Changes in Soil Inorganic Nitrogen from Field to Stream Bank in the Missisquoi Watershed

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Introduction

Although phosphorus is most often the limiting nutrient for algal growth in Lake Champlain, there is some evidence that nitrogen limitation also occurs. The most readily available forms of nitrogen are the inorganic species nitrate and ammonium. Unlike phosphate, nitrate is not strongly retained in the soil and it can move downward through the soil profile or laterally with shallow groundwater. Ammonium is a monovalent cation and is retained in the soil by cation exchange processes. However, it can be rapidly converted to nitrate by microbial activity. Nitrogen is added to crop fields as organic N in manure and compost or inorganic N in fertilizer. Most of the organic N is eventually mineralized to ammonium, which is in turn, oxidized to nitrate. There is a narrow band between having enough N to grow a high yielding corn crop and having too much N that might cause environmental damage. With soil testing and proper management, this balance can be maintained.

Objectives

- Identified the changes in soil inorganic nitrogen in transect from corn to stream bank
- Identified the changes in soil inorganic nitrogen with depth

Methods

Field Methods

With the cooperation of crop consultants and dairy farmers, located transects along stream banks of the Missisquoi and its tributaries.

3 points for each transect:

- 1 m from stream bank edge
- Halfway through riparian buffer
- 5 m into corn

4 depths: 0-15 (plow layer), 15-30, 30-60 and 60-90 cm

Where possible, also obtained bank samples at 1 m intervals.

Laboratory Methods

All soils air dried and sieved through 2 mm screen

Inorganic N (nitrate and ammonium) determined by extraction with 1 *M* KCl with a solution: soil ratio of 5, 15 minute shaking and filtration.

Nitrate determined by the Cd-reduction method on a flow injection auto analyzer (FIA).

Ammonium determined by the salicylate nitroprusside blue method on the FIA.

Results

17 transects sampled in four fields from three active dairy farms

- 17 x 3 points x 4 depths = 204 samples
- 30 bank samples (not all transects had bank samples)

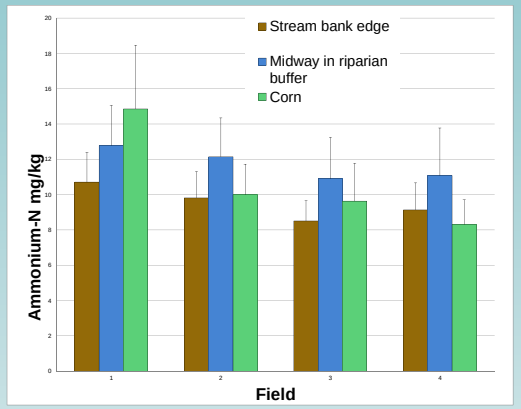

Figure 1: Mean concentrations of Ammonium-N for all depths (0-90 cm) from stream bank edge to corn.

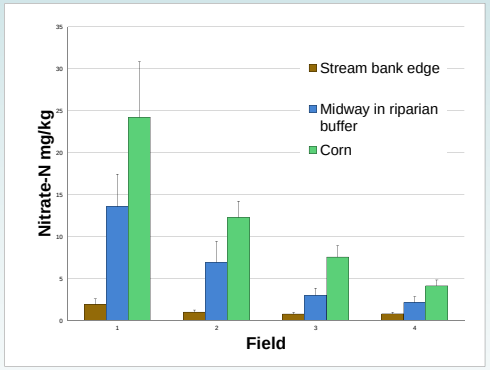

Figure 2: Mean concentrations of Nitrate-N for all depths (0-90 cm) from stream bank edge to corn.

0-15 cm samples	Nitrate-N	Ammonium-N
	mg/kg	mg/kg
Streambank	0.37	26.46
Near streambank edge	2.15	10.18
Midway in riparian buffer	12.08	11.71
Corn	21.47	12.97

Conclusion

Nitrate results appear to fit expected pattern:

- Highest in 0-15 of corn (where fertilized)
- Lower towards stream bank and with depth
- Some evidence for downward movement in corn field.
- Little evidence for lateral movement toward stream bank.
- The very low nitrate concentrations in the bank samples are noteworthy.

References

Publication on nutrient recommendations for field crops in Vermont: http://pss.uvm.edu/vtcrops/articles/VT_Nutrient_Rec_Field_Crops_1390.pdf

Publication on soil test procedures used in the Northeastern US: http://extension.udel.edu/lawngarden/lawn-garden/soil-health-composting/recommended-soil-testing-procedures-for-the-northeastern-united-states/

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