Tools to Quantify Risk in Nitrogen Management

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Driving Forces to Improve N Management

- Improving efficiency and achieving higher profits.
- Environmental concerns and regulatory pressure.
- Sustainability considerations.

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Outline

- Common risks in N management for corn.
- Participatory/adaptive management and on-farm evaluations
- Examples of quantifying risk in N management.

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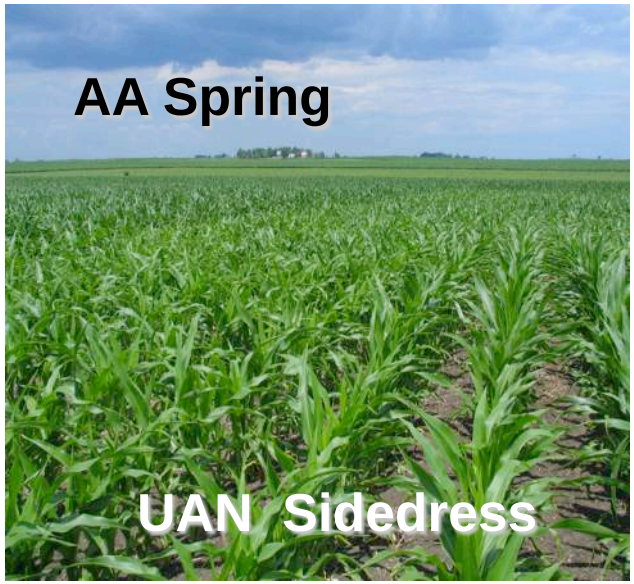
Common Risks in N Management

N loss

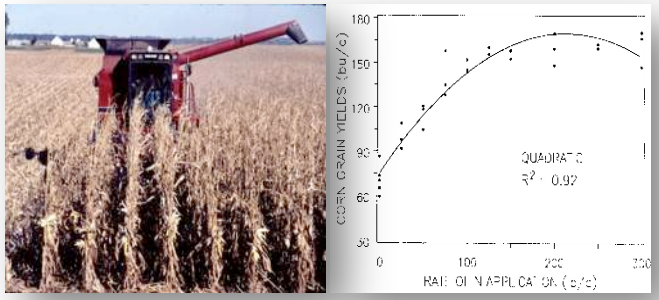
Reduced N availability due to lack of moisture



Yield loss

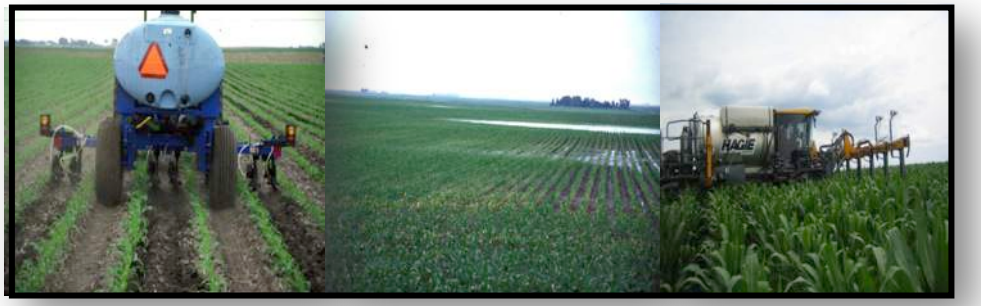
After-the-Fact

Description



For-the-Future

Prediction and Prescription



Uncertainty and Risk

LOW **HIGH**

To make prescriptions for the future, we need to address the uncertainty in spatial variability, weather, management, market prices, technological constrains and etc.

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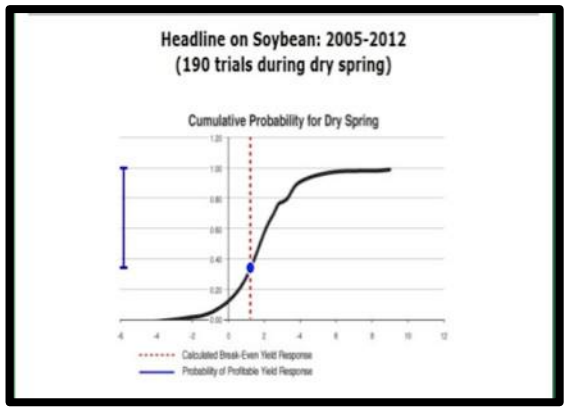
On-Farm Network®

Using Precision Ag. Tools to evaluate management practices in crop production.



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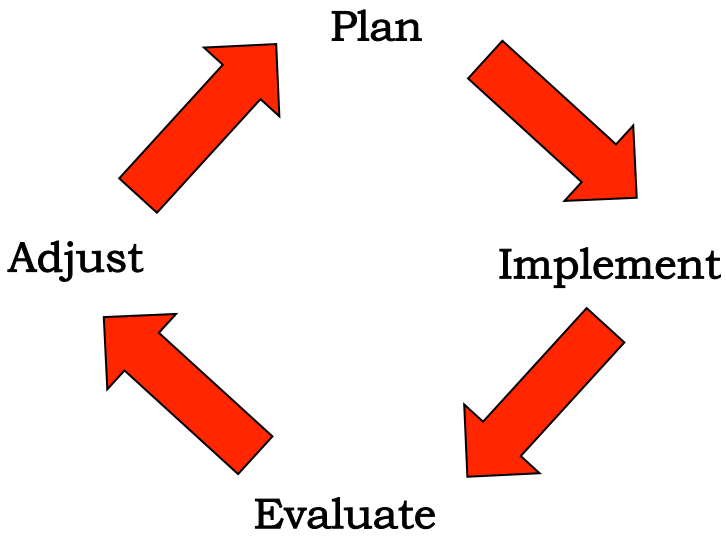
Participatory Learning/Adaptive Management

Organize farmers to collect data to solve production problems.



