

Chesapeake Goal Line 2025:
Opportunities for Enhancing Agricultural Conservation

Hunt Valley, MD

5 October 2010



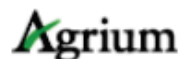
Effectively Enhancing N Use Efficiency

Tom Bruulsema, PhD, CCA
Director, Northeast Region, North America Program



IPNI Mission

“to develop and promote scientific information about the responsible management of plant nutrition for the benefit of the human family.”



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Outline

1. 4R Nutrient Stewardship for N

- a. Right source, right rate, right time, right place
- b. Stakeholder engagement for sustainability

2. Performance Indicators

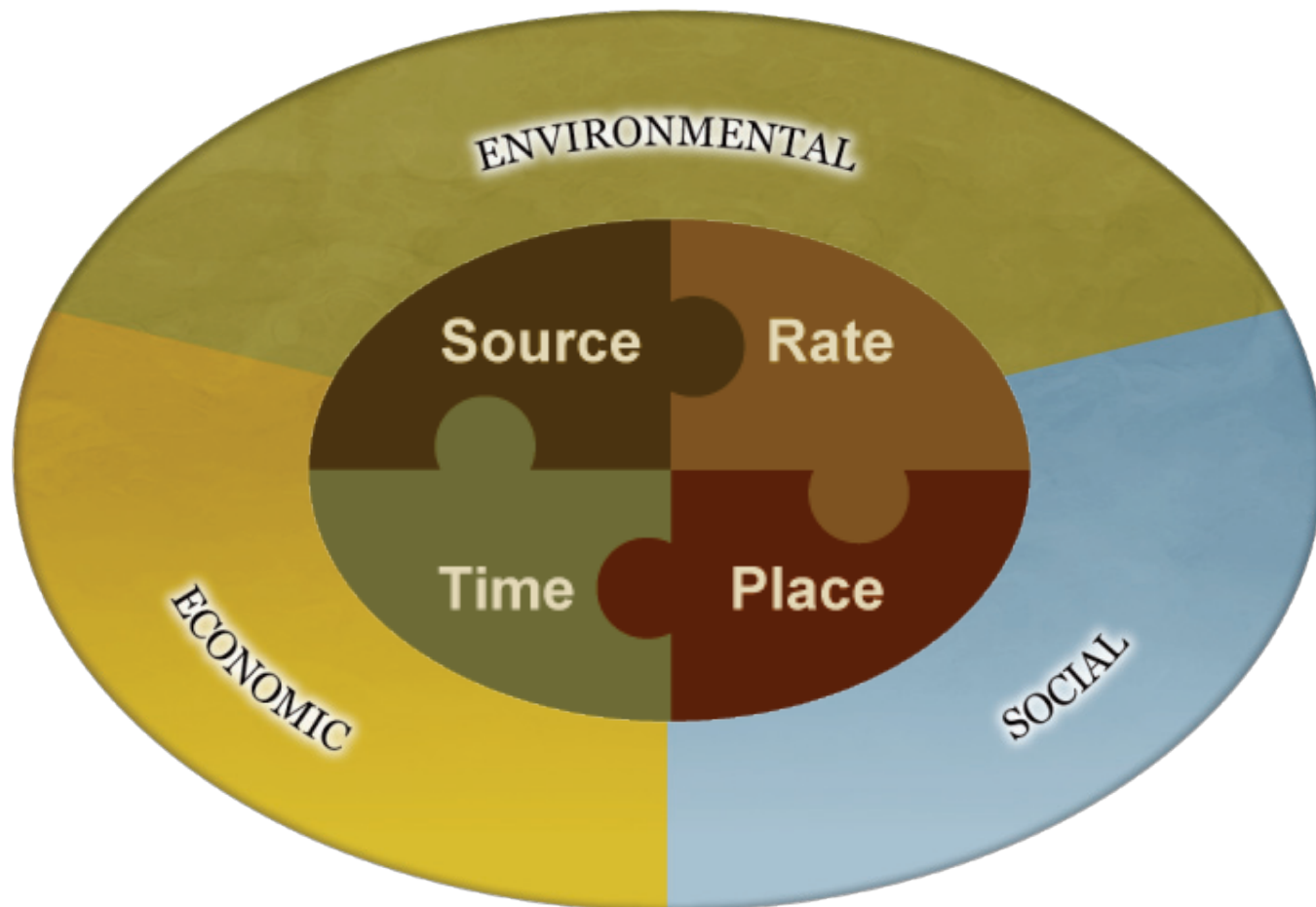
- a. Nutrient balances
- b. Nutrient use efficiency

3. Precision agriculture

- a. Spatial and temporal variability
- b. Adapting N management to weather

4R Nutrient Stewardship

- **Right Source @ Right Rate, Right Time & Right Place**
 - Linking practices to science for sustainability performance





About Mosaic | Products & Services | Community Investment | Sustainability

ABOUT US | INVESTORS | CUSTOMERS | SUSTAINABILITY

Sustainability

- The Environment
- Health and Safety
- Policies and Procedures



Sustainability

- Our Approach
- Economic
- Social
- Environment

Home > Sustainability

Sustainability

Highlights in Sustainability

Fertiliser | Industrial Products | Health Care & Food | Animal Feed | Company



SUSTAINABILITY

Inotec Privat

Sustainability

Sustainable development as a basic principle

The company strategy of K+S KALI GmbH's is driven by long-term and sustainable growth. As the largest subsidiary of the K+S Group we believe the basic principle of sustainable growth is both opportunity and challenge at the same time. We describe sustainable growth as a balanced relationship between the economic, ecological and social objectives. One important component of our company strategy is the compliance with our [fundamental values](#). They are the foundation of our worldwide activities, and serve as the direction within our daily business. Our employees are



- News
- About us
- Board of management
- History
- Sites
- Methods of processing
- Supply chain
- Sustainability
- Quality management
- Certificates
- Links

SUSTAINABLE

ZINC

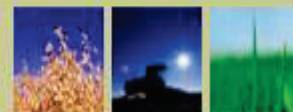
Zinc can be recycled indefinitely, without loss of its physical or chemical properties



