



IPNI Research Supports the Worldwide Fertilizer Industry

The Fertilizer Industry Round Table
Tampa Bay, Florida
November 7-8, 2007

Terry L. Roberts
President, IPNI

Challenges facing the fertilizer industry

Environment :

- Reactive N
- Water quality
- Air quality
- Soil quality
- Manure & point source pollution
- Greenhouse gases
- Land degradation and desertification

Production:

- Inadequate and unbalanced fertilization
- Lack of, or out-of-date fertilizer recommendations
- Farmer profitability under higher fertilizer costs
- Heavy metals in fertilizers
- Organic vs. inorganic agriculture
- Safe and nutritious food



IPNI Strategic Plan

Mission Statement: *The mission of IPNI is to develop and promote scientific information about the responsible management of plant nutrition for the benefit of the human family.*

Goals

Provide collaborative leadership development on global plant nutrition issues.

Facilitate research on environmentally responsible use of plant nutrients needed for agriculture to meet future global demand for food, feed, fiber, and fuel.

Provide science-based plant nutrient and fertilizer use information to industry, farmers, agricultural and environmental leaders, scientists, and public policy-makers.

Fulfill member needs that align with IPNI goals and resources.

Facilitate research on environmentally responsible use of plant nutrients needed for agriculture to meet future global demand for food, feed, fiber, and fuel.

- Establish a v
- Collaborate s
strategic par
- Investigate, implementat
nutrition tec
- Participate in
organizations
age and provide n
information.
- Continually improve our communication
network to facilitate and streamline the
exchange of scientific information.

- Structure plant nutrition research to optimize the efficiency of available natural resources (soil, water, and nutrients) and human resources (time, labor, and money).
- Support investigations seeking to optimize the production of high quality food, feed, fiber, and fuel.



How do we accomplish this?

- Scientific staff
- Research foundation
- Direct research support
- Collaboration with others
- Influence other research



How do we accomplish this?



- 22 Ph.D. scientists in 8 program areas
 - 6 scientists in North America
 - 12 scientists in International regions
 - 4 in management




How do we accomplish this?

Foundation for Agronomic Research (FAR) ... sister organization to IPNI



Leader in research and education for agricultural productivity and environmental stewardship




ABOUT FAR

> Learn about our beginning, our purpose, our functions and our people.




PROJECTS

> Find what projects are active and what research we've unveiled in the past.



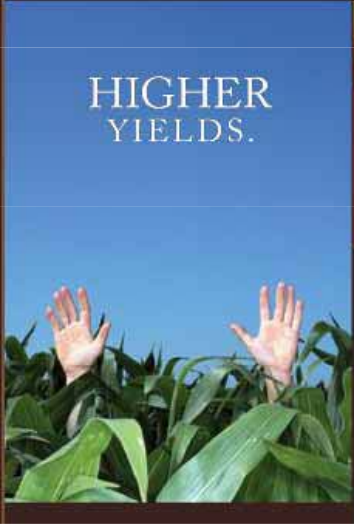
NEWS & EVENTS

> Check news and schedules of FAR and industry-wide events.



FRIENDS OF FAR


FIVE FOR FIVE
GREAT REASONS YEAR COMMITMENT



HIGHER YIELDS.

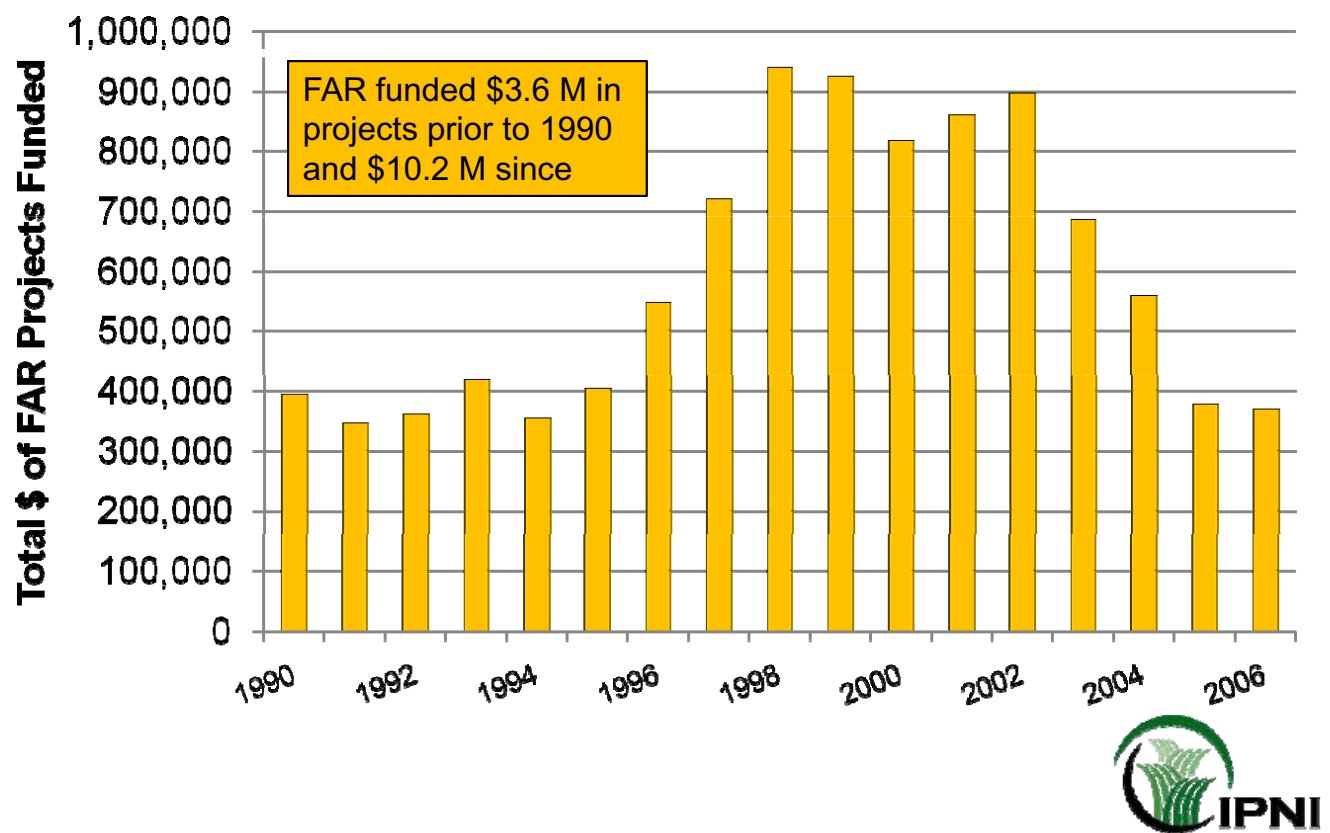
Become a Friend of FAR

Funding for research in applied production agriculture has been declining for many years. Many university staff positions for field research and Extension have been eliminated. They are more dependent on FAR's support than

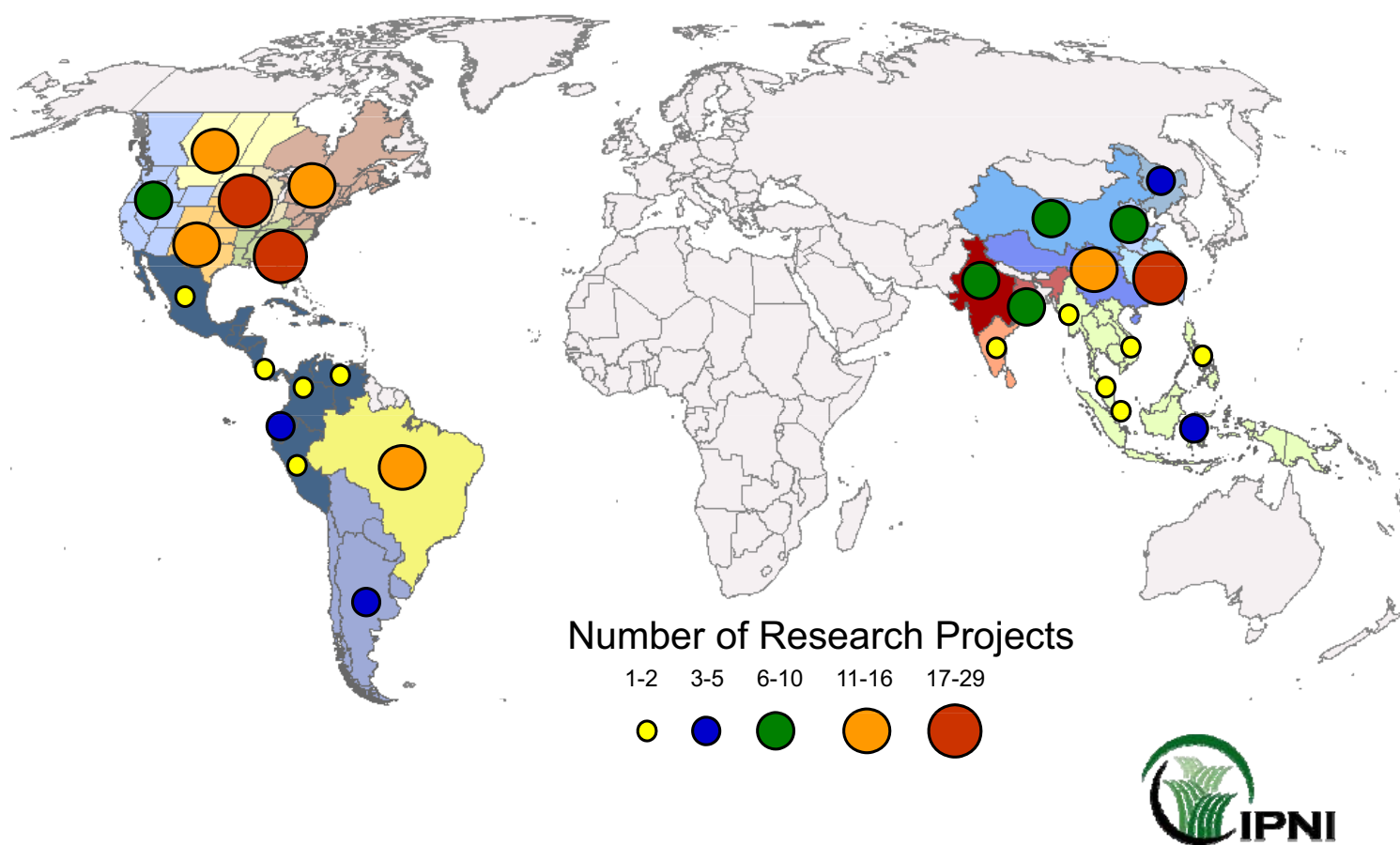


Dr. Harold A. Klee
spending his time and inspiration when he should be using his talent.

History of Project Funding by FAR



2007 Research Projects - 219



North American Research Projects

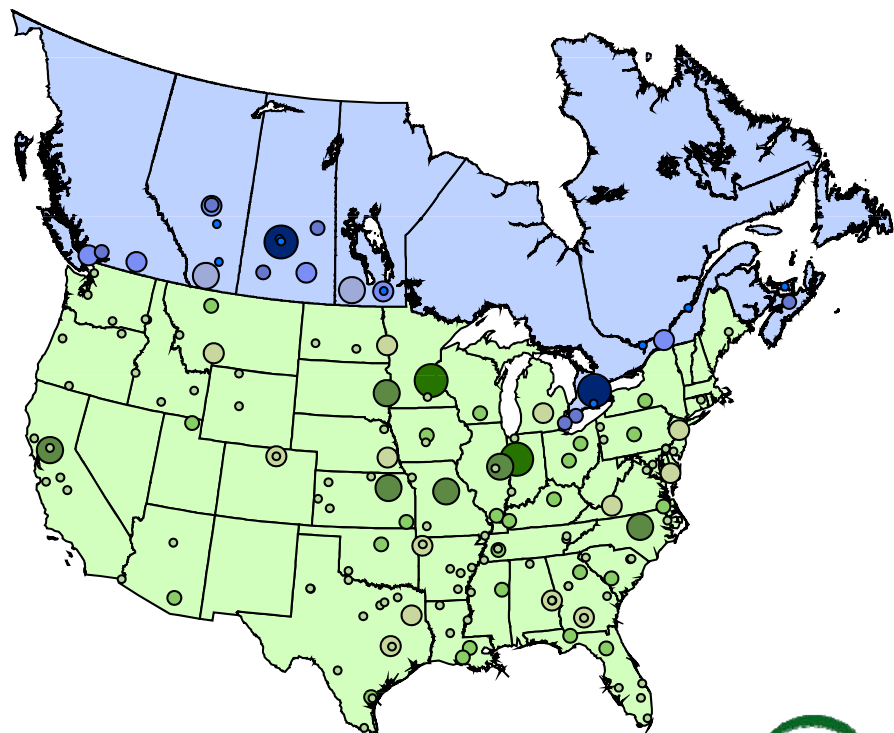
Legend

Projects by ZIP


- 1 - 2
- 3 - 5
- 6 - 9
- 10 - 13
- 14 - 18

Projects by ZIP

- 1
- 2 - 3
- 4 - 6
- 7 - 9
- 10 - 13



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Research I
Visit these
sites for m
PPI/PPIC/
supported
> FARme
> IFAPS P
> USB Pro

Topic

Topic

Alfalfa

Banana

Barley

Boron

Calcium

Canola

Carbon Sequestration

Chloride

Citrus

Coarse Grains

Copper

Corn

Cotton

Crop Quality

Crop Rotations

Cropping Systems

Cultural Practices

Education

Environment

Extension

Fertigation

Fertilizer Economics

Fertilizer Placement

Field Variability

Flax

Foilar Fertilization

Forages

Fruits

Grid Sampling

Topic

Grid Sampling

High Yields

Iron

Irrigation

Legumes

Magnesium

Manganese

Manure Management

Micronutrients

Maxiumum Economic Yield (I

Micronutrients

Microorganisms

Molybdenum

Nickel

Nitrogen

Nutrient Deficiency

Nutrient Management

Nutrient Removal

Nuts

Oats

Oil Palm

Oilseeds

Phosphorus

Plant Analysis

Plantation Crops

Potassium

Potato

Profitability

Pulse Crops

Recommendations

Topic

Oil Palm

Oilseeds

Phosphorus

Plant Analysis

Plantation Crops

Potassium

Potato

Profitability

Pulse Crops

Recommendations

Rice

Sandy Soils

Site-specific Management

Soil Acidity and Liming

Soil Management Zones

Soil Testing

Solutions

Sorghum

Soybeans

Starter Fertilization

Sugarbeet

Sulfur

ed by IPNI and FAR

or Topic

Printable Version

contains fundamental information on the research projects
American project funded has a project number in which the
e number following the letters is associated with a specific
neral topic.

clude short articles or tables, published papers or reports,
study.


ed with caution. The IPNI staff often post photos and in-
n to offer an opportunity to stay abreast of projects of
d.

ided as resources permit.

