

Nitrate Downward Movement in Agricultural Soil as Influenced by Biosolids



Guanglong Tian

Introduction

The United States produces 7 million ton biosolids annually, and 50% of them are used in farmland as nitrogen fertilizer. As any other N fertilizer source, the N in biosolids will be transformed into nitrate through microbial decomposition and/or nitrification. While part of nitrate can be used by annual crops, some parts of the nitrate are subject to leaching into the subsoil beyond rooting depths. The downward movement of nitrate not only decreases N use efficiency, but can also impair groundwater quality. The assessment of N distribution down the soil depth can provide information to evaluate the nitrate downward movement of N fertilizer sources.

Experiment and Methods



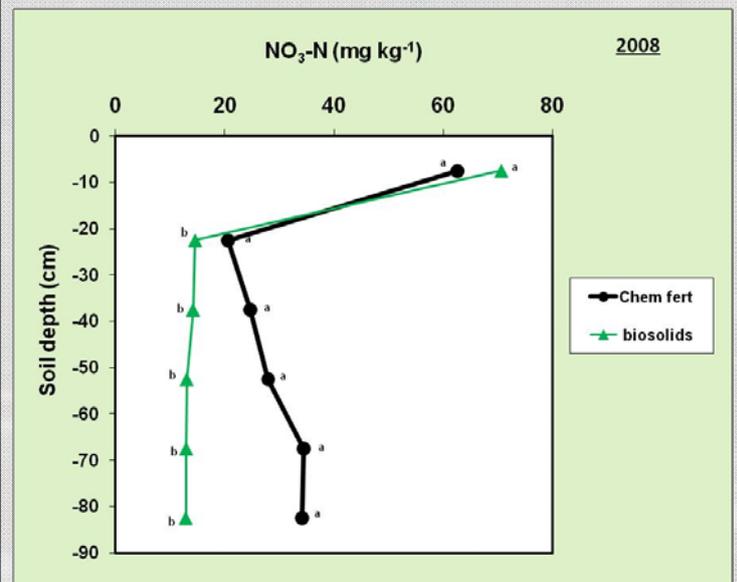
- Long Term experiment established in 1973
- At Canton, Fulton County, western Illinois
- Soil derived from mine spoil
- RCB with 4 replications
- Treatments (yearly application)
 - Chemical fertilizer: 336 kg N ha⁻¹ yr⁻¹
 - Biosolids: 35 Mg ha⁻¹ yr⁻¹
- Liquid biosolids (1973-'84);
 - Air-dried biosolids (1985-'08)
- Cropped with corn every year
- Deep coring soil sampling in 2008
- Nitrate in soil analyzed in KCl extract

Results

Biosolids characteristics (mean \pm SE):

| | Liquid biosolids | Air-dried biosolids |
|------------------------|------------------|---------------------|
| Volatile solids (%) | 47.8 \pm 2.2 | 37.0 \pm 1.6 |
| Org. nitrogen (%) | 2.64 \pm 0.14 | 1.59 \pm 0.10 |
| NH ₄ -N (%) | 2.25 \pm 0.17 | 0.37 \pm 0.05 |

The distribution of nitrate along soil profile after 35-yr application of biosolids and chemical fertilizer:



Summary

- Nitrate concentration in the subsoil lower under biosolids than chemical N fertilizer.
- Soil nitrate concentration showed an increase from 15-30 cm to 75-90 cm depths under long-term use of chemical fertilizer, but this did not occur in biosolids.
- Biosolids use as N fertilizer will reduce nitrate downward movement in agricultural soils due to high stability of the biosolids N source.

Scan to view on-line or download:

