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breaking down barriers to environmental progress

Offset Opportunities for Row–Crop Agriculture in the Midwest: Comments on an Nitrous Oxide Reduction Protocol

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Objectives

Investigate two emissions factor based approaches:

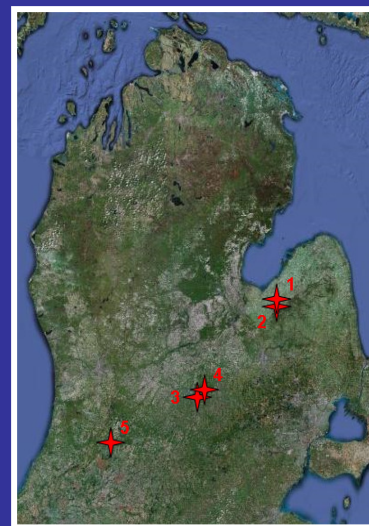
Tier 1 based upon IPCC default (1.0 %)

Tier 2 based upon regionally derived field data

Examine the criteria for prioritization of agricultural activities that target GHG mitigation, using as an example, a preliminary approach for a Midwest, row-crop N_2O reduction protocol

Protocol Overview

- Five sites (8 site years)
- Corn – soybean rotations
- Conventional tillage
- Six N fertilizer (urea) rates
- Static chamber methodology

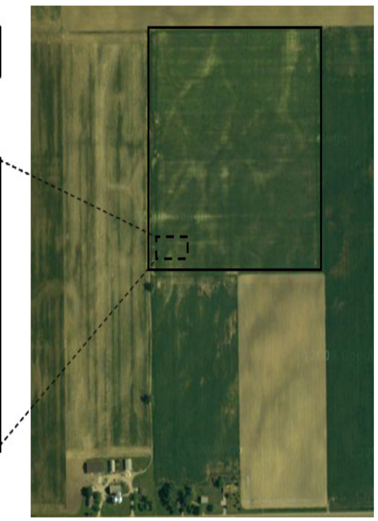


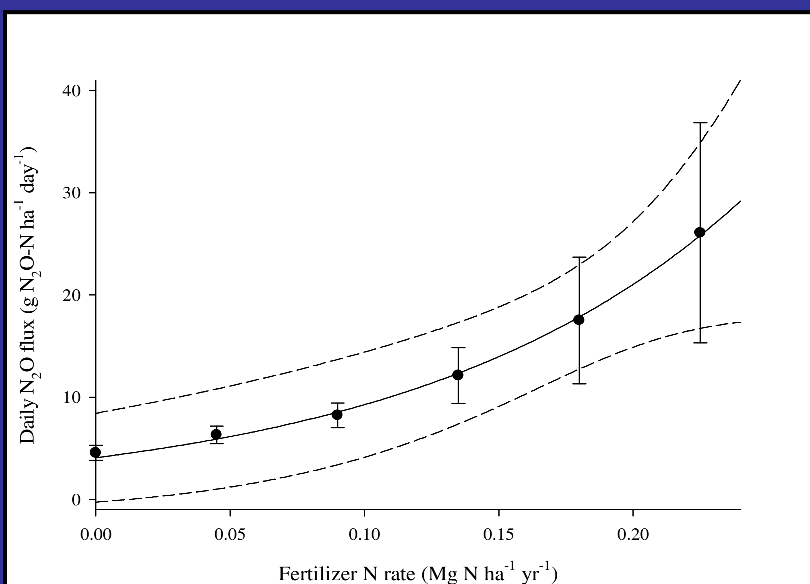
Nitrogen Rate (kg N ha^{-1})

Rep 1	Rep 2	Rep 3	Rep 4
0	135	180	45
90	225	225	0
180	180	90	90
225	0	45	135
135	45	0	225
45	90	135	180

35 m

60 m





- Empirical field data
- Biological basis – threshold response
- N fertilizer rate proxy for N_2O emissions
- Regional (Tier 2) emissions factor
- GHG credits from reduction in N rate

Hoben et al. 2010. Global Change Biology, in review.

Protocol Evaluation

1 Physical and Economic Potential – High/Med/Low?

- Net GHG/ha, total ha available, and over what time frame
- Costs for management shifts (opportunity costs, capital costs, ...)

