



2008 ASA, SSSA, CSS Meeting, Houston, TX

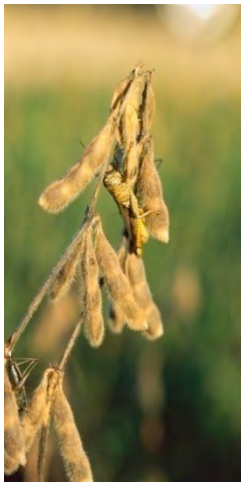
Implementing Adaptive Nitrogen Management Practices for Corn on a Large Scale: a Case Study in Iowa



Peter Kyveryga and Tracy Blackmer

On-Farm Network®

Iowa Soybean Association

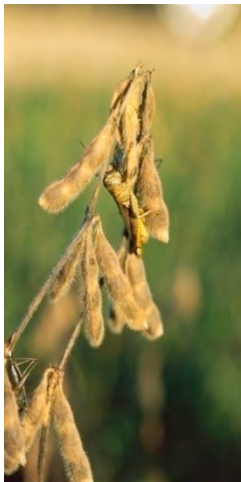


Haiying Tao and Thomas Morris

Department of Plant Science

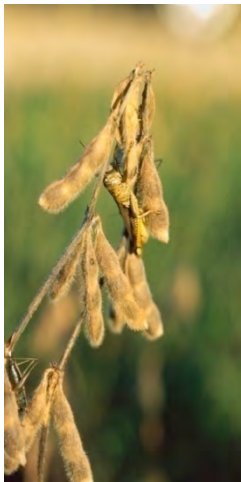
University of Connecticut





Why Adaptive Management?

- Controlled experiments give *strong cause-and-effect inference*, but often a *narrow range of applicability* in field ecosystems (Lee, 1999)
