuben | 37.8 | 16.7 |
| Genesee | 37.6 | 17.8 | Suffolk | 46.0 | 23.0 |
| Greene | 41.5 | 19.0 | Sullivan | 41.5 | 19.0 |
| Hamilton | 43.4 | 20.4 | Tioga | 41.5 | 19.0 |
| Herkimer | 44.3 | 20.5 | Tompkins | 34.5 | 15.0 |
| Jefferson | 37.6 | 17.8 | Ulster | 41.5 | 19.0 |
| Kings | 46.0 | 23.0 | Warren | 33.6 | 14.8 |
| Lewis | 43.4 | 20.4 | Washington | 41.9 | 19.2 |
| Livingston | 34.5 | 15.0 | Wayne | 37.6 | 17.8 |
| Madison | 41.5 | 19.0 | Westchester | 41.9 | 19.2 |
| Monroe | 37.6 | 17.8 | Wyoming | 34.5 | 15.0 |
| Montgomery | 44.3 | 20.5 | Yates | 34.5 | 15.0 |
| Nassau | 46.0 | 23.0 | | | |
| New York | 46.0 | 23.0 | | | |
| Niagara | 37.6 | 17.8 | | | |
| Oneida | 44.3 | 20.5 | | | |

¹ USDA SCS. 1992. Agricultural Waste Management Field Handbook. Part 651 Figures 10C-1, 10C-2.

² C. Liezert. Agricultural Waste Management Software 2.21. October 1995. Ohio Engineering, USDA NRCS.

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winter precipitation (PW, from October through March in inches): $SI = (2 * PW / PA)^{1/3}$ County-based values for both PA and PW can be found in Table 2.

Management Implications

An LI below 2 inches indicates that the potential for nitrate leaching below the root zone is low. An LI greater than 10 inches indicates that the potential for soluble nutrient leaching below the root zone is large while LI's between 2 and 10 are considered intermediate. In order to meet the requirements of the NRCS nutrient management standard (590) for N leaching, producers are expected to *implement* best management practices if the LI score for a field is high (>10). Producers are expected to *consider* the same practices on a case-by-case basis if the LI score for a field is intermediate (2-10). Best management practices recommended for soils with medium to high N leaching indices are:

- Unless the New York Phosphorus Index identifies the need for P based fertility management, manure and fertilizer application rates should be based on Cornell guidelines for meeting crop N needs.
- For corn, pre-plant (other than starter fertilizer) and early post plant *broadcast* applications of commercial nitrogen without the use of nitrification inhibitors are not recommended.
- Sidedress applications should be made after the corn has at least four true leaves.
- If starter N must be broadcast (e.g., for small grains or new seedlings of grass), apply fertilizer as close to expected planting date as possible (ideally within 3 days or less).
- For row and cereal crops, including corn, maintain starter fertilizer N rates below 50 lbs/acre actual N under normal conditions.
- Manure and fertilizer applications should be adjusted based on information provided in "Nitrogen Recommendations for Field Crops in New York", Department of Crop and Soil Sciences Extension Series E01-4.
- Evaluate the need for sidedress N applications based on PSNT or other soil nitrate-nitrogen tests.
- Sod crops should not be incorporated in the fall. Chemical sod killing may be carried out when the soil temperature at a 4 inch depth is approaching 45°F. Depending on location, this will not likely take place until early October.
- Minimize fall and/or winter manure application on good grass and/or legume sod fields that are to be rotated the

following spring.

- Appropriate ammonia conservation is encouraged. Losses can either be reduced by immediately incorporating manure or eliminated by directly injecting manure as a sidedress application to growing crops.
- Plant winter hardy cover crops whenever possible, regardless of, but especially when fall manure is applied (e.g., rye, winter wheat, or interseed ryegrass in summer).
- Manure may be applied in the fall where there is a growing crop. Judicious amounts of manure can be applied to or in conjunction with perennial crops or winter hardy cover crops. Applications should generally not exceed the greater of 50 lbs/acre of first year available N or 50% of the expected N requirement of next year's crop.
- Frost incorporation/injection is acceptable when soil conditions are suitable but winter applications should be made in accordance with the New York Phosphorus Index.
- Manure N application on legumes is acceptable to satisfy agronomic requirements when legumes represent less than 50% of the stand. When legumes represent more than 50% of the stand, manure may be applied at a rate not exceeding 150 lbs of available N/acre.

References

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