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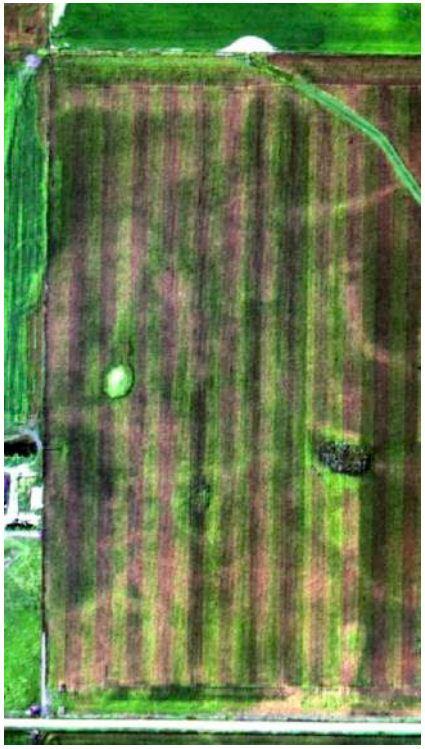
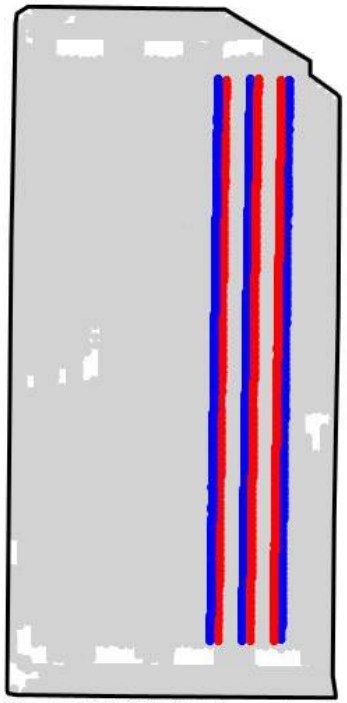
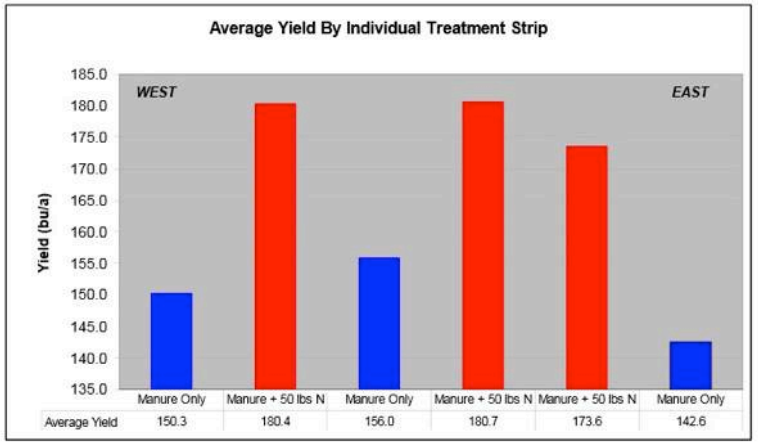
On-Farm Replicated Strip Trials



Aerial imagery



Treatment Layout



Yield differences between treatments

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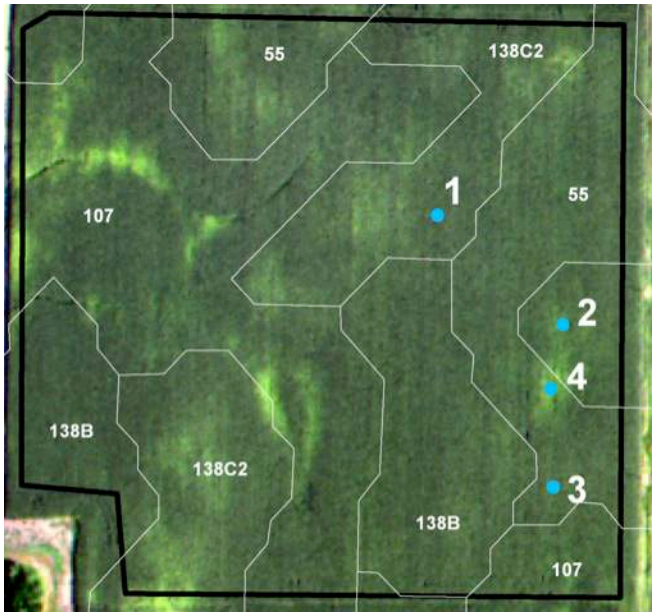
Corn Stalk Nitrate Survey with Late-Season Aerial Imagery



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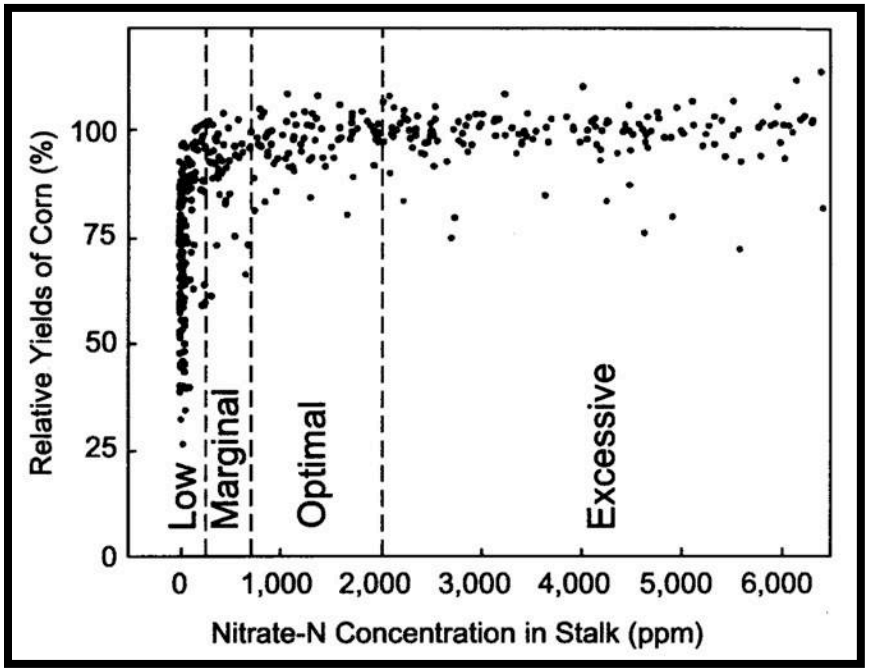
Corn Stalk Nitrate Test

