



Assessment of the predictive quality of simple indicator approaches for nitrate leaching from agricultural fields

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Diffuse N losses from agriculture are a major cause of excessive nitrate concentrations in surface and groundwaters. Leaching through the soil is the main pathway of nitrate loss. For environmental management, an anticipatory assessment and monitoring of nitrate leaching risk by indicator (index) approaches is increasingly being used. Although complex Nitrogen Loss Indicator (NLI) approaches may provide more information, relatively simple NLIs may have advantages in many practical situations, for instance, when data availability is restricted.

In this study, we tested four simple NLIs to assess their predictive properties: 1. N balance (Nbal); 2. exchange frequency of soil solution (EF); 3. potential nitrate concentration in leachate (PNCL); 4. a composite NLI (balance exchange frequency product, BEP). Field data of nitrate leaching from two sites in northeast Germany along with published data from several sites in Germany, Scotland and the USA were utilized.

Nbal proved to be a relatively poor indicator of N loss for the time frame of one year, whereas its prediction accuracy improved for longterm averaged data. Correlation between calculated EF and experimental data was high for single year data, whereas it was lower for longterm averaged data. PNCL gave no significant correlations with measured data and high deviations. The results for BEP were intermediate between those for Nbal and EF.

The results suggest that the use of EF is appropriate for assessing N leaching loss for single year data and specific sites with comparable N input and management practices, whereas for long-term averaged data, Nbal is better suited. BEP is an appropriate NLI both for single year and longterm data which accounts for source and transport factors and thus is more flexible than source based Nbal and transport based EF. However, such simplified NLIs have limitations: 1. the N cycle is not covered completely; 2. processes in the vadose zone and the aquifer are neglected, 3. assessment of management factors is restricted.