Grass

Vegetation

Material and Efficiency





Research Database Home

Select Projects By or or

visit these other
sites for more
IPNI/IFPRI/FAR
supported research:

> FARresearch.com

> IFPRI Project

> USB Project

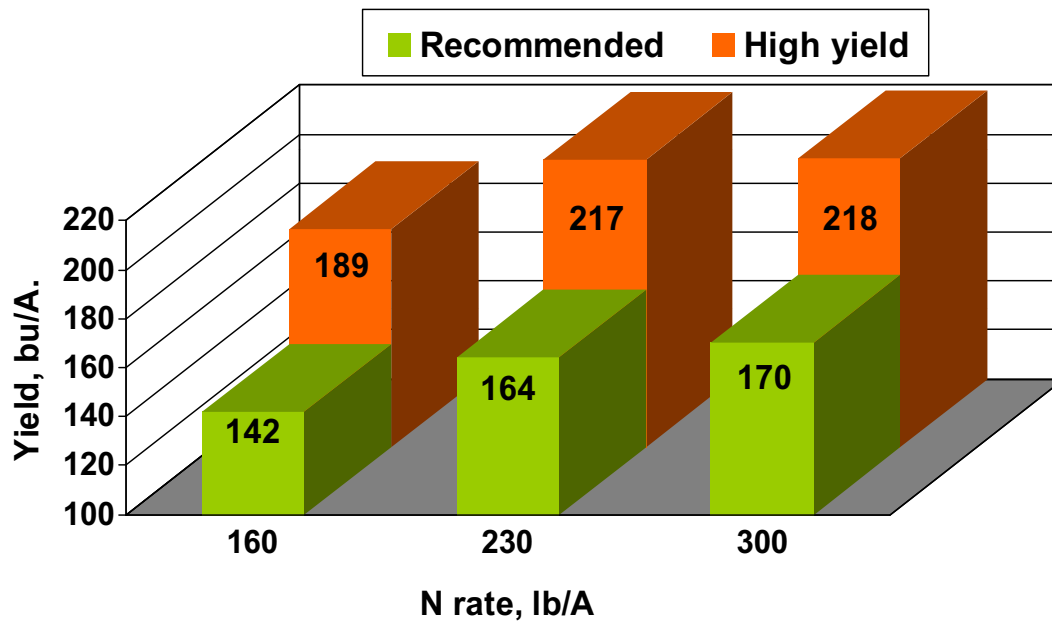
Recommendations

AB-11	Fertilizer Requirement of Irrigated
AR-25F	Nitrogen Source, Timing and Rate
AR-31F	Development and Implementation
BOLIVIA-1	Network of fertilization experiment
CA-19F	Potassium Nutrition of Pistachio
CHONGQING-NMS05	Nutrient Management Strategies
FAR-06F	Development and Implementation
GA-19F	Use of Enhanced Soil Survey to Q
GANSU-NMBF	Nutrient management and balance
GANSU-NMS01 PA	Nutrient Management in the Pove
GUANGXI-NMS02	Nutrient Management Strategies
GUATEMALA-05	Phosphorus fertilization and soil p
HUBEI-23	Soil Nutrients Status in Root Lotu
IA-09F	Variability in Soil Test Potassium
IA-11F	Coordination of Management Prac
ID-08F	Development and Implementation
IL-34F	Development and Implementation
INDONESIA-23	Oil Palm Management Program (O
INNER MONGOLIA-NMBF	Nutrient management and balance
JIANGXI-NMS21	Soil Nutrient Management Strategies for a Monitored Village in Shangqiao County, Jiangxi
KS-34F	Development and Implementation of Fertilizer BMP Guides for Six Selected Major Cropping Systems
MB-10	Fertility Management of Winter Wheat Grown after Alfalfa
MD-08F	Evaluation of Different Management Factors for Consistent 100 bu/A of No-till Wheat
ND-12F	Development and Implementation of Fertilizer BMP Guides for Six Selected Major Cropping Systems
NINGXIA-NMBF	Nutrient management and balanced fertilization on main crops in Ningxia province
NWZ INDIA-69	Assessment of Phosphorus and Potassium Requirements for Maximum Economic Yield of Major Crops of Central Plain Zone of Uttar Pradesh
NWZ INDIA-70	Site Specific Nutrient Management in Mosambi Sweet Orange (Citrus sinensis (Osbeck)
NWZ INDIA-71	Balance Fertilization for Maximization of Crop Yields in Gujarat
NY-08F	Development and Implementation of Fertilizer BMP Guides for Six Selected Major Cropping Systems
ON-17	Impact of Fertilization Rates on Yield and Quality of Cabbage and Nitrate Leaching
QINGHAI-NMBF	Nutrient management and balanced fertilization on main crops in Qinghai province
QINGHAI-NMS01 G	Preliminary Study of the Impact of Fertilization on Seeded Grasses in Qinghai
SD-10F	Site-specific Management Guidelines
SHANXI-NMS01 PA	Soil Nutrient Management Techniques and its Application in Impoverished Areas of Shanxi
SICHUAN-NMS02	Effect of Balanced fertilization on Reviving Degraded Grasslands in Sichuan
SK-33	Evaluation of Agronomic Practices and Quality Parameters of Timothy Hay
SZ INDIA-39	Characterization of phosphorus in selected soil series of Karnataka and response of rice to applied phosphorus
TIBET-03	Effect of improved fertilization on yields of watermelon and broadbean in Tibet
TN-17F	Soil Fertility Requirements for Hybrid Bermudagrass Hay Production
WA-34F	Coordination of Management Practices Enhancing Total Efficiency (COMPETE): Wisconsin Report on Improving Assessments of Soybean Nutrient Needs

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Key research area: maximum yield research ...

Kansas High yield corn project



B. Gordon.

Average 2000 to 2003


Average across 2 populations
(28,000 and 42,000 plants/A)

KSU recs.= 30 lb P_2O_5 /A, no K or S

High yield= 100 lb P_2O_5 /A, 80 lb K_2O /A, 40 lb S/A



Key research area: maximum yield research ... Ecological Intensification



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Nitrogen
Phosphorus
Potassium
Secondary Nutrients
Regional Programs
Ecological Intensification

Why is Ecological Intensification Important?

World population is expected to increase from the current 6.5 billion to over 9 billion by 2050. This represents an approximate 40% increase in just over 40 years. An obvious question is "where will we get the needed food, fiber, and fuel for all these additional people?" Another question that arises is "how much impact will this have on environmental quality?" The answer to these questions can at least partly be found in the concept and practice of ecological intensification (EI) of cropping systems. The following points generally address why EI is important to the future of world agriculture.

[Click here to read more](#)

Publications	Presentations	Research
<h4>Ecological Intensification Related Publications</h4> <p>Potential Biofuels Influence on the Fertilizer Market</p> <p>Recent paper given by Dr. Paul Fiehn at the 2007 Fluid Forum</p> <p>Read the paper</p>	<h4>Ecological Intensification Related Presentations</h4> <p>Ecological Intensification of Irrigated Corn and Soybean Systems</p>  <p>Presentation by Andrew Bohrer discussing</p>	<h4>Ecological Intensification Related Research</h4> <p>Ecological Intensification of Irrigated Corn and Soybean Cropping Systems</p>  <p>This experiment seeks to (1) quantify and understand the yield potential of corn and soybean under irrigated conditions; (2) evaluate crop management practices that achieve system maximum potential; and (3) determine global warming and soil carbon sequestration potential of intensively managed corn</p> <p>Go to project</p>

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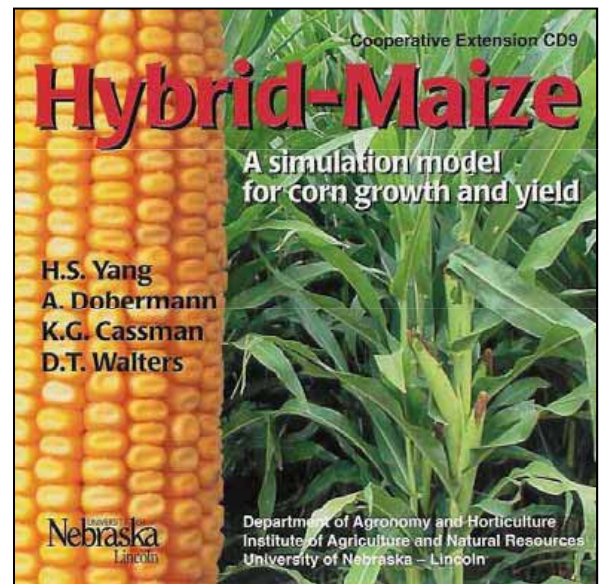
University Nebraska (UNL) Ecological Intensification study

- Initiated in 1999
- Main plots are crop rotation (CC, CS)
- Sub plots are
 - Population- recommended & 2 higher
 - Nutrients - recommended & enhanced
- Have achieved corn yields of >280 bu/A
- An important product is Hybrid-Maize