2 Scientific Certainty – High/Med/Low?

- Is information (measurement and modeling) sufficient by practice, crop, and geography?
- Does directional certainty exist for net GHGs?

3 Possible Barriers – Addressable?

- Yield decline (affects production elsewhere and economic impact)
- Economic cost – break-even price too high?
- Technical barriers – monitoring, adoption, or production barriers
- Social barriers or negative community or farmer impacts
- Negative ecological impact
- Life cycle analysis – significant negative upstream or downstream GHGs

4 Implementation & Accounting Barriers – Addressable?

- Measurement, monitoring and verification – Are there good methods for measuring or modeling GHG outcomes on a project scale? and for verifying projects?
- Additionality – Can it be assessed sufficiently?
- Baseline – Are there viable approaches for setting baseline? Sufficient data?
- Leakage risk – Is there leakage risk (life cycle analysis)? Can it be accounted for?
- Reversal risk – Can risk be estimated? Can it be accounted for? Is it too high?

5 Significant Co-benefits?

May consider activity with lower GHG potential if it provides other social, economic or environmental co-benefits

1 **Physical and Economic Potential – High/Med/Low?**

- Net GHG/ha, total ha available, and over what time frame
- Costs for management shifts (opportunity costs, capital costs, ...)

Potential Impact of protocol

Linear Tier 1: Reduction (139 → 118 lb N/ac) ~ 0.05 tons CO_2e a^{-1} yr^{-1}

Non–Linear tier 2: Reduction (225 → 190 lb N/ac) ~ 0.6 tons CO_2e a^{-1} yr^{-1}

CCX Conservation Tillage Practice = 0.4 – 0.6 tons CO_2e a^{-1} yr^{-1}

86 million acres of US farmland planted to corn in 2009 (USDA)

Potential reduction of 52 million tons CO_2e a^{-1} yr^{-1}

Millar et al. 2010. Mitigation and Adaptation Strategies for Global Change

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Scientific Certainty – High/Med/Low?

- Is information (measurement and modeling) sufficient by practice, crop, and geography?
- Does directional certainty exist for net GHGs?

N_2O reduction protocol

- N_2O emissions from corn - soybean rotations and winter wheat
- Multiple year, site, and measurements
- Less reactive N – less likelihood for increased N_2O emissions
- High GWP - unlikely that 'positive' impact overcome by increases in other GHG emissions or reduced C sequestration – directional certainty exists?

More empirical data ?

- Other crops required (focus on representative regional crops/rotations ?)
- Other practices required (focus on representative, regional BMPs ?)
- Other regions/states required (North Central, Northeast, South, West)

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Possible Barriers – Addressable?