- *Nutrient management policies and regulations require a wide range of applicability*
- *Emphasis on social-participatory learning and cooperation among many stakeholders*



Analytical Survey Objectives

- Characterize distribution in N sufficiency levels (based on CSNT) on the large scale in Iowa
- *Identify major management categories (N forms, timing, tillage, weather, soil types) that are different in corn N status at different scales*

Analytical Survey Design



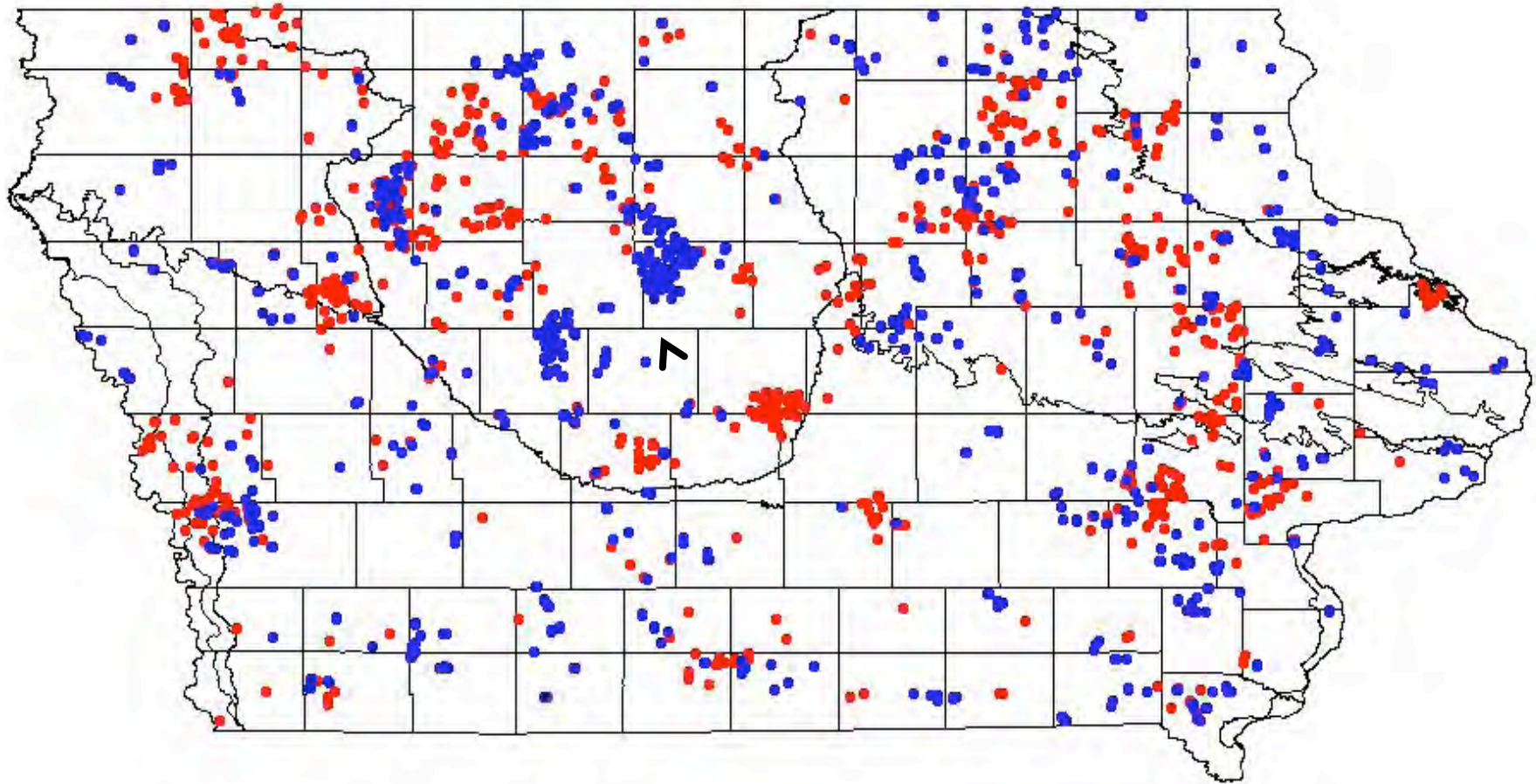
Target Population:
Major N management practices in Iowa