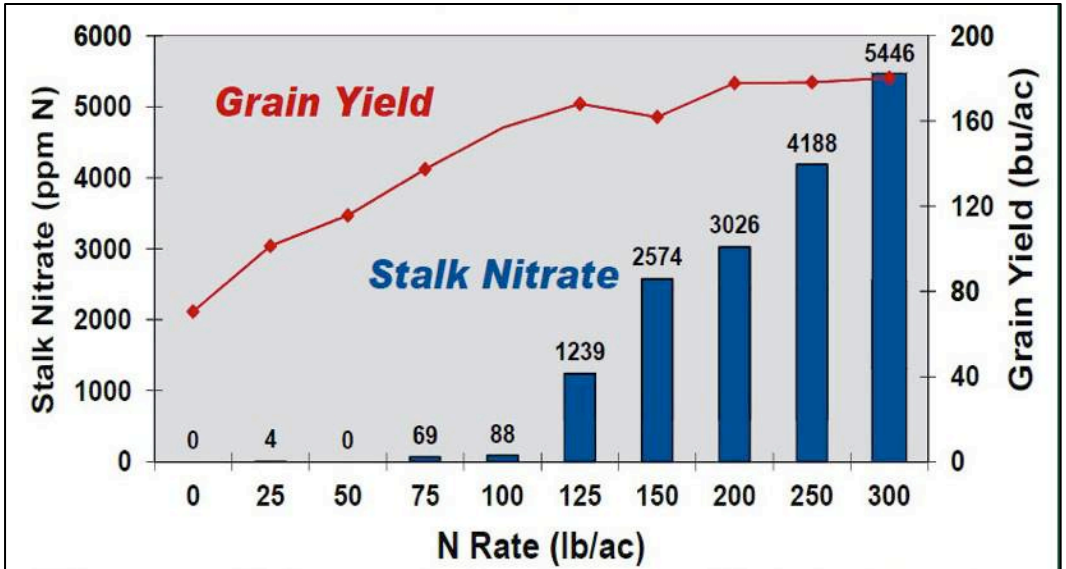
- The test provides corn N status: “supply vs demand”.

- Stalk nitrate values do not correlate with yields or economic optimal N rates.



Stalk Nitrate Values and Yields

- Stalk nitrate values do not correlate with yield or economic optimal N rates.
- After-the-fact N status: “supply vs demand”.



(Data used with the permission of Dr. Greg Binford, University of Delaware)

Quantifying Risk using On-Farm Evaluations

- Risk of economic yield loss from reduced N applications.

- Risk of corn N deficient status within fields.

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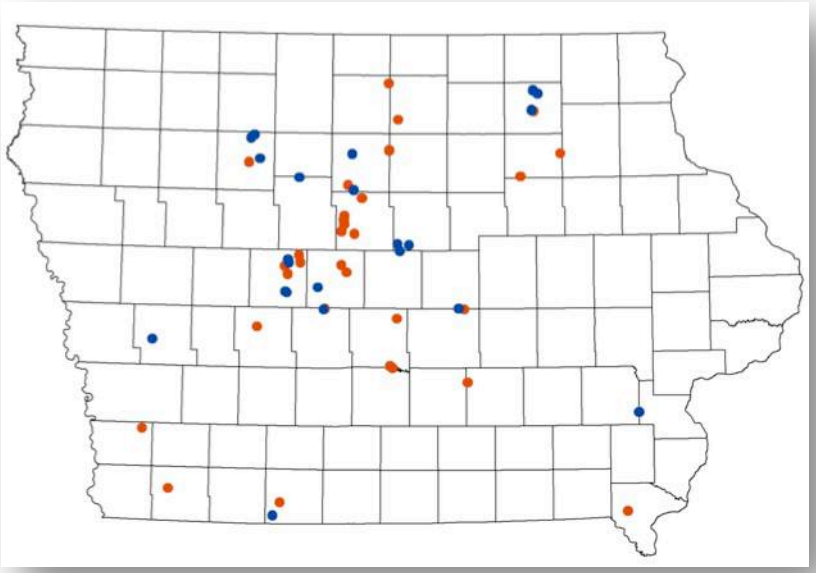
Risk of Economic Yield Loss from Reducing N Applications

When and where and at what risk?