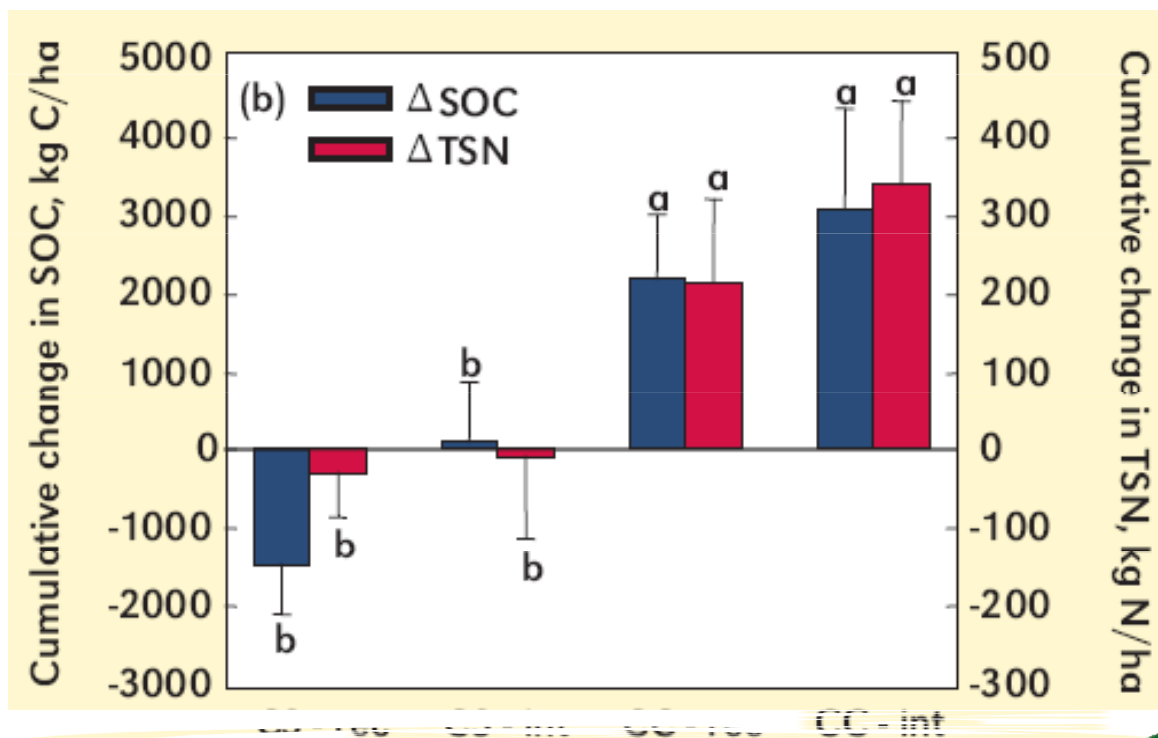
Hybrid-Maize simulation software

- A user friendly program
- Provides a mechanistic approach to determining yield potential
 - Analyzes impacts of several factors (climate, planting date, row spacing, and hybrid)
- Analyzes site yield potential, simulates growth, forecasts yield in-season



UNL EI project

Change in soil C and N after 4 years



Estimated net global warming potential (GWP) for maize in Nebraska, U.S.

GWP components		Continuous corn (CC)		Corn-soybean (CS)	
		Recomm.	Intensive	Recomm.	Intensive
----- kg CO ₂ -C equivalents/ha/yr -----					
Agricultural Production ¹	N fertilizer	220	330	80	180
	P, K, fertilizer	0	60	0	60
	Lime	60	90	60	90
	Seed, pesticides	50	60	50	60
	Machinery, transport	20	30	20	30
	Diesel	90	90	80	80
	Irrigation	140	140	110	110
	Grain drying	110	120	90	100
Total		690	920	490	710
Δ Soil C ²		-440	-620	300	-20
Soil N ₂ O ³		320	570	250	340
Soil CH ₄ ³		-30	-30	-20	-10
GWP⁴		540	840	1,020	1,020

¹ Continuous corn production system: corn crops grown during 2000-2005. Corn-soybean production system: corn crops grown during 2000-2004 and soybean crops grown during 2005. Data were collected in June 2000 and June 2001 for continuous corn crops and June 2001 for corn-soybean crops.

² Soil C: change of soil C for 100 year time frame. For continuous corn system, the change of soil C was -0.15% for two corn crops (2003-2004) and one soybean crop (2005). For corn-soybean system, the change of soil C was -0.15% for two corn crops (2003-2004) and one soybean crop (2005).

³ Soil N₂O: Agricultural production + 44000 + soil N₂O + soil CH₄.

Expansion of Ecological Intensification studies in 2008

- Title: Towards a Global Approach for Nutrient Management in Maize

- U. of Nebraska/IRRI: Dobermann et al.

- Objectives:

- Add a nutrient management module to the Hybrid-Maize software and evaluate it globally.

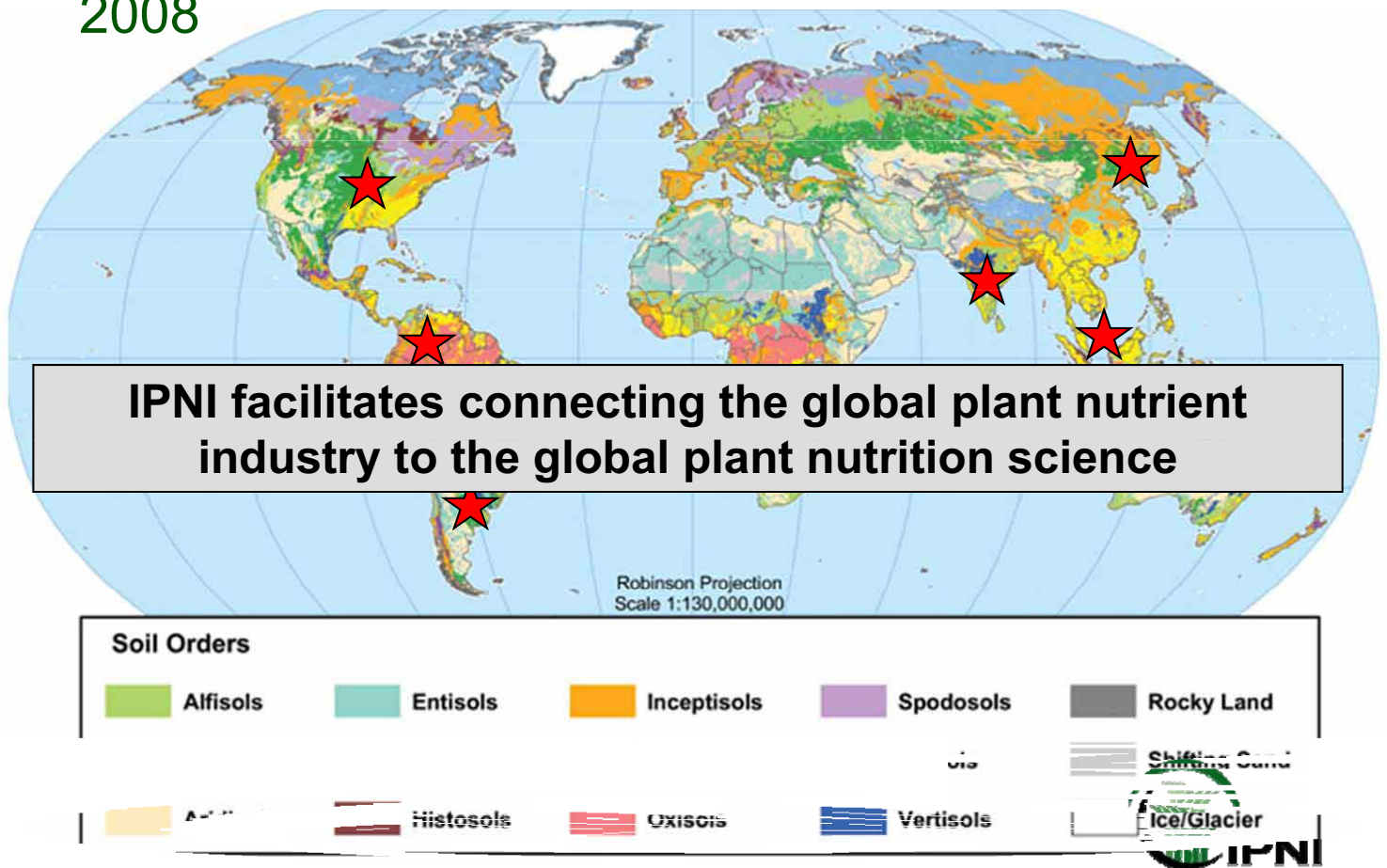
- IPNI involvement:

- Funding, Staff input on nutrient model development, and coordination of global field evaluation of model



El Maize Evaluation Locations

2008



Key research area ... Site Specific Nutrient Management (SSNM)



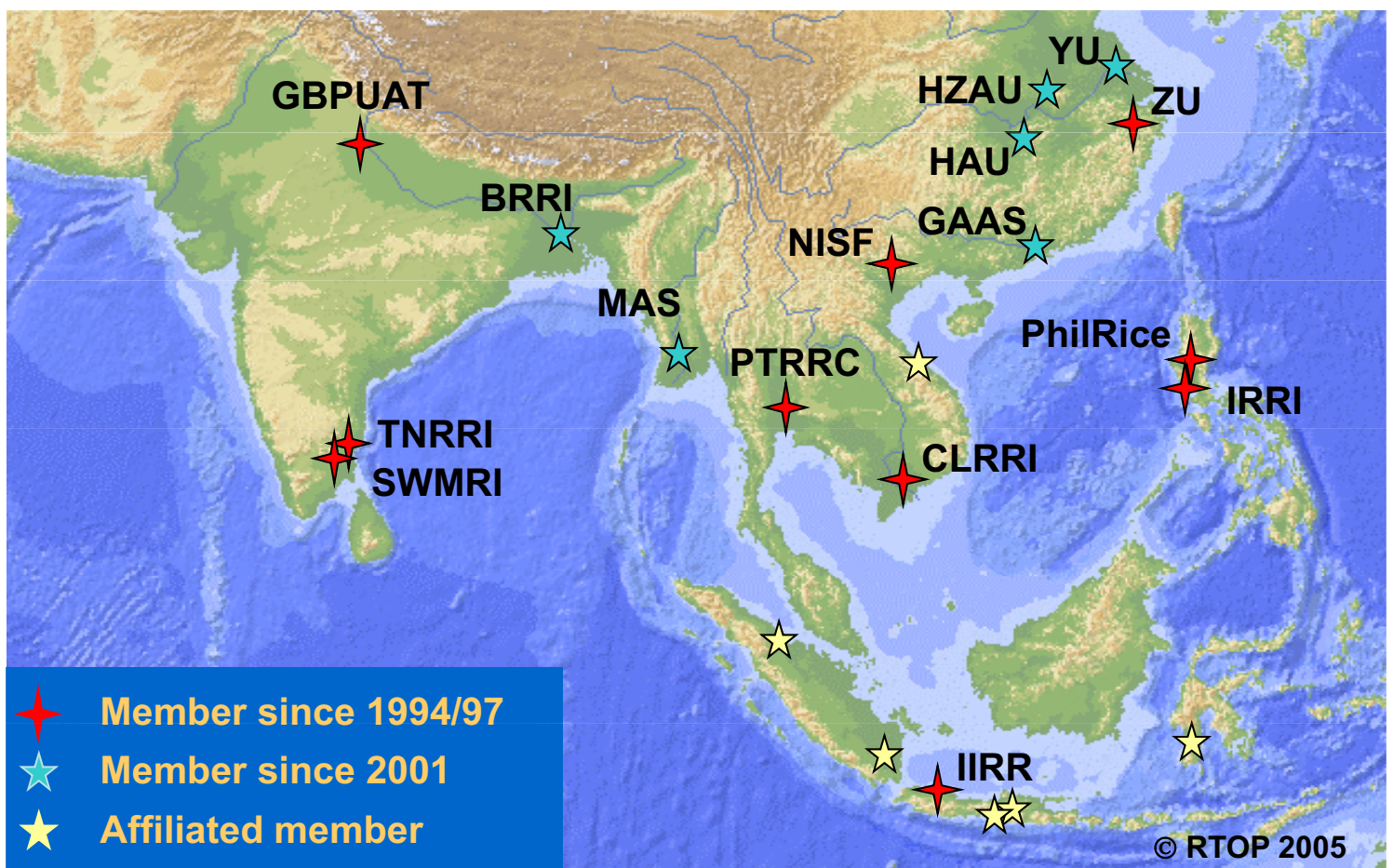
- SSNM ... different definitions
 - precision farming ... varying inputs within field
 - decision making for whole small fields



Irrigated Rice Research Consortium (IRRC) ... SSNM for Rice

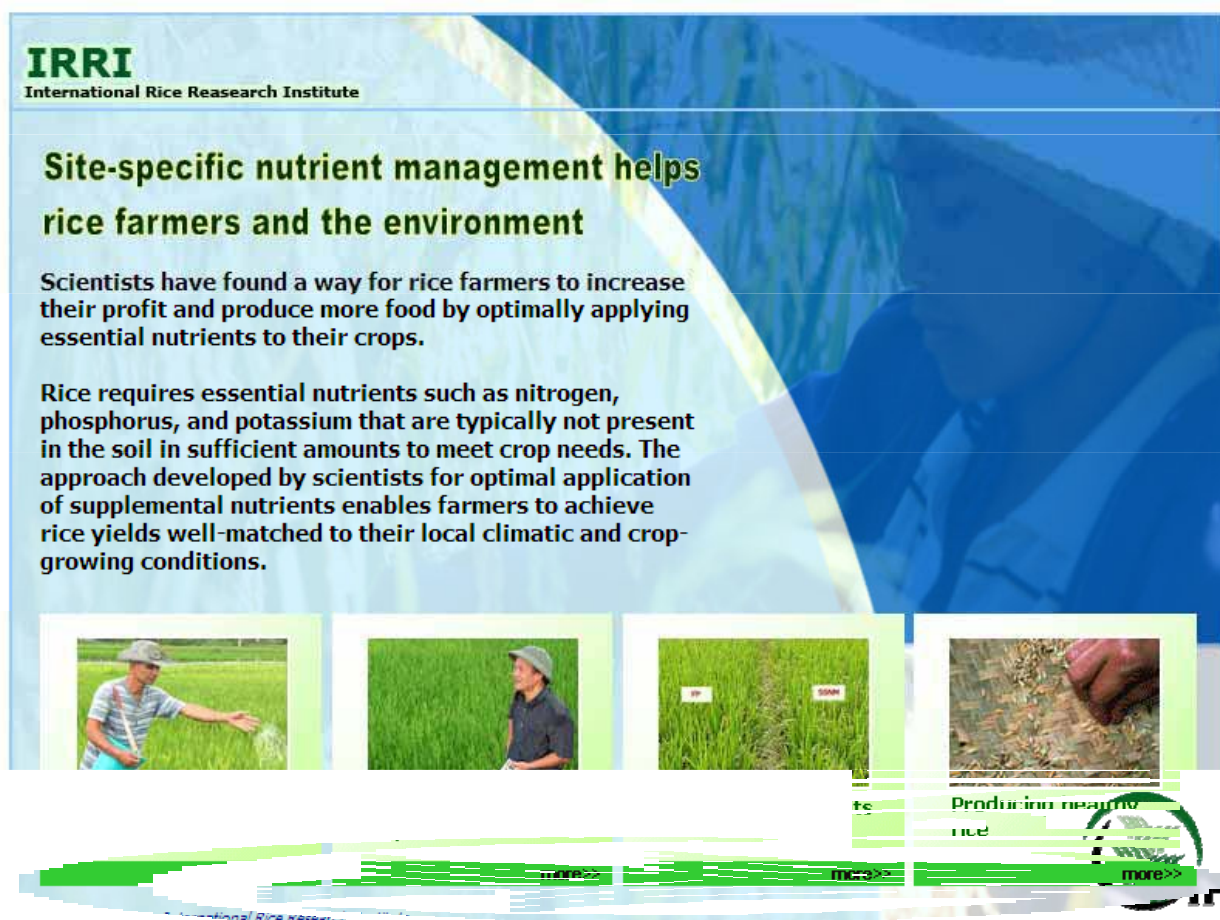


Collaborative effort funded by SDC, IFA, IPI, and IPNI and administered by the Irrigated Rice Research Institute (IRRI)



By-products of the IRRC:

<http://www.irri.org/irrc/ssnmrice/>






IRRI
International Rice Research Institute

Site-specific nutrient management helps rice farmers and the environment

Scientists have found a way for rice farmers to increase their profit and produce more food by optimally applying essential nutrients to their crops.