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COMPANY PROFILE | PRODUCTS & SERVICES | CUSTOMER CENTRE | INVESTOR INFORMATION | MEDIA ROOM | IN THE COMMUNITY | CAREERS

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Our Company

Investors

Sustainability

Careers

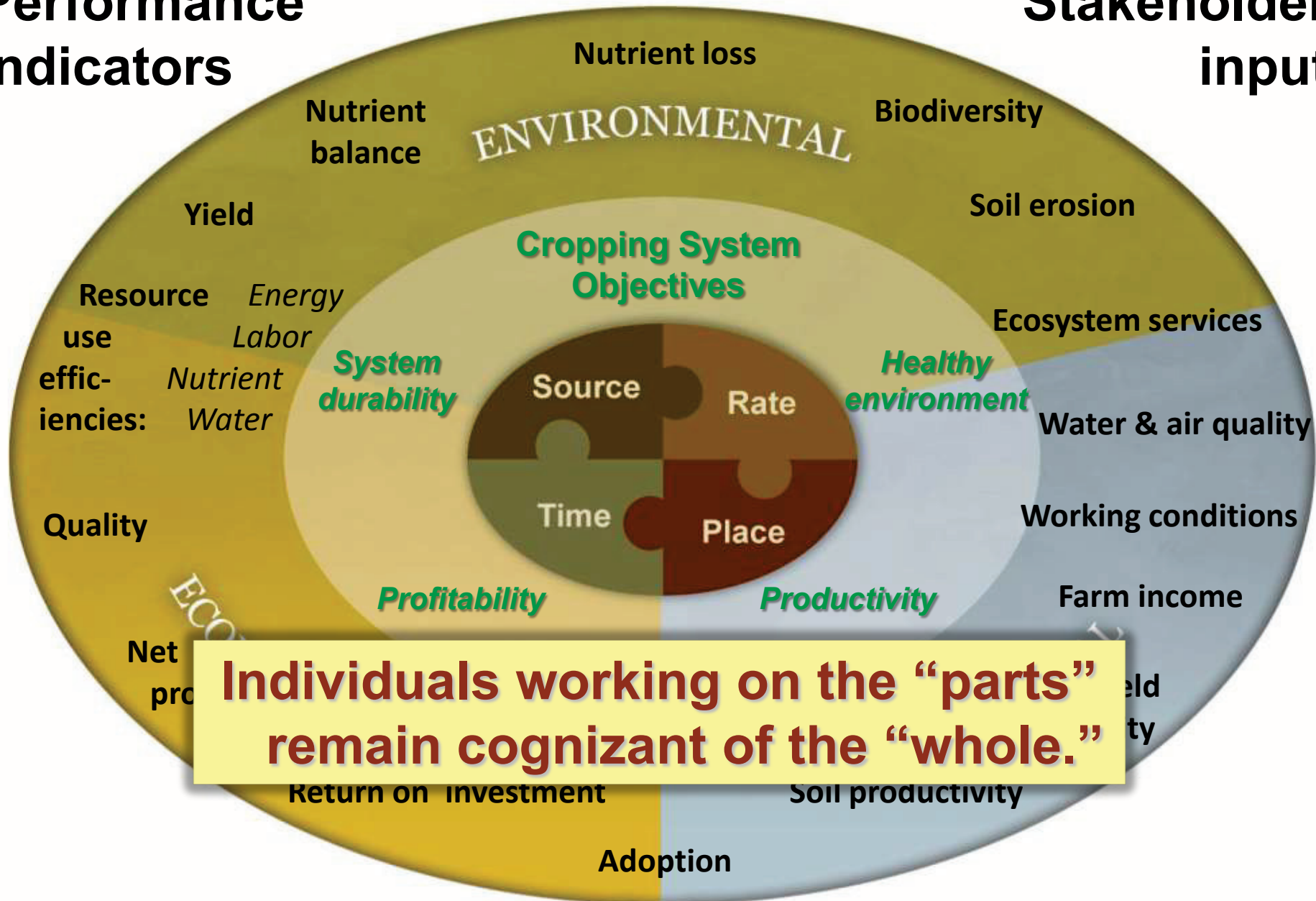
SUSTAINABILITY

SUSTAINABILITY /



Performance indicators

Stakeholder input



Individuals working on the "parts" remain cognizant of the "whole."

Right Source at Right Rate, Right Time, Right Place





A Preliminary
**Nutrient Use
 Geographic
 Information
 System (NuGIS)**
 for the U.S.