Observational units:
3 major soil types

Cluster sampling:
3 samples within a field



Guided Corn Stalk Nitrate Survey in Iowa



Des Moines Lobe

- 2006
- 2007

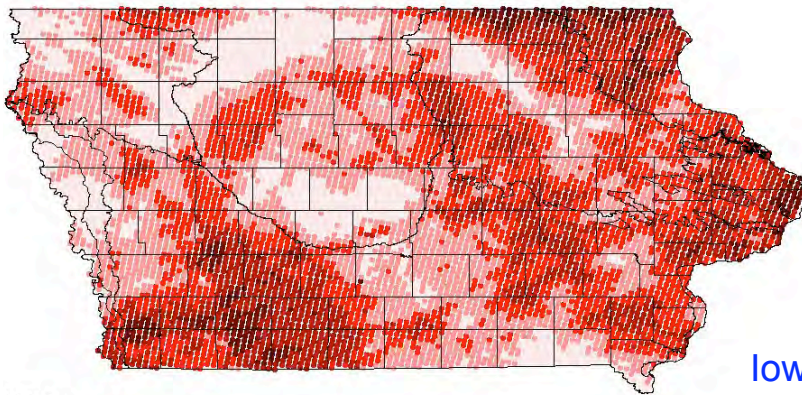
County
Landforms

2006-695 fields
2007-840 fields

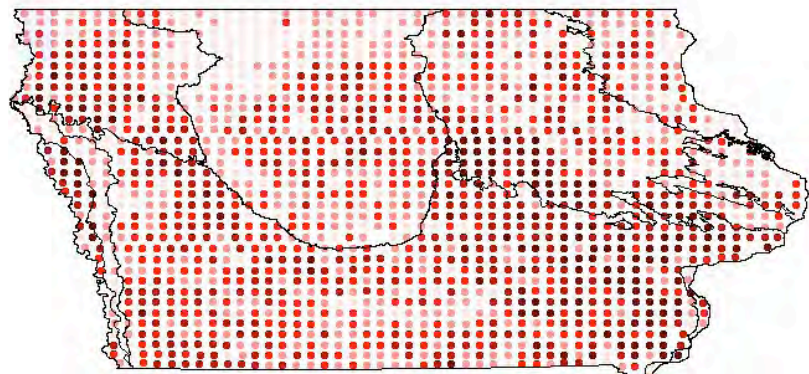
Management Information and Weather Data

- *Categorical*: Timing, Fertilizer and Manure Forms, Tillage, Rotation, and Soil Types
- *Continuous*: Monthly Rainfall, Cumulative Rainfall, Soil Moisture, and Total N Rate