2006: 34 on-farm trials

2007: 22on-farm trials

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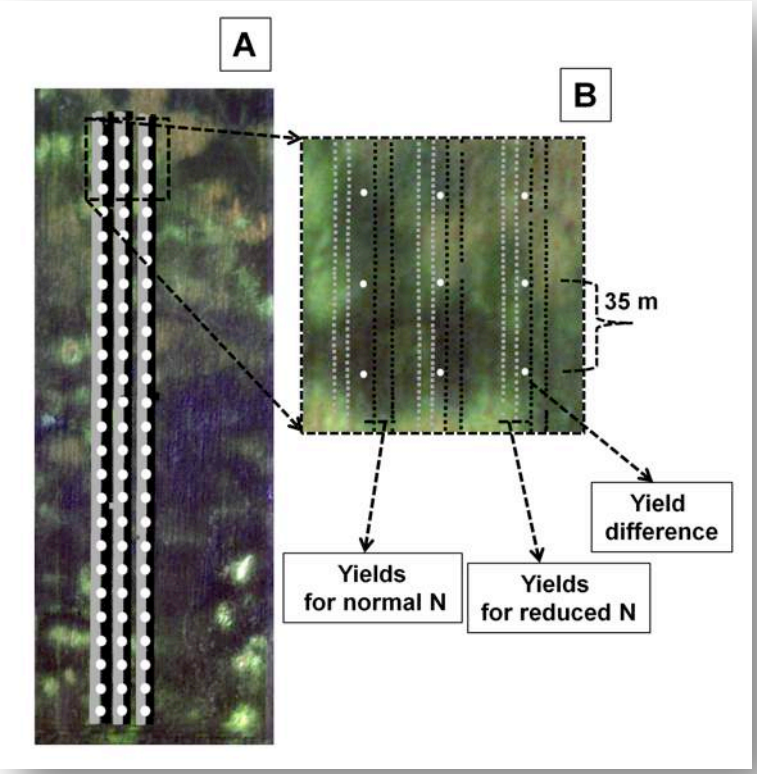
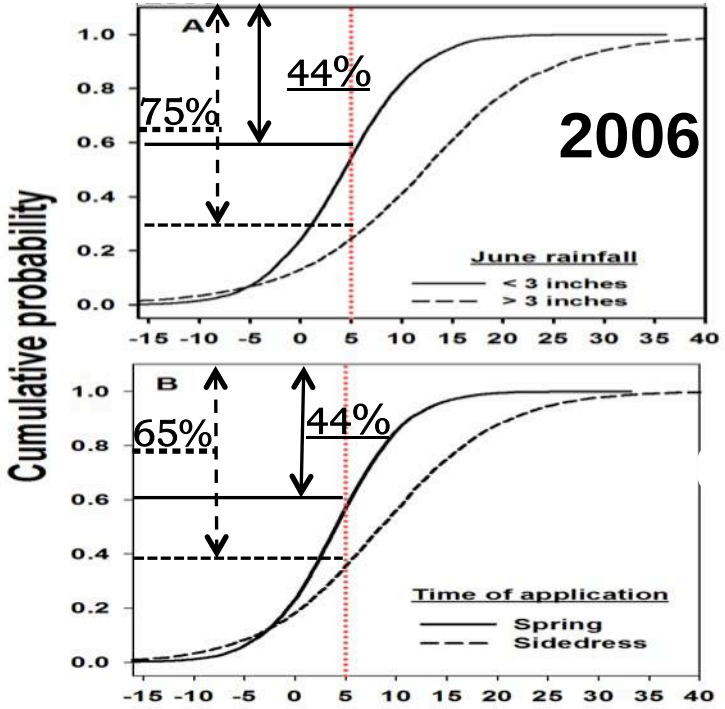
Where and When N Rates can be Reduced?

Farmers' normal N rates compared with rates reduced by 50 lb N/acre.



Risk of Economic Yield Loss

During a dry spring: higher risk from above-normal rainfall in June and larger yield losses from sidedress than from spring N applications.



Yield Loss from Reduced N (bu/acre)

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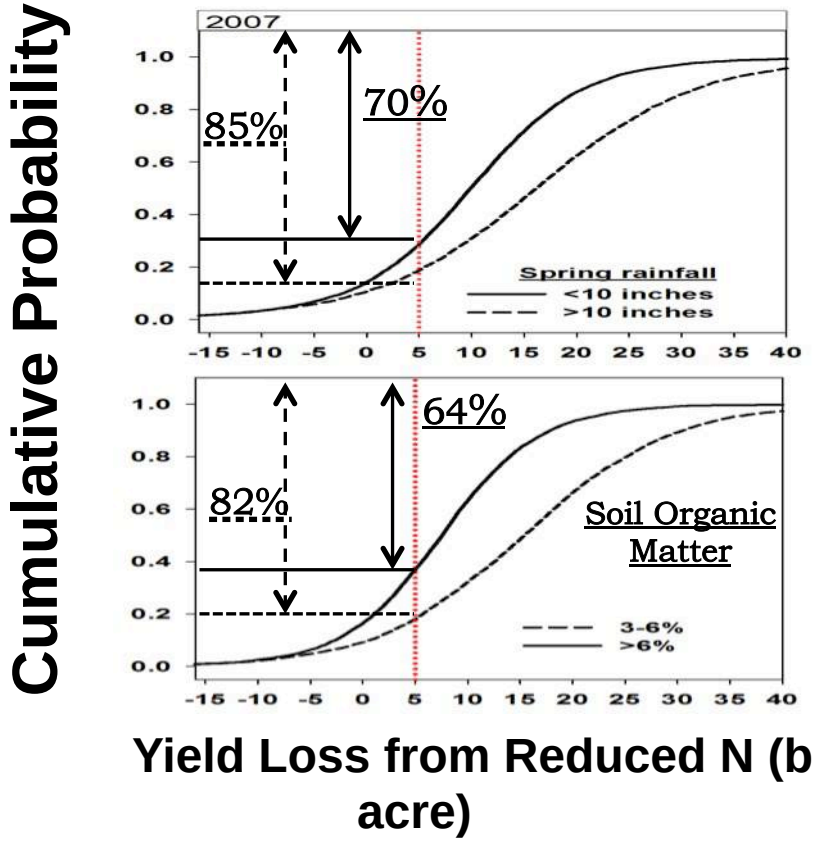
Risk of Economic Yield Loss:

Wet spring: larger risk from above-normal spring rainfall and within areas with lower SOM.