Rice requires essential nutrients such as nitrogen, phosphorus, and potassium that are typically not present in the soil in sufficient amounts to meet crop needs. The approach developed by scientists for optimal application of supplemental nutrients enables farmers to achieve rice yields well-matched to their local climatic and crop-growing conditions.



more>>>

Producing near maximum rice

more>>>

IPNI

A better match

SSNM provides a specific management for nitrogen, potassium, and phosphorus to optimize supply and demand of nutrients.

The guidelines are well-matched to growing conditions for effective use by farmers. They provide information on nutrient supply, fertilizer materials, and irrigation.

[Divers](#)

Tools for farmers

Among the tools developed for farmers is the leaf color chart (LCC) used to estimate leaf nitrogen content. The LCC is a plastic ruler-shaped strip containing four or more panels ranging in color from yellowish green to dark green.

Farmers adjust their rates and timing of nitrogen fertilizer based on the color of rice leaves. Dark green leaves indicate little or no immediate need for nitrogen. Yellowish green leaves indicate a relatively higher and urgent need of the crop for nitrogen fertilizer.

[The right practice at the right time](#)[Ensuring the best for farmers](#)

Determining the need for nitrogen fertilizer using the LCC

Image: International Rice Research Institute



SSNM for Maize



Site-specific nutrient management in maize

Indonesia

IAARD, ICFORD,
AIAT, SEAP, UN

Vietnam

NISF, WASI, IAS,
Cantho University,
CLRRI, SEAP

Philippines

UPLB Corn RDE
network, PhilRice,
DA, SEAP

★ 2004-2007

★ 2005-2007

★ 2005-2007



Leaf Color Chart from rice being adapted to corn

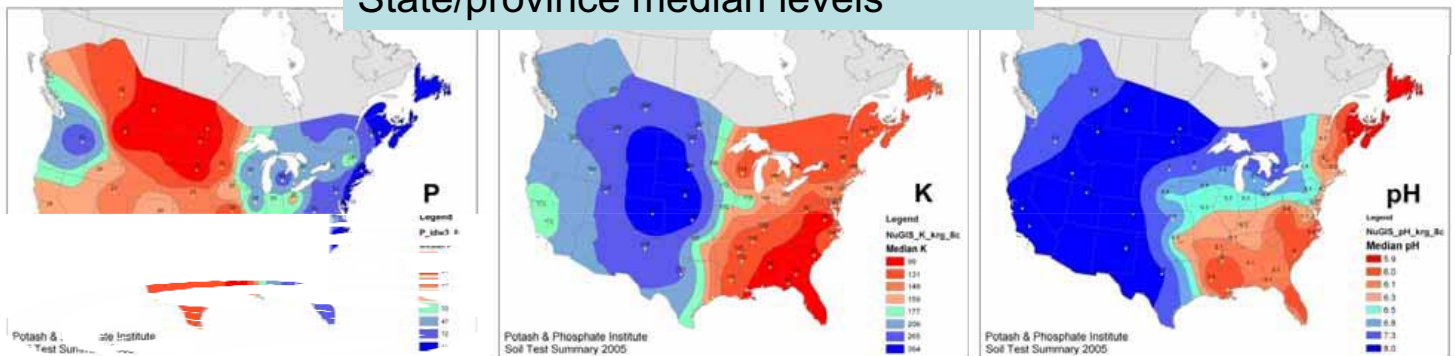


Key Research area ... soil testing and fertilizer recommendations

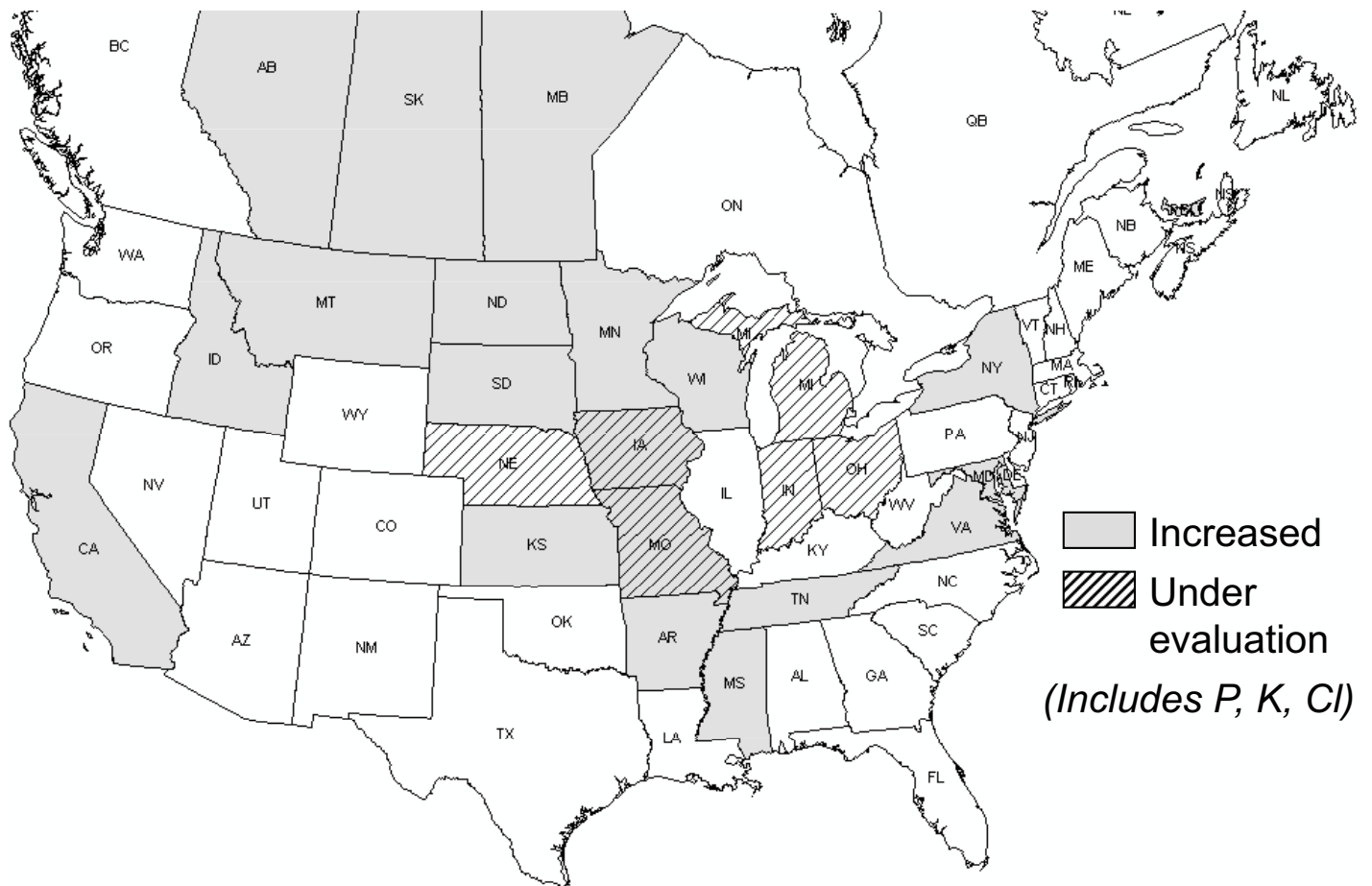
Soil test summaries:

- Most intensive effort currently in North America, where surveys are conducted every 4 years
- Most recent for the 2005 crop year
 - 3.4 million soil samples and involved 70 labs

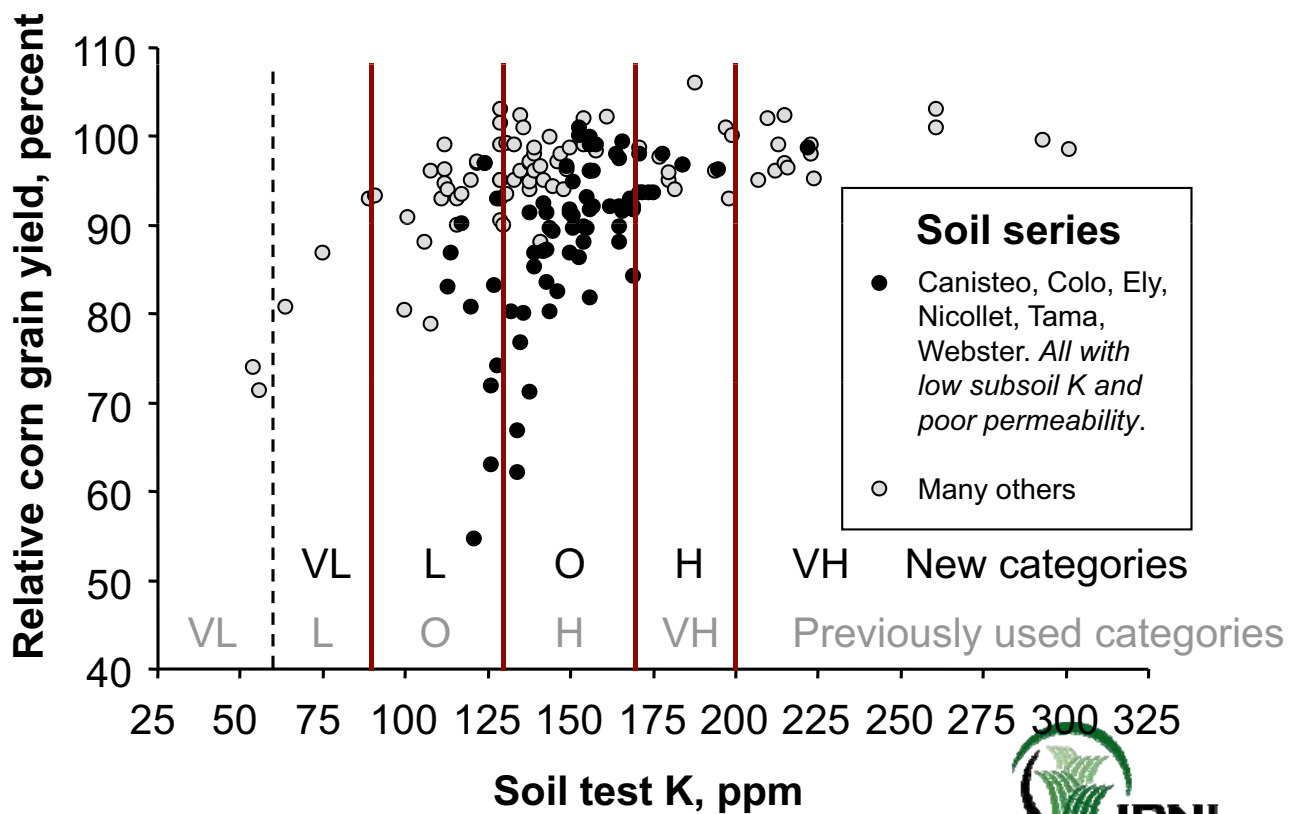
State/province median levels



IPNI/FAR research affects P/K recommendations



Recent soil test calibration data: Iowa State Univ.



Mallarino et al., 2003

Recommendation Changes in Iowa

Soil test category	% of IA soils*	
	Old	New
Very low	3	12
Low	9	24
Optimum (Medium)	24 36	24 60
High	24	13
Very high	40	27

Number in red is % medium or below.

K recommended
or used in Iowa
(1000 tons K₂O)

Old recs 260
2001-2 use 440
New recs 572 (30% incr)
2004 use 606 (39% incr)

- Recommendations doubled because of new calibration
- Farmers responded to the change



Trends in N Recommendations ... Decoupling of rate recommendations and crop yield

IOWA STATE UNIVERSITY
Agronomy Extension

Iowa State University
ISU College of Agriculture
ISU Agronomy Department
ISU Extension

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Corn Nitrogen Rate Calculator

Finding the Maximum Return To N and Most Profitable N Rate
A Regional (Corn Belt) Approach to Nitrogen Rate Guidelines

This web site provides a process to calculate economic return to N application with different nitrogen and corn prices and to find profitable N rates directly from recent N rate research data. The method used follows a newly developed regional approach for determining corn N rate guidelines that is being implemented in several Corn Belt states.

[Regional Corn N Rate Publication](#)

Single Price RatioMultiple Price Ratios

Choose state

Iowa
Illinois - North
Illinois - Central
Illinois - South
Minnesota
Wisconsin - V1/H1YP Soils
Wisconsin - M/LYP Soils
Wisconsin - Irr. Sands

Choose rotation pattern(s)

☒ Corn following soybean
☐ Corn following corn

☐ Include non-responsive sites

Set corn and nitrogen prices


Anhydrous Ammonia (82% N)360.80 (\$/Ton)

Nitrogen price0.22 (\$/lb N)

Calculator Results

How to Use

Master



SSNM ... *Indian Approach*

- **Developing SSNM fertilizer prescriptions for Maximum Economic Yield (MEY) of crops based on:**
 - **Soil testing to establish background nutrient levels available for the crop**
 - **Nutrient removal using a realistic target yield**
 - **Balanced and adequate fertilization for a target yield**



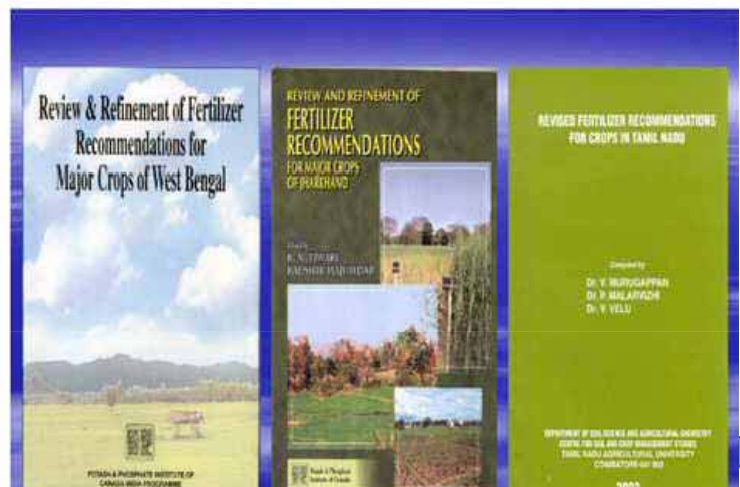
SSNM helped maximizing productivity of Rice and Wheat under RWCS (t/ha)

Site	FP	SR	SSNM	SSNM % Increase over FP	SSNM % increase over SR
Ludhiana	15.86	15.95	16.96	6.94	6.33
Modipuram	11.80	11.99	16.46	39.49	37.28
Kanpur	10.98	13.24	14.35	30.69	8.38
Sabour	9.37	11.40	14.18	51.33	24.39
SR= State recommendation, FP= Farmers practice					



IPNI research has changed official fertilizer recommendations in 6 states

- This represents an additional potential consumption of **0.82 M t N**, **0.84 M t of P_2O_5** and **0.89 M t of K_2O** .
 - currently working with officials in the States of Maharashtra, Kerala, Uttaranchal, Haryana, Himachal Pradesh and Assam to revise recommendations.