A PUBLICATION OF THE

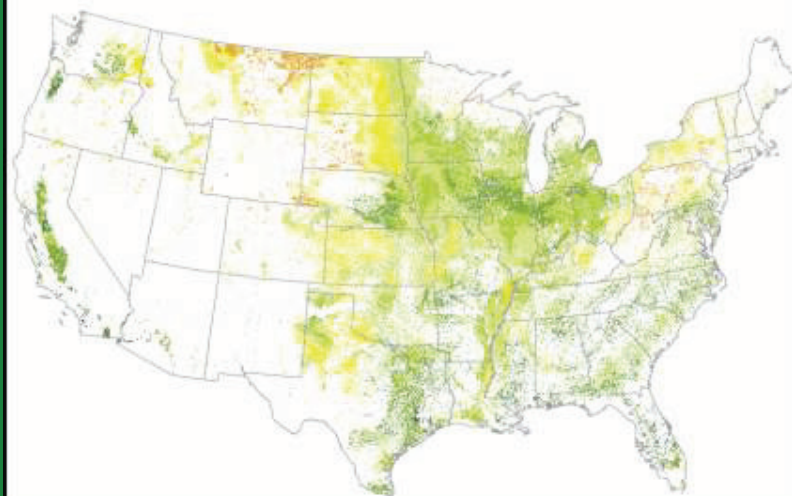


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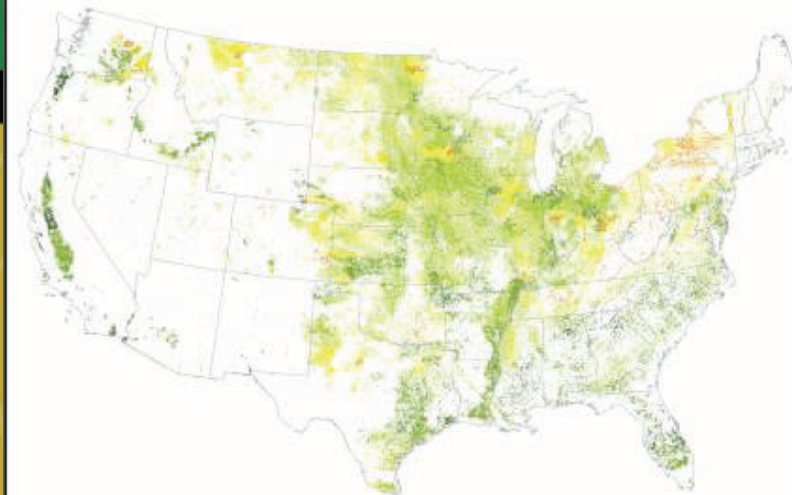