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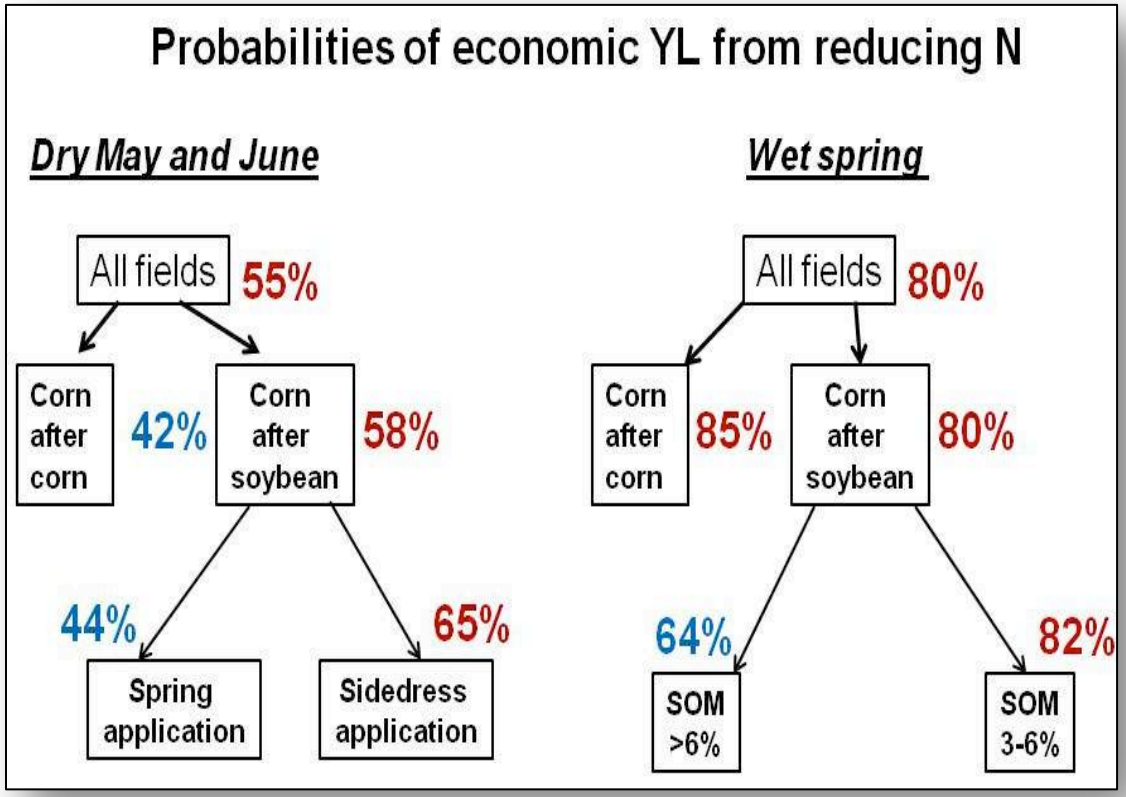
Nitrogen Reduction Decision Tree

Practices with lower risks (in blue) are more preferable, especially in years with dry May and June.



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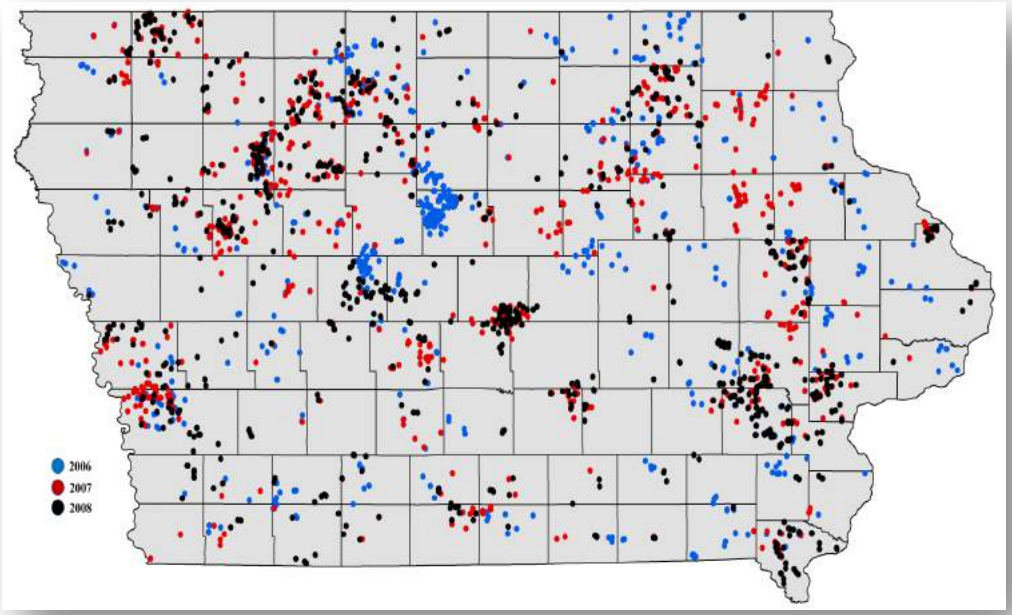
Estimating the Risk of Deficient Corn N Status within Fields



- 2006 --- 683 fields
- 2007 --- 824 fields
- 2008 --- 828 fields

30 groups of growers

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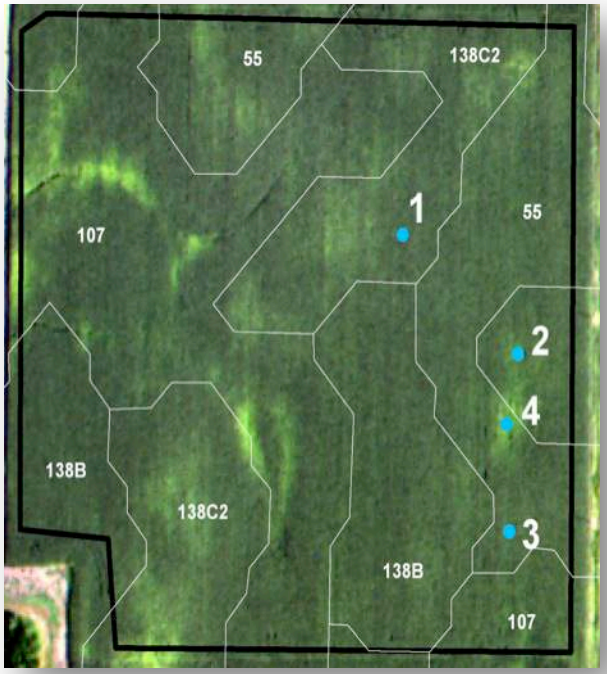
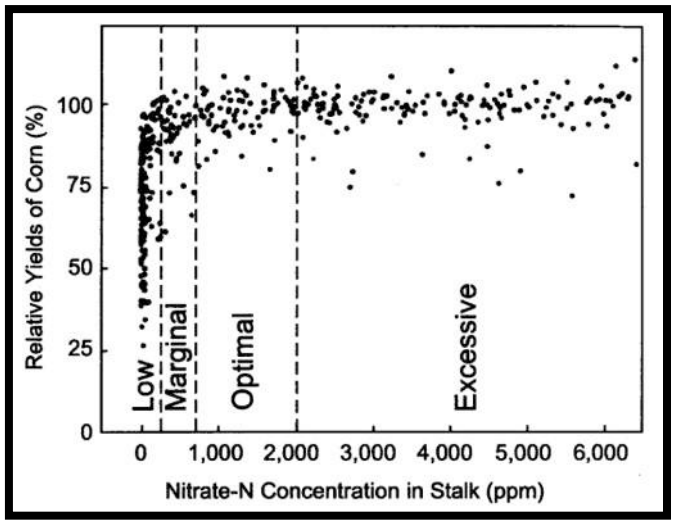
Using Stalk Nitrate Test and Aerial Imagery