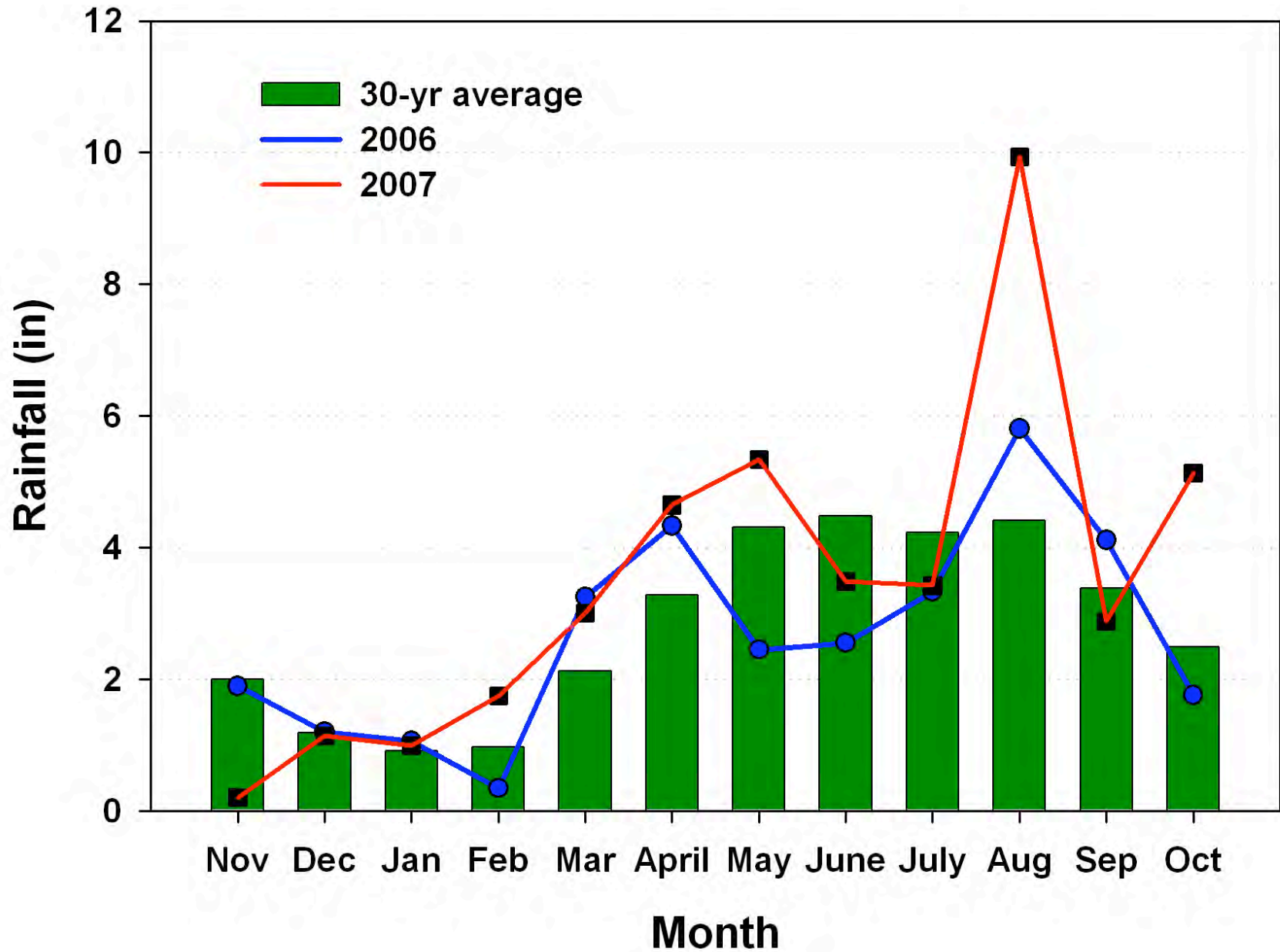
**Spatially Interpolated
Daily 4-km Grid Rainfall**