Estimated N balance

1987



2007

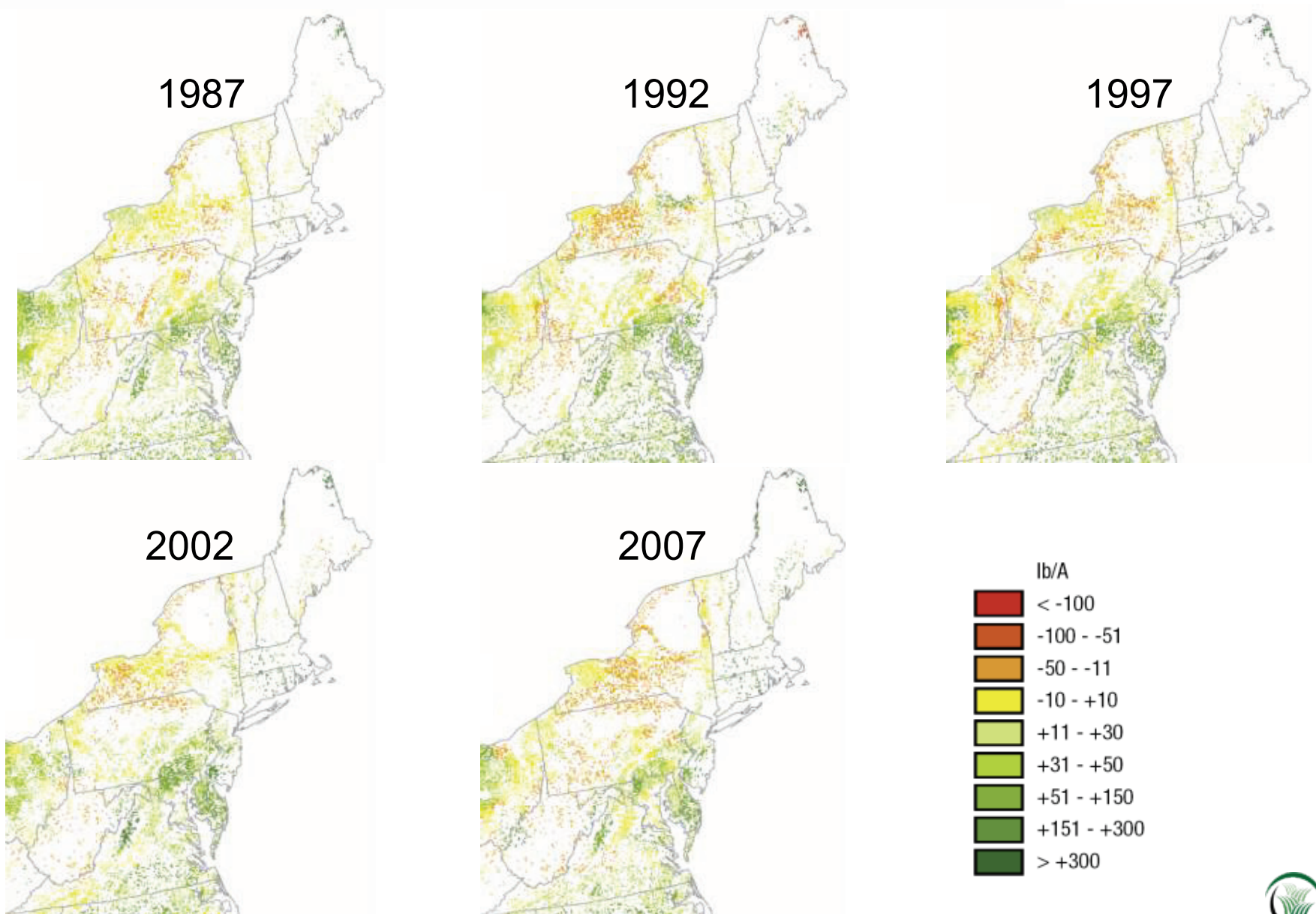


2010

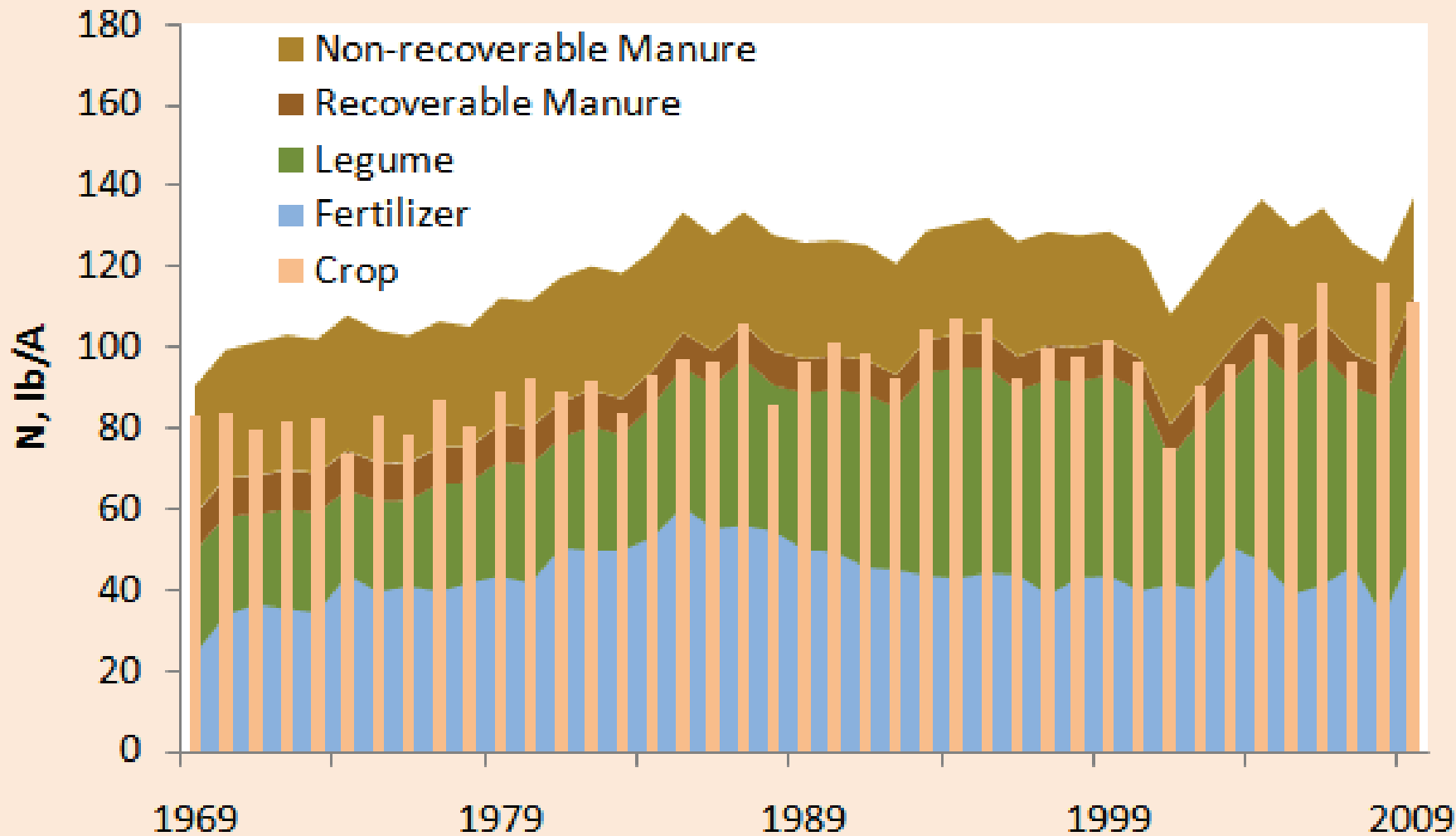
Item No. 20-3270 Reference No. 09130

Estimated N balance by watershed, 1987-2007.

(fertilizer + recoverable manure nutrients + legume N fixation - nutrient removal by crops, expressed as lb/planted acre)