Other key research areas

- Fertilizer best management practices
- Nutrient and Asian Rust interactions
- Basic research in P and K

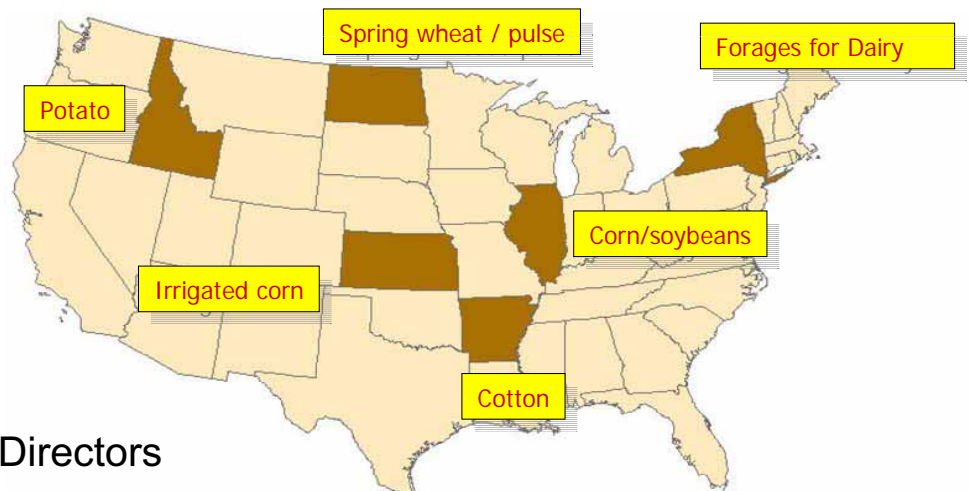




BMP Project

NRCS Conservation Innovation Grant

- ***BMPs for Fertilizer Management***
- ***2005--3yr project funded @ \$482,000***
- ***6 cropping systems in 6 states***

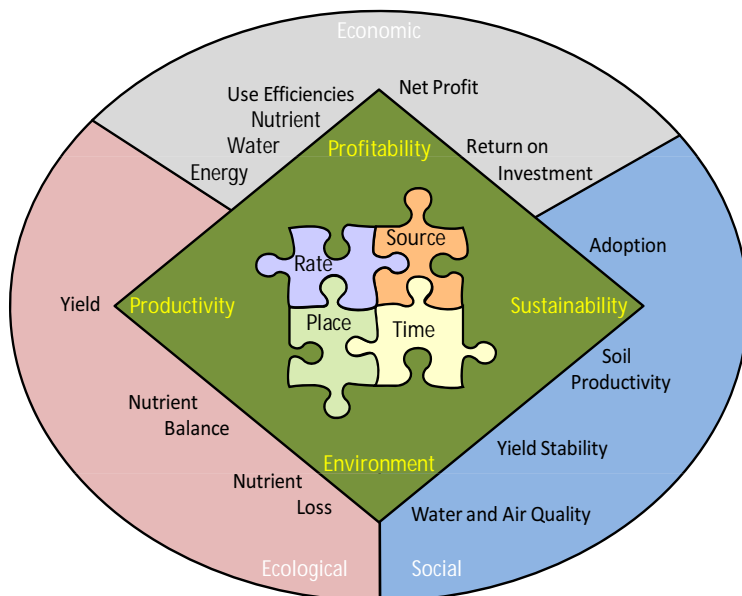


- Lead by IPNI Regional Directors
 - Developed straw-man BMP Guides for each system
- Stakeholder teams in each region
- Train-the-trainer sessions for NRCS, Extension, CCAs, etc.
- Developments featured in InfoAg 2007
- On-line delivery of BMP Guides and training materials (2008)

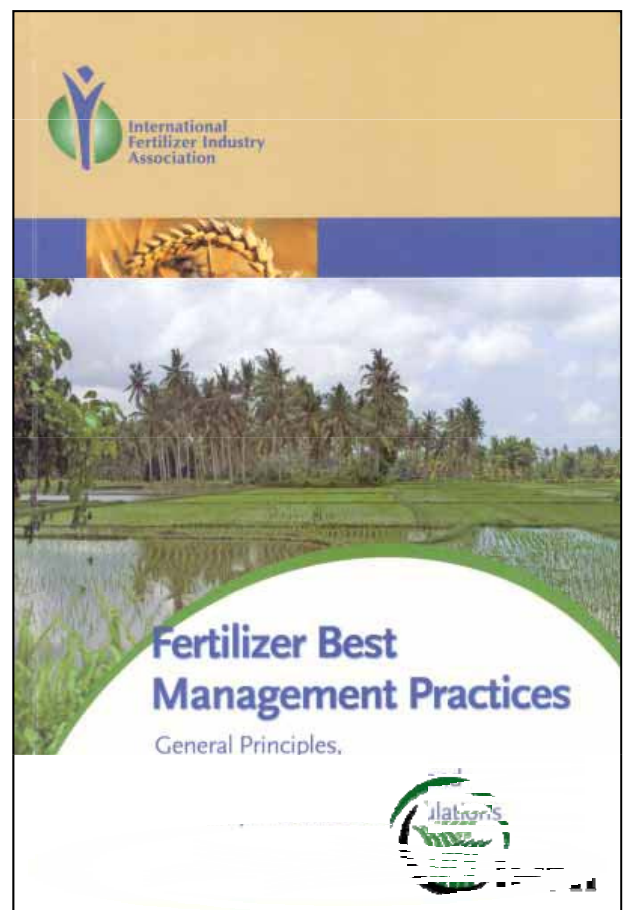


BMP research supports global efforts of IFA to define a strategy for adoptions of FBMPs

- Global framework for fertilizer BMPs



Source: IPNI Task Force

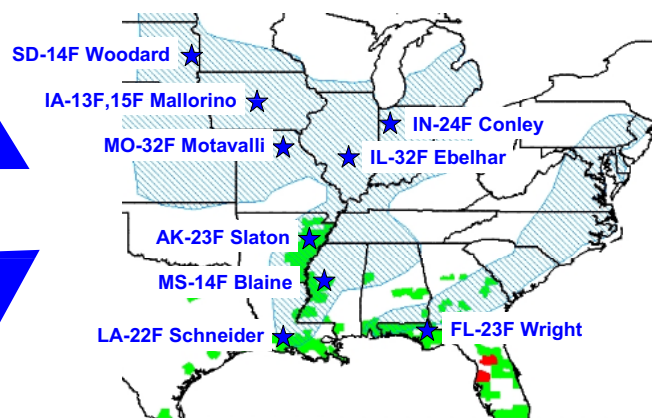


Nutrients and plant health (U.S. and Brazil)

**Asian Soybean Rust ...
arrival in U.S. late in 2004**



**2007 is third year of studies on
nutrients and soybean plant health**



**Brazil program/U. of Hohenheim:
Glyphosate may increase
susceptibility to pathogens**

**Will RR beans be more susceptible ?
Are responses to P, K, Cl, and micros
affected ?**



P and K Fellowship Programs

K Fellowship

Purdue University

Supporters: Mosaic;
PotashCorp

P Fellowship

Kansas State University

Supporters:
Agrium, Mosaic, PotashCorp, S
implot

- Provide long-term (10 yr) significant support to selected universities
 - Establish “centers of excellence for P and K research”
- Objective to train graduate students in the:
 - Beneficial role of P and K in food production
 - Realities of the farm and the fertilizer industry
- IPNI Role – convener the meetings re: project direction



Challenges facing the fertilizer industry

- The industry needs to be able to defend and justify the use of fertilizer nutrients.
- Environmental concerns and agronomic problems are of major concern of the global fertilizer industry ...it is difficult to separate environmental from agronomic issues



Challenges facing the fertilizer industry

- If we cannot show through scientific means that fertilizer nutrients are needed, how to use them properly, and how to use them more efficiently, the industry will never be able to defeat unfounded environmental accusations and protect nutrient use from inappropriate regulations.





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