Soil Moisture Township Based



Average Rainfall in Iowa



Statistical Analysis

- Proportional Odd Logistic (Ordinal) Regression
(Hosmer and Lemeshow, 2000)
- Predicting cumulative probabilities
 - 1) **Deficient** vs Marginal, Optimal, Excessive
 - 2) **Deficient , Marginal** vs Optimal, Excessive
 - 3) **Deficient, Marginal, Optimal** vs Excessive
- Estimating **the cumulative odd ratio** $[(p/1-p)]$ **Factor**
for a sample to be in **Excess**
- Standard errors were adjusted for clustering
sampling (Surveylogistic-SAS and R-statistical software)

Log Odd Ratio
Intercept 1
Intercept 2
Intercept 3

Probability of Excess-Statewide 2006

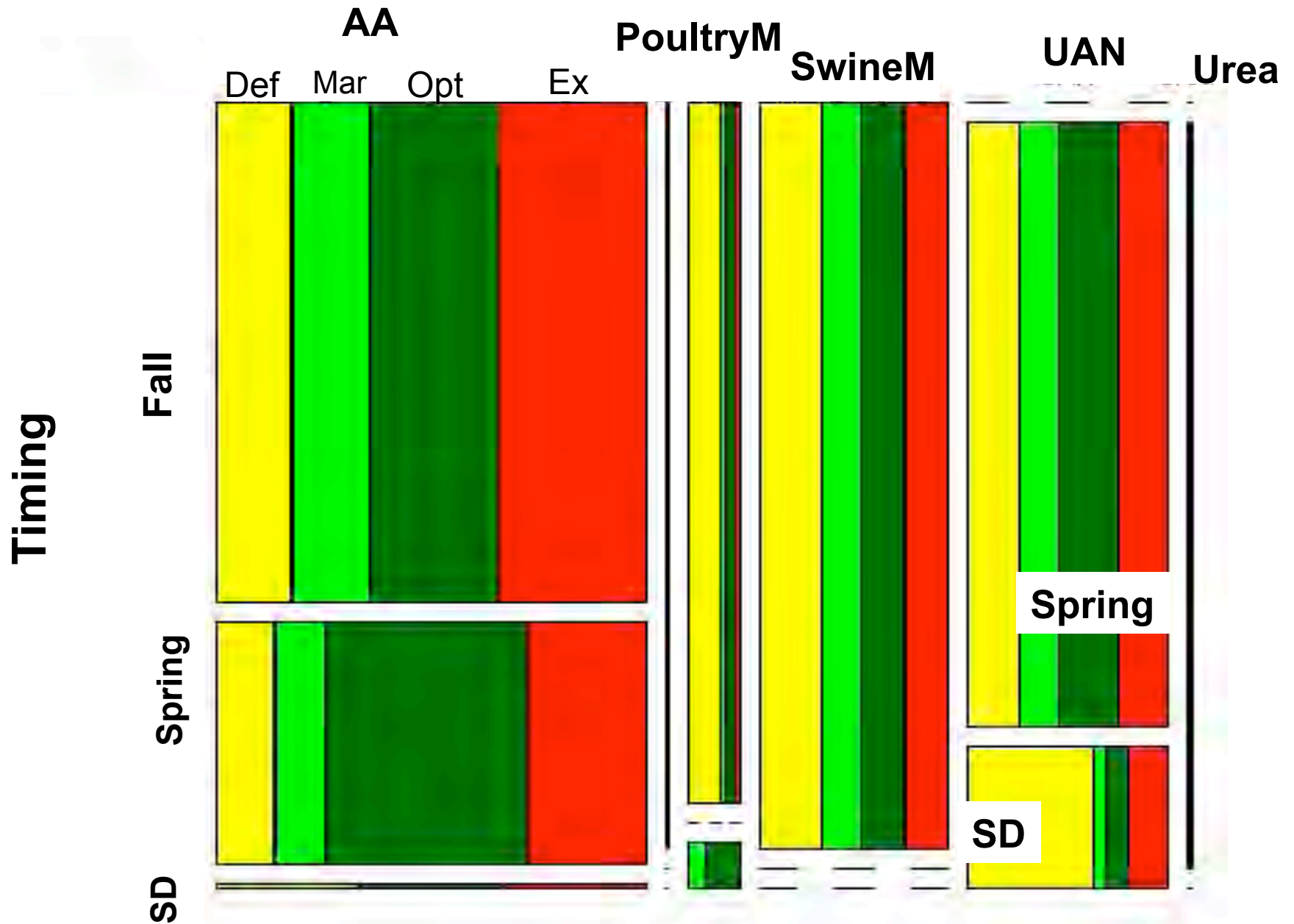
Factor	Category	Odds Ratio
N Rate	continuous	1.01***
May Rainfall	continuous	1.16***
Rotation	Alfalfa	2.25
	Soybean	1.06
	Reference: Corn	
N Form	Beef Manure	0.48
	Poultry Manure	0.26*
	Swine Manure	0.85*
	UAN	0.61
	Urea	0.79
	Reference: AA	
Timing	Spring	1.13
	Sidedress	0.96
	Reference: Fall	
Tillage	Tilled	1.05
	Reference: No-Till	