Ontario Cropland Nitrogen Balance



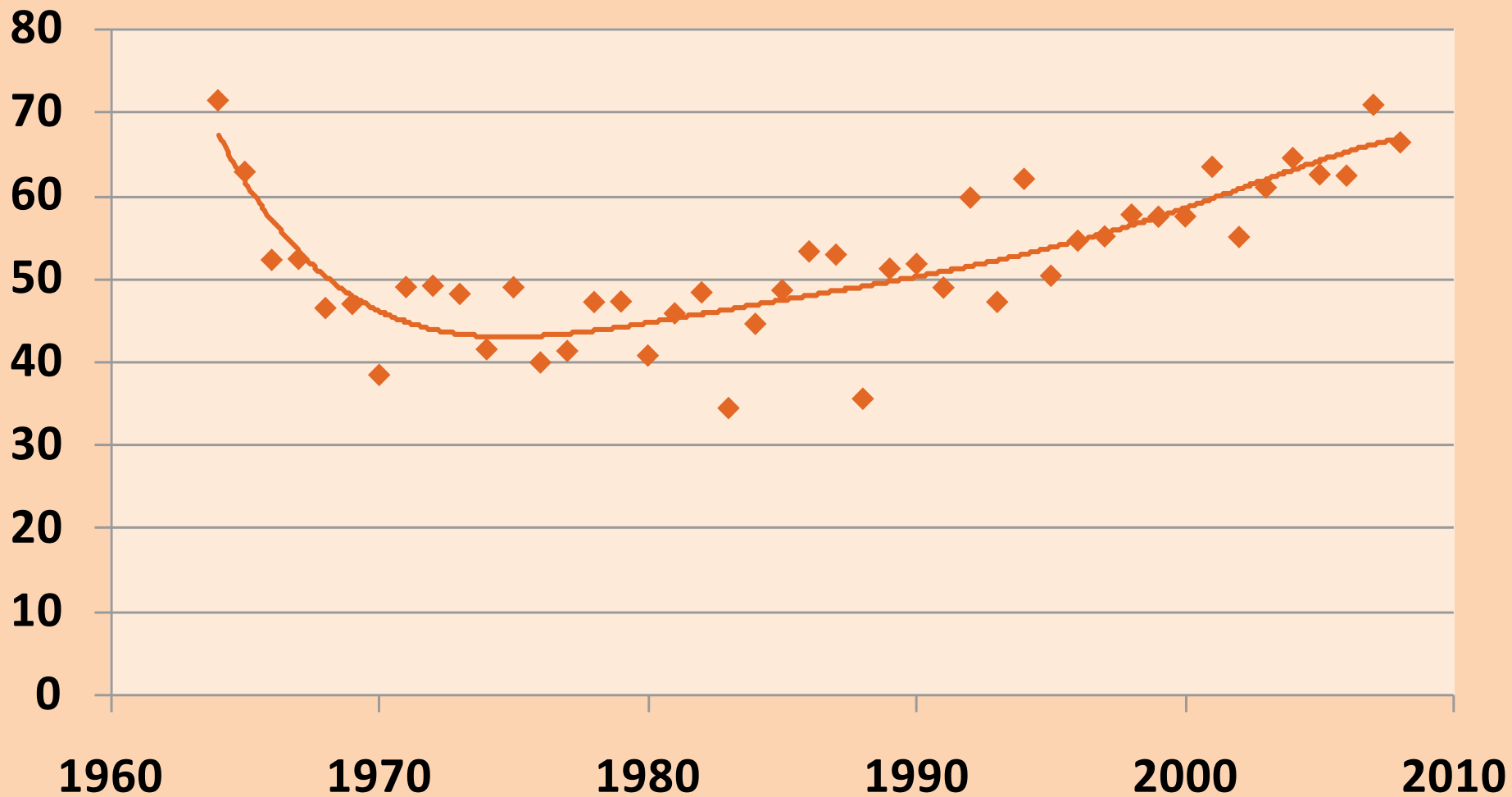
N Use Efficiency

NUE term	Calculated from	Typical levels for N (corn or wheat)
PFP	Y/F	40-80 lb/lb 0.7-1.4 bu/lb
AE	$(Y-Y_0)/F$	10-30 lb/lb 0.2-0.5 bu/lb
PNB	R/F	<100% = deficiency >100% = surplus
RE	$(U-U_0)/F$	50% (whole-plant) 33% (grain only)

Y=yield, F=fertilizer, R=removal, U=uptake

Partial Factor Productivity, US Corn

kg of corn per kg of N fertilizer applied



Recommendation Development

Policy Level

Regulatory, Infrastructural

Regional Level

Agronomic
scientists

Farm Level

Producers, Crop
advisers, Dealers

**LOCAL SITE
FACTORS**

- Climate
- Policies
- Land tenure
- Technologies
- Financing
- Prices
- Logistics
- Management
- Weather
- Soil
- Crop demand
- Potential losses
- Ecosystem vulnerability

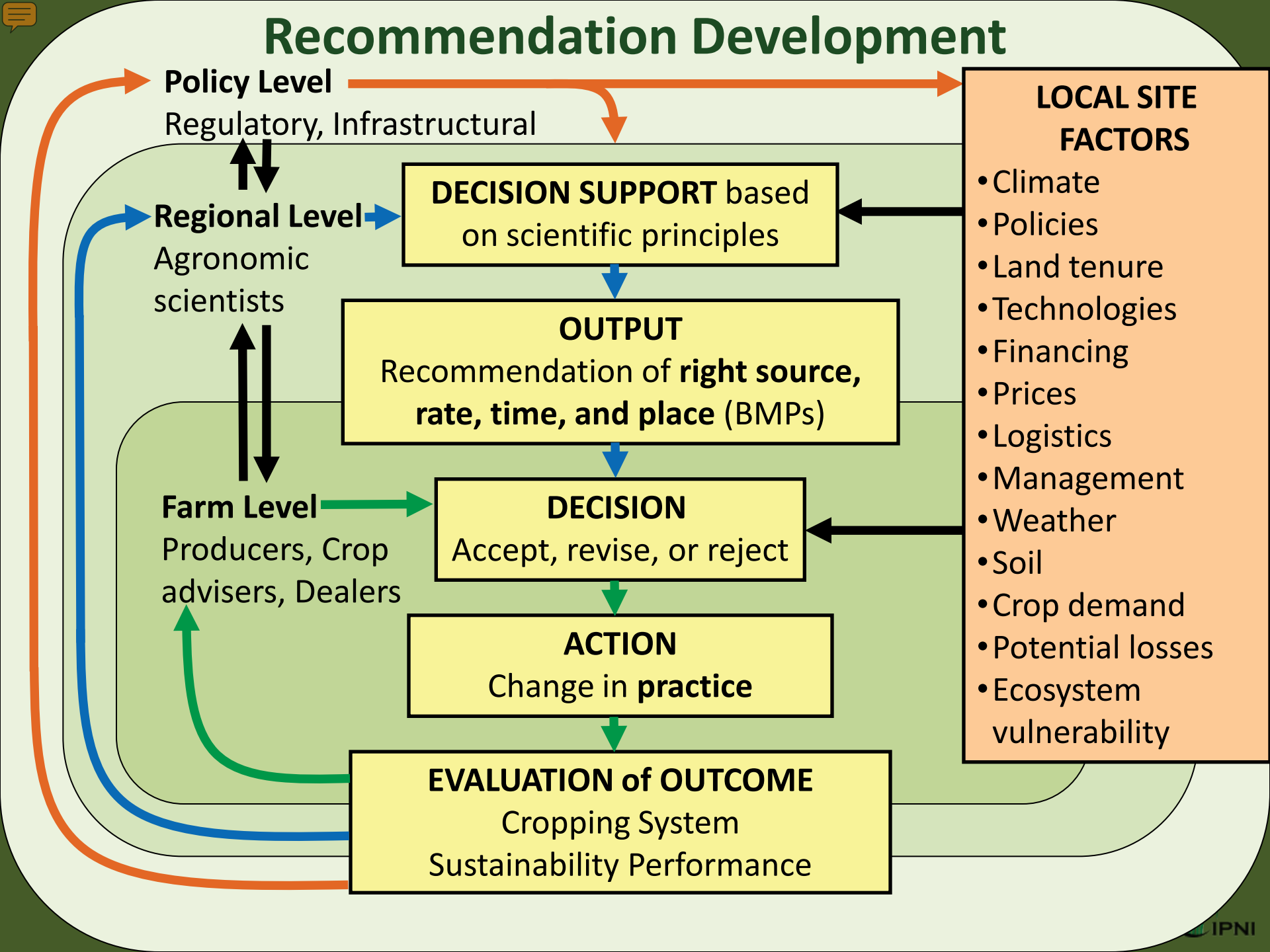
DECISION SUPPORT based
on scientific principles

OUTPUT
Recommendation of **right source,
rate, time, and place** (BMPs)