Deficient **Sufficient**

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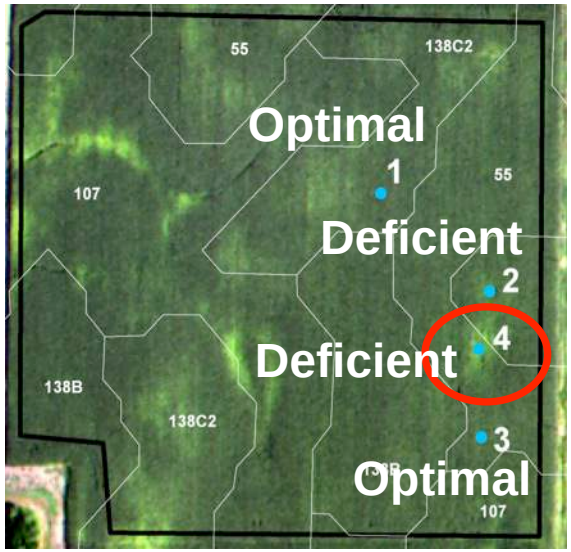
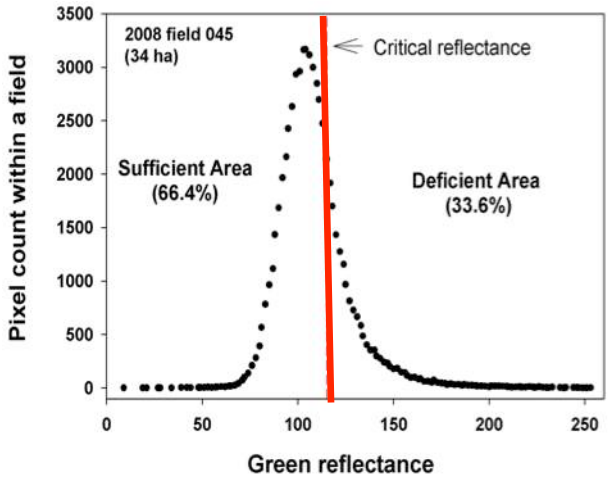
Quantifying Within Field Areas with Deficient N Status





Estimated deficient area: N loss, fertilizer skips or reduced N availability.

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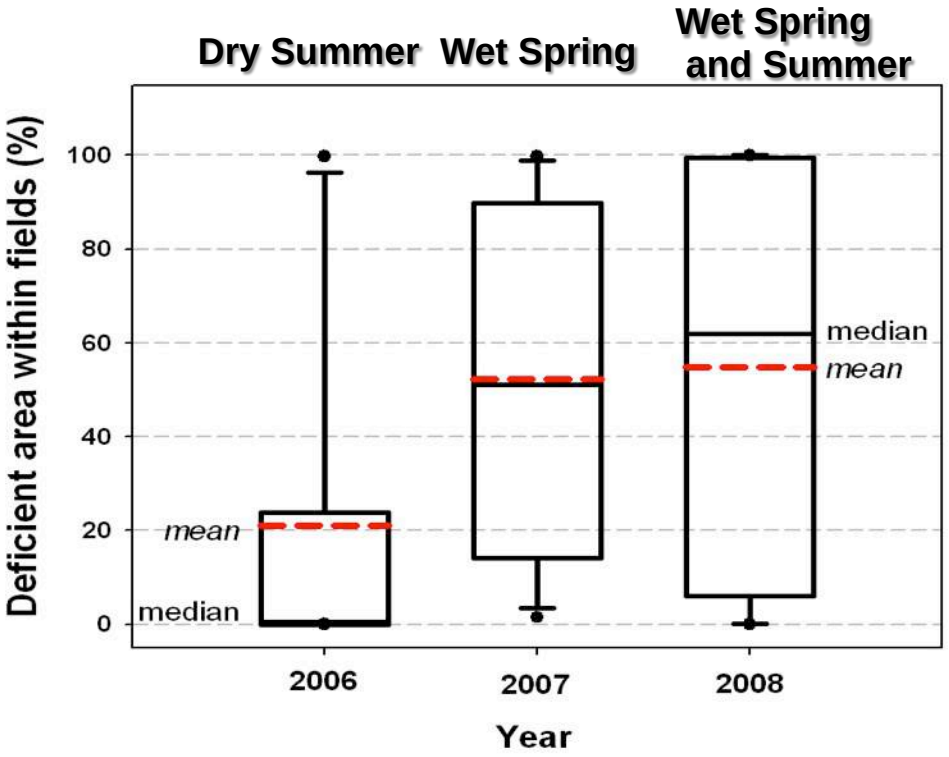
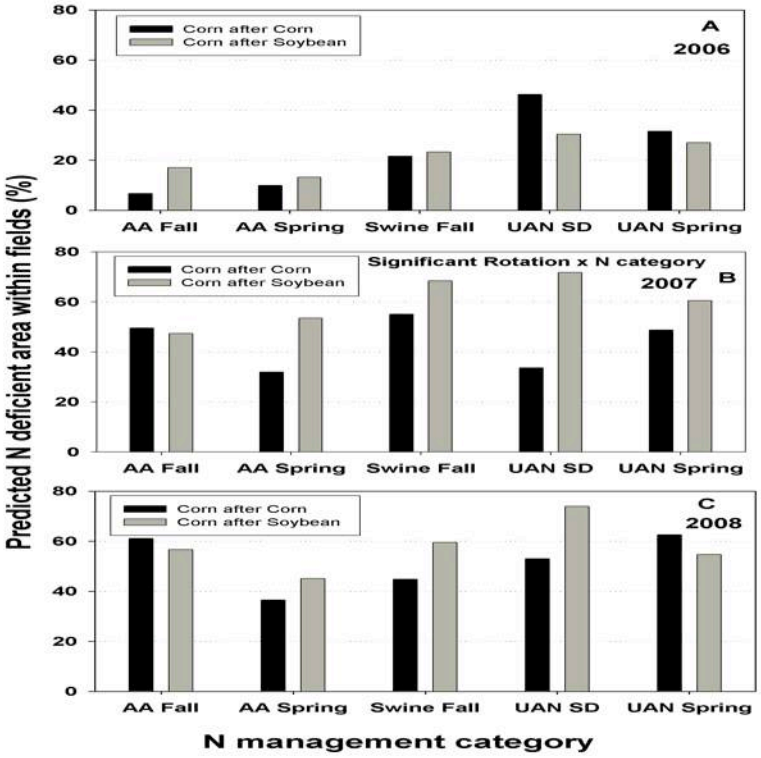
Areas with Deficient N Status across Iowa