Des Moines Lobe in 2006

Factor	Category	Odds Ratio
N Rate	continuous	1.01*
May Rainfall	continuous	1.37*
Rotation	Soybean Reference: Corn	1.00
N Form	Poultry Manure Swine Manure UAN Urea Reference: AA	0.15* 0.49 0.76 0.42
Timing	Spring Sidedress Reference: Fall	1.09 0.27**
Tillage	Tilled Reference: No-Till	0.59

280 fields

Des Moines Lobe in 2006



A wide-angle photograph of a cornfield. The corn plants are in the early stages of growth, appearing as a dense carpet of green. The field extends to a flat horizon under a bright blue sky with soft, white clouds. The overall scene is bright and clear.

Fall-applied AA

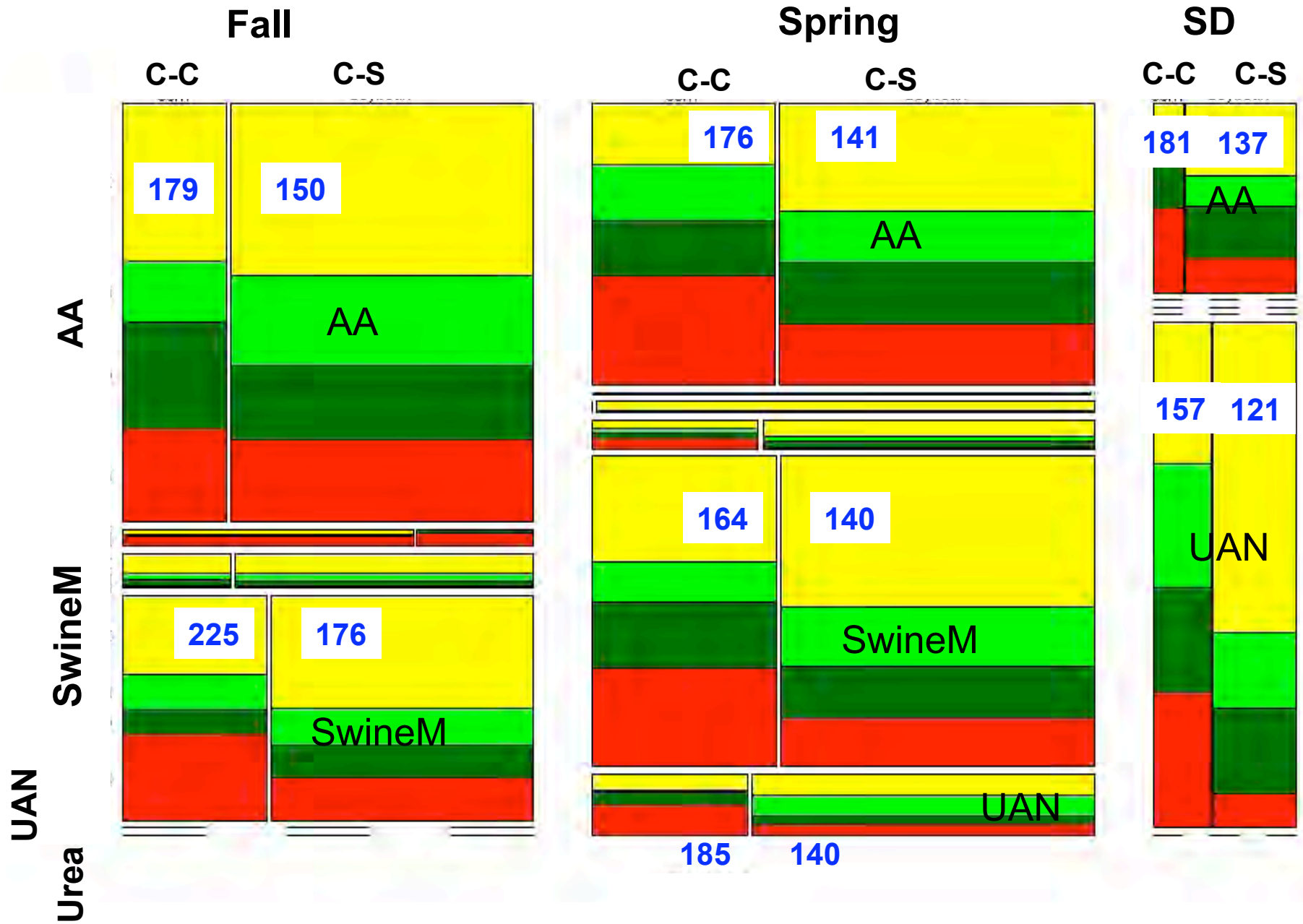
Sidedress UAN

Photo taken by Gaylia Ostermeier

Statewide in 2007

Factor	Category	Odds Ratio
N Rate	continuous	1.01***
Spring Rainfall	continuous	0.93**
Rotation	Alfalfa Soybean Reference: Corn	16.80 0.71***
N Form	Beef Manure Poultry Manure Swine Manure UAN Urea Reference: AA	5.56 0.22** 0.42** 0.57* 0.64
Timing	Spring Sidedress Reference: Fall	1.60** 1.60**
Tillage	Tilled Reference: No-Till	1.12