DECISION
Accept, revise, or reject

ACTION
Change in **practice**

EVALUATION of OUTCOME
Cropping System
Sustainability Performance



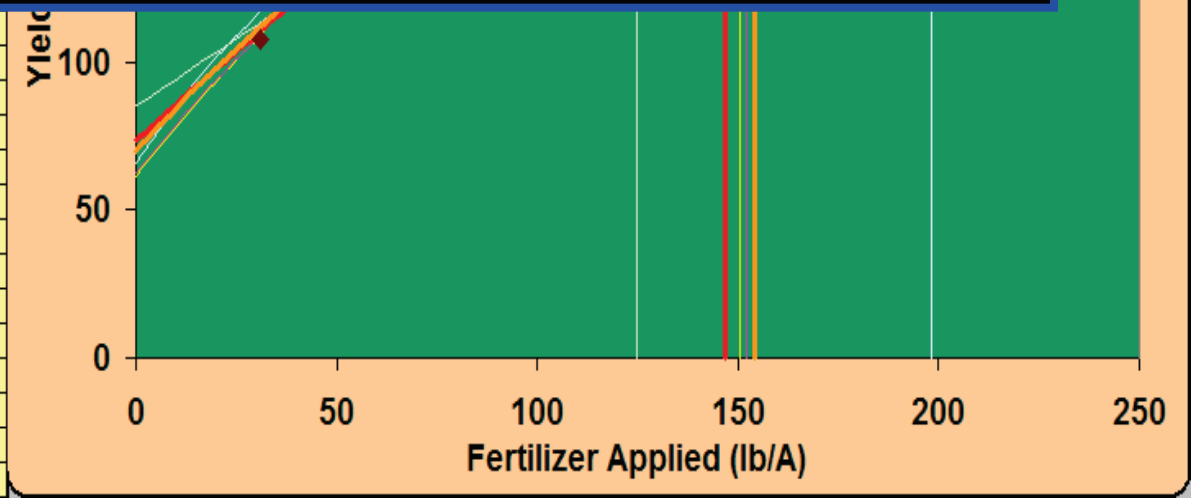
Crop Nutrient Response Tool (CNRT) v4.0

Step 1: Enter rate and yield data.
 Step 2: Click the Fit button.
 Step 3: Adjust crop and fertilizer prices.
 Step 4: Click to append information to summary.

Fertilizer rate, lb/A	Crop Yield, bu/A	Fit	R ² -weighted Mean	Quadratic (Q)	Quadratic-Plateau (QP)	Mitscherlich (M)	Linear-Plateau (LP)	Spherical (SP)
31	108			62	63	216	85	74
61	134			1.70	1.67	-150	0.91	125
91	158			-0.0052	-0.0051	-0.013	199	155
121	197							
154	202							
		R ² :		96%	96%	94%	96%	96%
		MERN (lb/A):	154	151	152	198	125	147
		Yield @ MERN (bu/A)	198	199	199	206	199	198
		Partial Factor Productivity (PFP)	1.29	1.32	1.31	1.04	1.59	1.35
		Agronomic Efficiency (AE _N)	0.82	0.84	0.80	0.70	0.94	0.85
		Partial N Balance (PNB):						101%
		Recovery Efficiency (RE _N)						95%
								125
								37%

MERN (lb/A):	151
Yield @ MERN (bu/A)	198
Partial Factor Productivity (PFP)	1.31
Agronomic Efficiency (AE _N)	0.85
Partial N Balance (PNB):	98%
Recovery Efficiency (RE _N)	96%

Crop (\$/bu)	4.50		
Fertilizer (\$/lb)	0.55		
Price ratio (f/c)	0.122222222		
Crop N content (lb/bu)	0.75		
N harvest index	0.67		
Fertilizer source			



Append site information to summary



CANADIAN FERTILIZER INSTITUTE
INSTITUT CANADIEN DES ENGRAIS

4-R Nutrient Management Plan Worksheet for Crop Advisors

To Assist in Gathering Information to Develop a Nutrient Management Plan for a Field

(Make a copy for each field as needed.)

Farm Name: _____

Contact Person: _____

Sustainability Goals:

a. Economic

- i. _____
- ii. _____

b. Social

- i. _____
- ii. _____

c. Environmental

- i. _____
- ii. _____

BETTER CROPS WITH PLANT FOOD

A Publication of the International Plant Nutrition Institute (IPNI)

2010 Number 3

In This Issue...

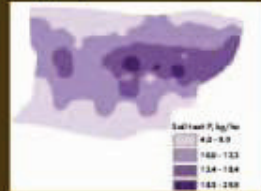
Precision Agriculture:
Does It Make Sense?



Temporal Variability of
Crop Response to Fertilizer



GIS-Based Soil Fertility
Mapping Use in India



Also:

Precision Topics from
Argentina, Australia, Brazil,
China, India, Russia, USA...