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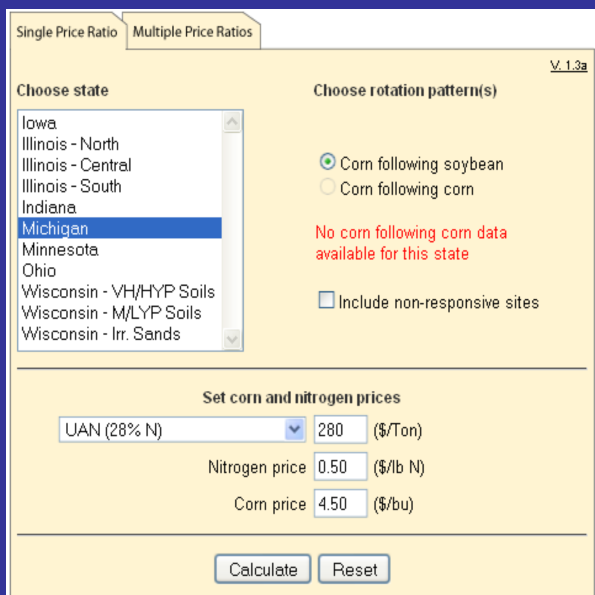
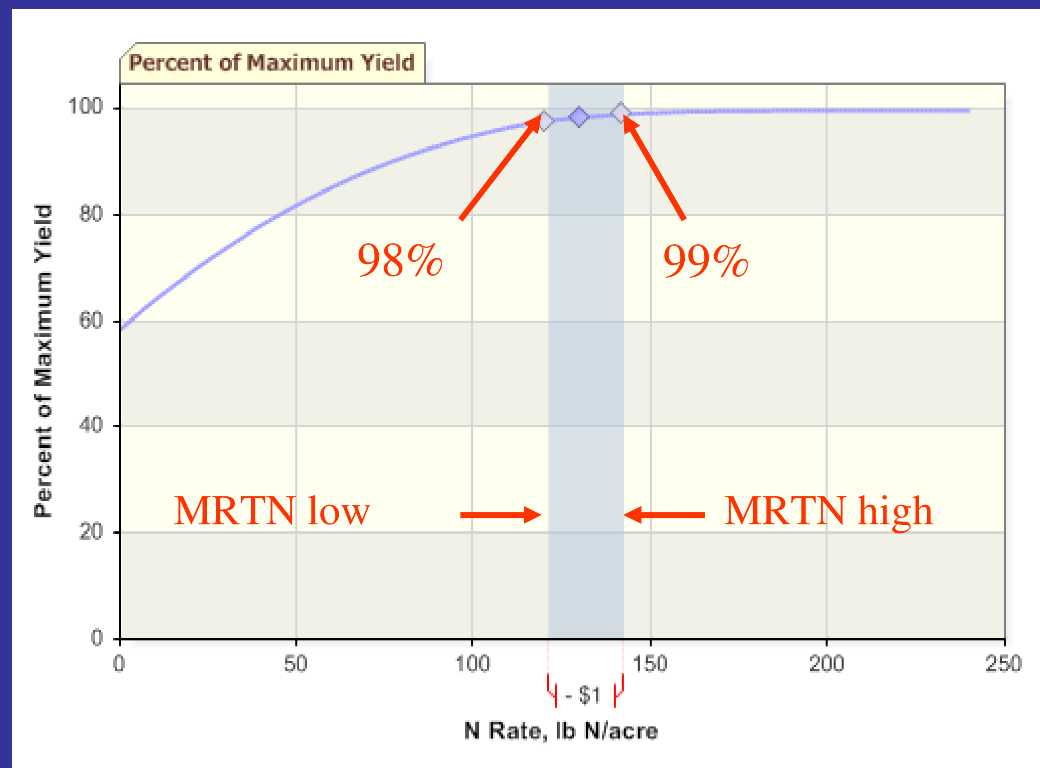
Maximum Return To Nitrogen (MRTN) approach (regional economic optimum)



MRTN Rate (lb N/acre):	127
Profitable N Rate Range (lb N/acre):	118 - 139
Net Return to N at MRTN Rate ($/acre):	$235.60
Percent of Maximum Yield at MRTN Rate:	98%



IOWA STATE UNIVERSITY
Agronomy Extension
Corn Nitrogen Rate Calculator
Finding the Maximum Return To N and Most Profitable N Rate

4

Implementation & Accounting Barriers – Addressable?

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- Crop 'test strips'
- Soil and plant testing
- Precision agriculture techniques
- Producer management records
- Offset Aggregators
- Validation and Verification
- Desk reviews
- Site visits
- Non-compliance penalties

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- Baseline

  Conservative approach - Verifiable management records

- Additionality

  Would project occur without carbon credit funding ?

  Barriers (Regulatory, Common Practice, Technical, Social etc)

- Permanence / Reversal

  Avoided N_2O emissions occur immediately - irreversible and permanent

  Reserve / buffer pools – non-permanence risk analysis

  Producer aggregation – collective persistence of credits

- Leakage

  Land maintained for production for many years prior to project implementation

  MRTN approach: no yield reductions, no yield compensation, no additional N use

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Significant Co-benefits?

May consider activity with lower GHG potential if it provides other social, economic or environmental co-benefits

- Reduced potential for nitrate leaching and run-off ?
- Reduced fertilizer production upstream ?
- Integrate with BMPs

- Community support
- Conserve biodiversity
- Promote innovative project design
- Mitigate investor risk
- Increase funding opportunities for project developers

Comments

Protocol Attributes

- Scientifically robust
- Environmental integrity
- Transparent to all stakeholders
- Cost-effective

Protocol Provisions

- Negate / Minimize Productivity Loss
- Economic Incentive (MRTN rate)
- Environmental Incentive (N_2O reduction)
- Fungible Emission Reduction Credits

Thank You