Statewide in 2007

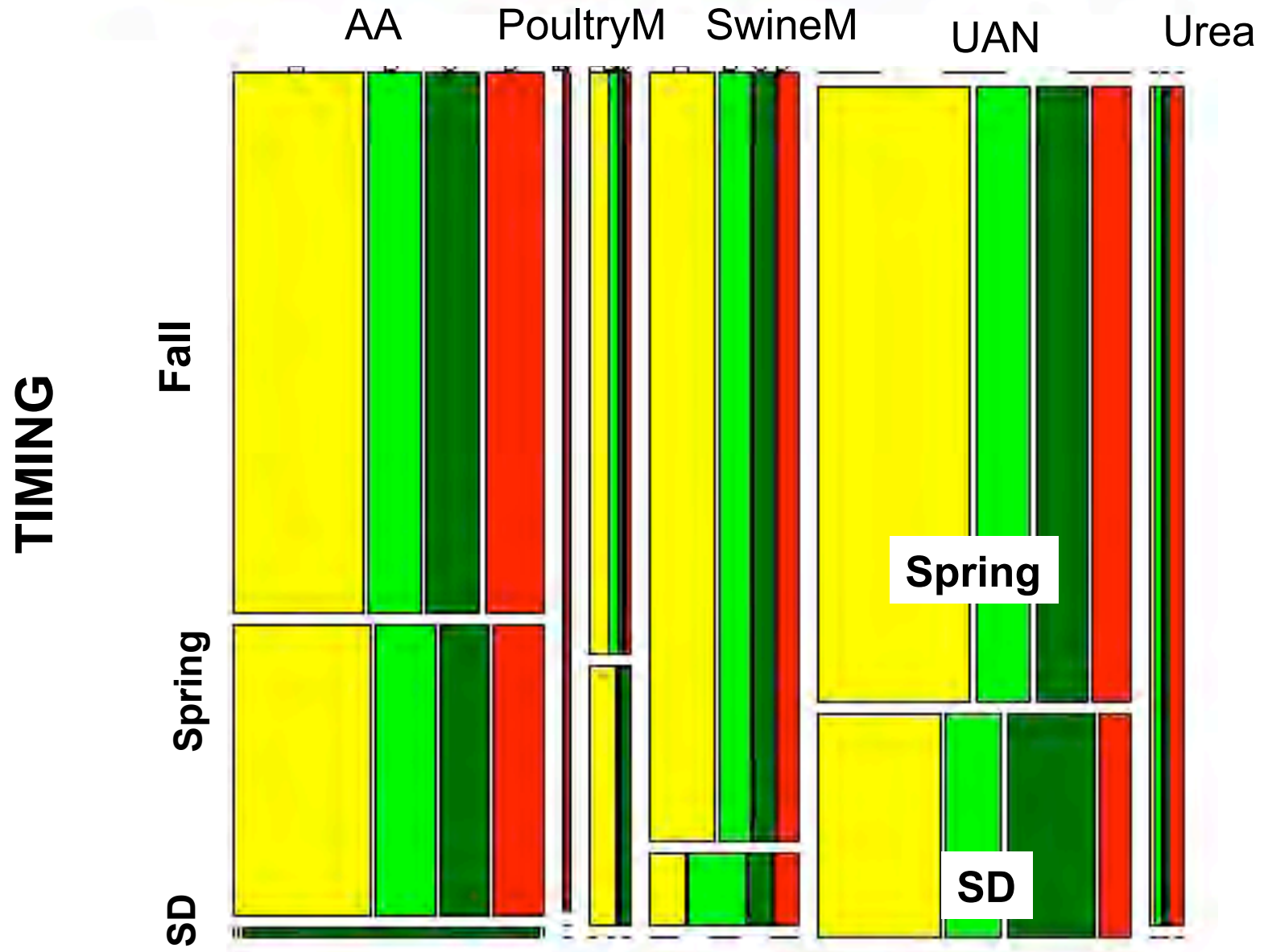


Des Moines Lobe in 2007

Factor	Category	Odds Ratio
N Rate	continuous	1.02***
Spring Rainfall	continuous	0.86***
Rotation	Soybean Reference: Corn	0.87
N Form	Poultry Manure Swine Manure UAN Urea Reference: AA	0.46** 0.33*** 0.44** 0.95
Timing	Spring Sidedress Reference: Fall	1.69 2.79***
Tillage	Tilled Reference: No-Till	3.03**

270 fields

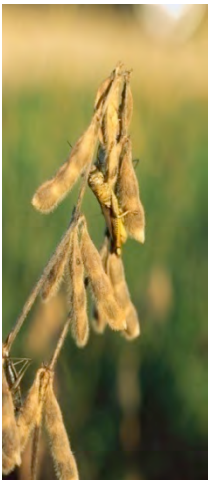
Des Moines Lobe in 2007



Major Observations

RAINFALL effect was significant in both years

- ROTATION effect in 2007: C-C performed better than C-S
- LIQUID SWINE and POULTRY manures performed less efficient than AA due to uncertainty in N availability and N losses
- UAN had problems in 2006 and 2007
- Detectible effect of TIMING in 2007 (a wet year)
- Des Moines Lobe: no effect of SOIL TYPES, TILLAGE interacted with the moisture in 2007

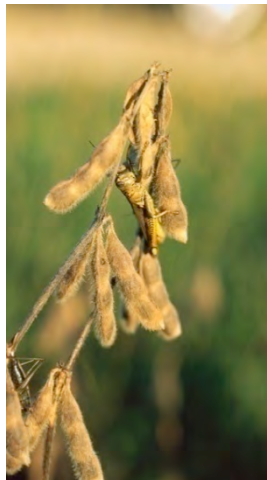


Adaptive Management on Large Scale



- Detect *unrecognized factors* affecting N availability for corn and *problem areas*
- Identify potential *N management categories* that can be treated differently in the future
- Build hypotheses for *additional controlled studies (replicated strip trials)*
- Empower growers to *collect, use, and learn from* data in their best interests

Acknowledgements



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