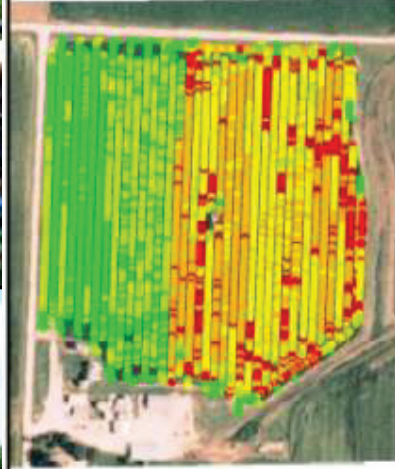
...and much more



www.ipni.net

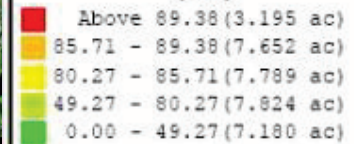
RECORD HARVEST

An AgriSense Map



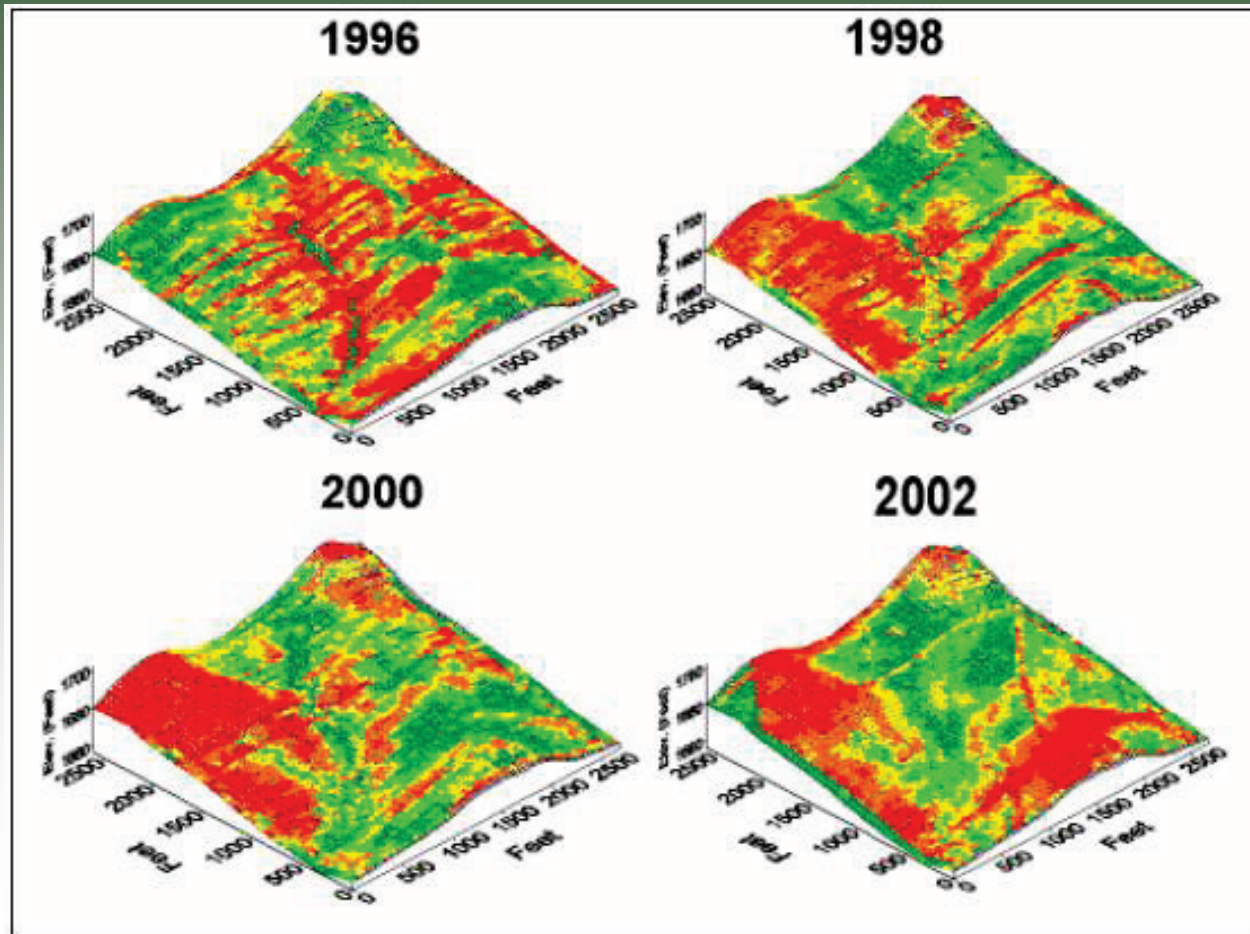
Fertilizer Legend

Rate Applied (Mass) (N)
(lb/ac)



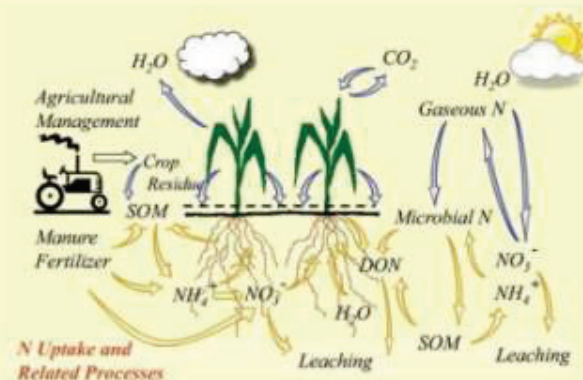
Focus Issue:
Spatial Variability

Temporal Variability



Managing Crop Nitrogen for Weather

Quantifying and Understanding Plant Nitrogen Uptake for Systems Modeling



Proceedings of the Symposium
“Integrating Weather Variability into Nitrogen Recommendations”