In relatively wet years (2007-08), the median size of N deficiency area was about 50% and about 0% in the dry year, 2006.



N Deficient Areas for Different Management Practices

Corn after corn fields with Sidedress UAN had the largest areas of N Deficiency in relatively dry 2006; Spring NH3 had the lowest in relatively wet years.



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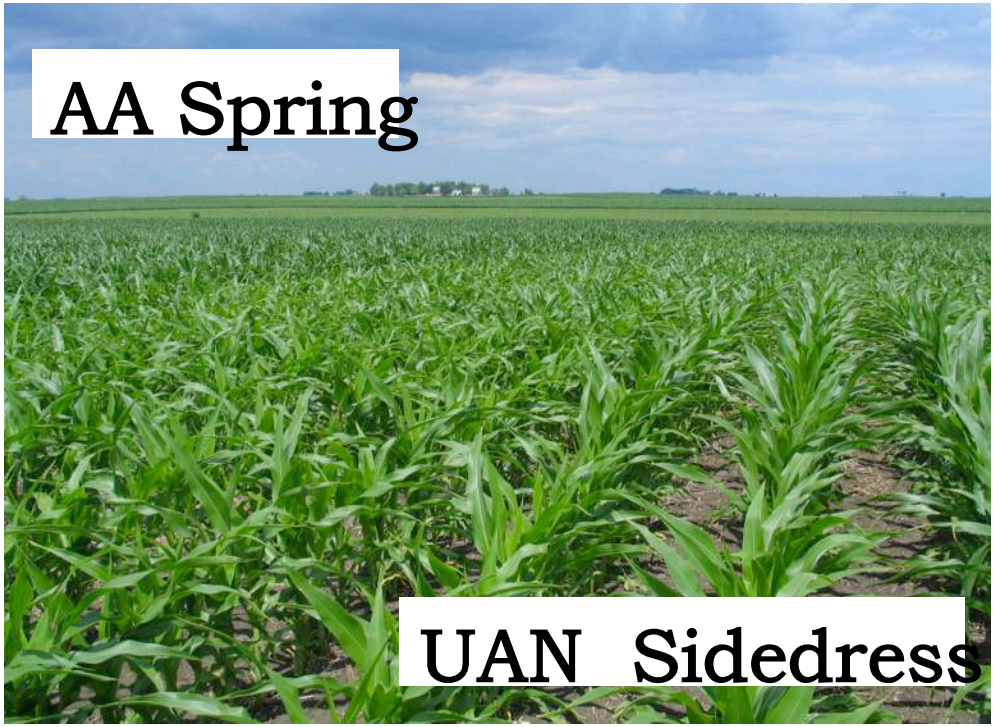
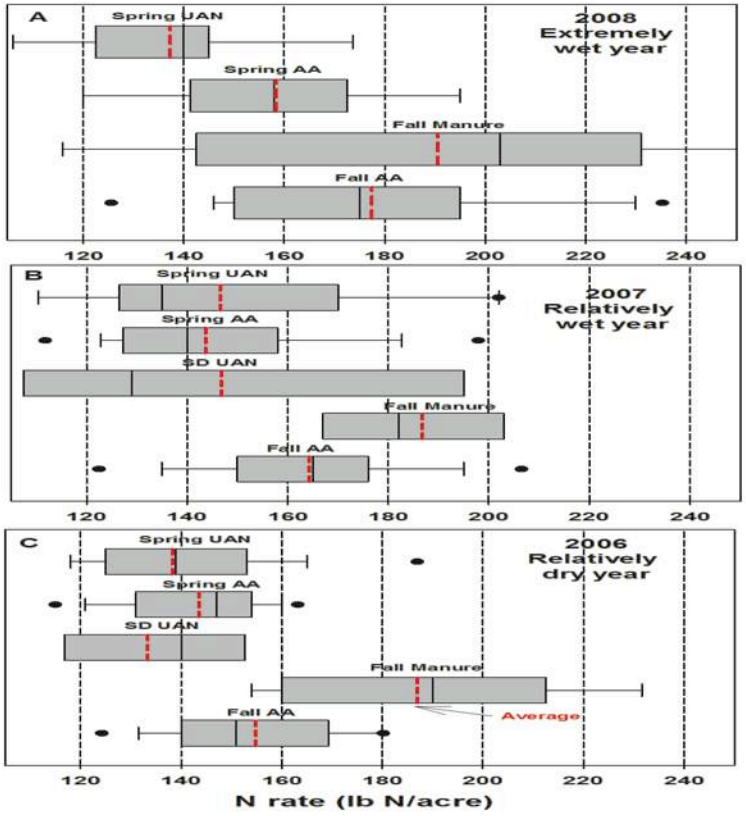
Risk of N Stress in Dry Conditions

Reduced N availability in fields with sidedress UAN because of soil moisture stress, especially corn after corn.