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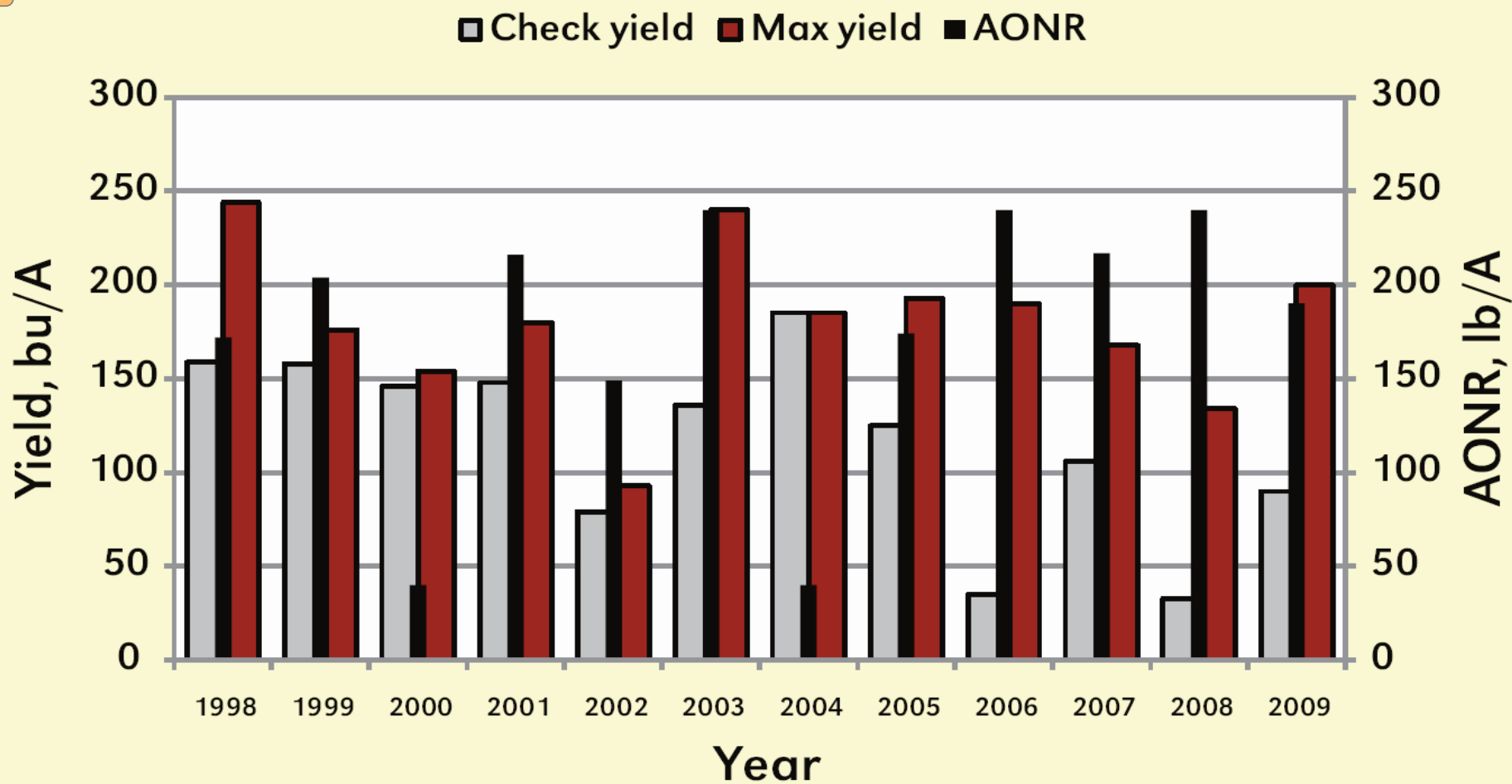


Figure 1. Maximum and check grain yields at the Northwest Research Station near Hoytville, Ohio, and the corresponding agronomic optimum N rates (AONR) necessary to achieve those yield levels for corn following soybean, 1998-2009.



Adapt-N

A tool for calculating corn sidedress nitrogen rates



What's Adapt-N
Used For?

What Info
Do I Need?

How Do I Use
Adapt-N?

Provide in-season N recommendations for corn production based on simple soils, management and crop inputs.

Key feature: accounts for changes in soil N due to early season weather and adjusts the in-season N recommendations accordingly.



Enhanced-Efficiency Nitrogen Sources

1. Synthetic organic compounds containing N

- urea-formaldehydes, IBDU, triazines, etc.



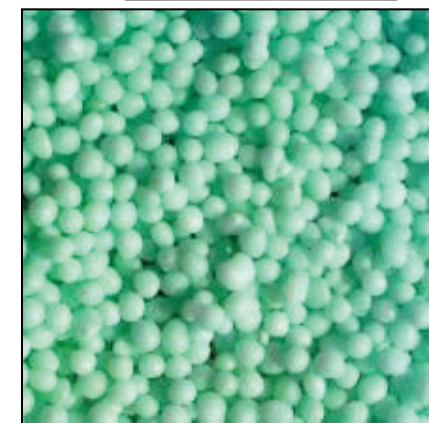
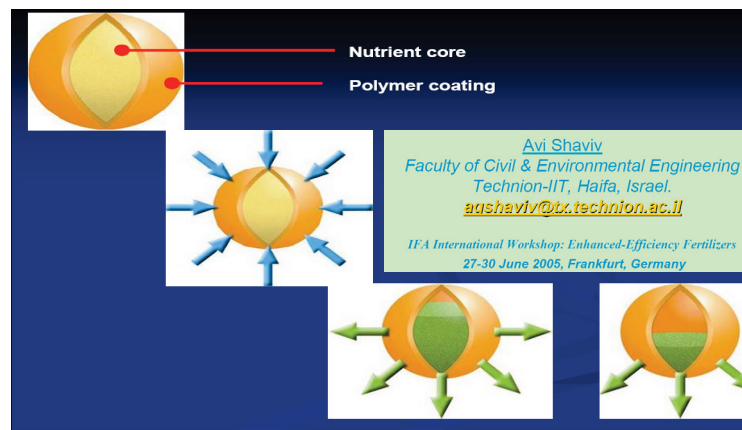
2. Physical coating or barrier around soluble N fertilizer

- Sulfur-coated or polymer-coated urea.



3. Stabilized materials

- urease and nitrification inhibitors





Three most important technologies and/or specific strategies 2010-2017

1. 4R Nutrient Stewardship for N

- a. Right source, right rate, right time, right place
- b. Setting farm-level sustainability goals through stakeholder input
- c. Promote on-farm measurement of N balances and N use efficiency

2. Precision agriculture

- a. Using GPS guidance to reduce overlaps and waste
- b. Enhanced crop management record-keeping
- c. On-farm evaluation of crop sensing technologies

3. Enhanced-efficiency N sources

- a. On-farm evaluation with public dissemination of results



Three most important technologies and/or specific strategies 2017-2025

1. 4R Nutrient Stewardship for N

- a. Right source, right rate, right time, right place
- b. Setting farm-level sustainability goals through stakeholder input
- c. Promote on-farm measurement of N balances and N use efficiency

2. Adapting N Management to Weather

- a. Field validation of weather-based crop and soil nutrient transformations and transport
- b. Weather probability prediction tools to guide management decisions

3. Precision agriculture

- a. Systems to manage within-field variability integrated with temporal (weather) variability

Comments Welcome

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