N Rates for Optimal Corn N Status

For corn after soybean, farmers applied slightly higher N rates to get optimal N status for Fall-applied Liquid Swine Manure and Anhydrous Ammonia.



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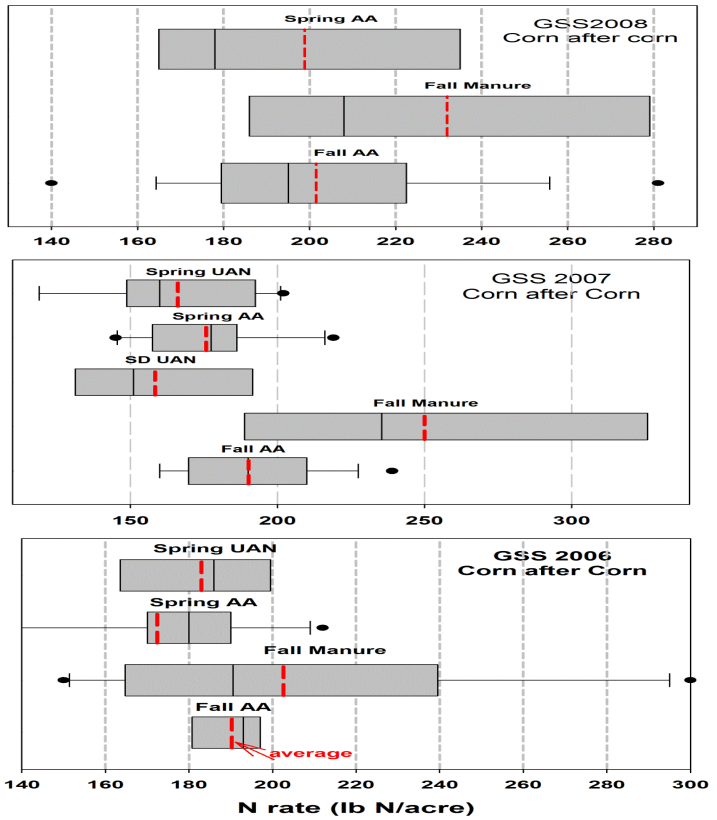
N Rates for Optimal Corn N Status

For corn after corn, slightly higher N rates were used to get optimal corn N status for Fall-applied Liquid Swine Manure and Anhydrous Ammonia.



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Risk of N Loss for Different Management Practices in Iowa

N management category (timing plus N source)	N loss mechanism	Factors promoting N loss	Relative risk of N loss during	
			wet[§] springs	*normal springs*
Fall AA	↓↑	Applications to relatively warm soils, high soil pH (>7.5), warm spells during the fall and winter	Very high/high	High/medium
Fall-injected liquid swine manure±	↓↑↑	Applications to relatively warm soils, high soil pH (>7.5), warm spells during the fall and winter, poor soil sealing during applications	Very high/high	High/medium
Spring AA	↓↑↑	Poor soil sealing during applications and high soil pH (>7.5)	Low/medium	Low
Spring UAN[¶] (incorporated)	↓↑↑	Heavy rainfall immediately after applications, timing between N application and incorporation into the soil	Very high/high/ medium	Low/medium
Spring urea[¶] (incorporated)	↓↑↑	Heavy rainfall immediately after applications, timing between N applications and incorporation into the soil	Medium/low	Low/medium
Sidedress UAN	↓↑	Heavy rainfall immediately after applications	Low/medium	Low
Sidedress AA	↓↑		Low	Low
Dribbled UAN	↑↓↑	Wet and heavy crop residues will promote NH_3 volatilization	Medium/low	Low/medium

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Ways to Quantify Risk in N Management

- Organizing groups of farmers.
- Using tools to collect feedback in N management.
- Aggregating data and quantifying differences between management practices.

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On-Line Database of Individual Strip Trial Reports

Year

All Years
2013
2012
2011
2010
2009
2008
2007

Crop

All Crops
Corn
Soybeans

Trial Type and Detail

All Trial Types	All Trial Details
Cover Crop	2 Pass vs 1 Pass Tillage
Crop Protection - Fungicide	30" Rows vs 15" Rows
Crop Protection - Fungicide and Herbicide	80-200-240 vs 39-100-120
Crop Protection - Fungicide and Insecticide	Acceleron vs Untreated
Crop Protection - Fungicide and Plant Nutrition	Accomplish LM vs Untreated
Crop Protection - Fungicide, Herbicide and Insecticide	Accomplish vs Untreated
Crop Protection - Herbicide	Actuate vs Untreated

Location

All Watersheds	All Counties
Apple-Plum	Adams
Big Papillion-Mosquito	Black Hawk
Blackbird-Soldier	Boone
Blue Earth	Bremer
Boone	Buchanan
Boyer	Buena Vista
Copperas-Duck	Butler

Display Results

Clear Results

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On-Line Database of Individual Strip Trial Reports

Location

All Watersheds	All Counties
Flint-Henderson	Hardin
Upper Iowa	Lee

Display Results | Clear Results

Year	Watershed	County	Crop	Trial Type	Trial Detail	Yield Difference bu/A	Trial ID	Trial Report	Stalk Nitrate Report	Scouting Report
2013	Flint-Henderson	Lee	Corn	Plant Nutrition - Manure + Nitrogen	Manure + N vs Manure	23.9	ST2013IA278A	View		
2013	Upper Iowa	Hardin	Corn	Plant Nutrition - Manure + Nitrogen	Manure + N vs Manure	-1.5	ST2013IA012A	View		

Average Yield Difference of the 2 records displayed: 11.2 bu/A.

Return on Investment

To calculate ROI of the selected trials, enter a market price for this crop and the cost per acre.

Market Price: $ 5

Cost Per Acre: $ 30

Return on Investment: $26.000 per acre.

Display Results

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Benefits of Aggregating Feedback Data from Farmer Groups

- Identifying differences between areas with different soils, rainfall patterns, and crop management.

- Helping farmers to adapt and make better management decisions.

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