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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- Lack of, or out-of-date fertilizer recommendations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

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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.

- 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.

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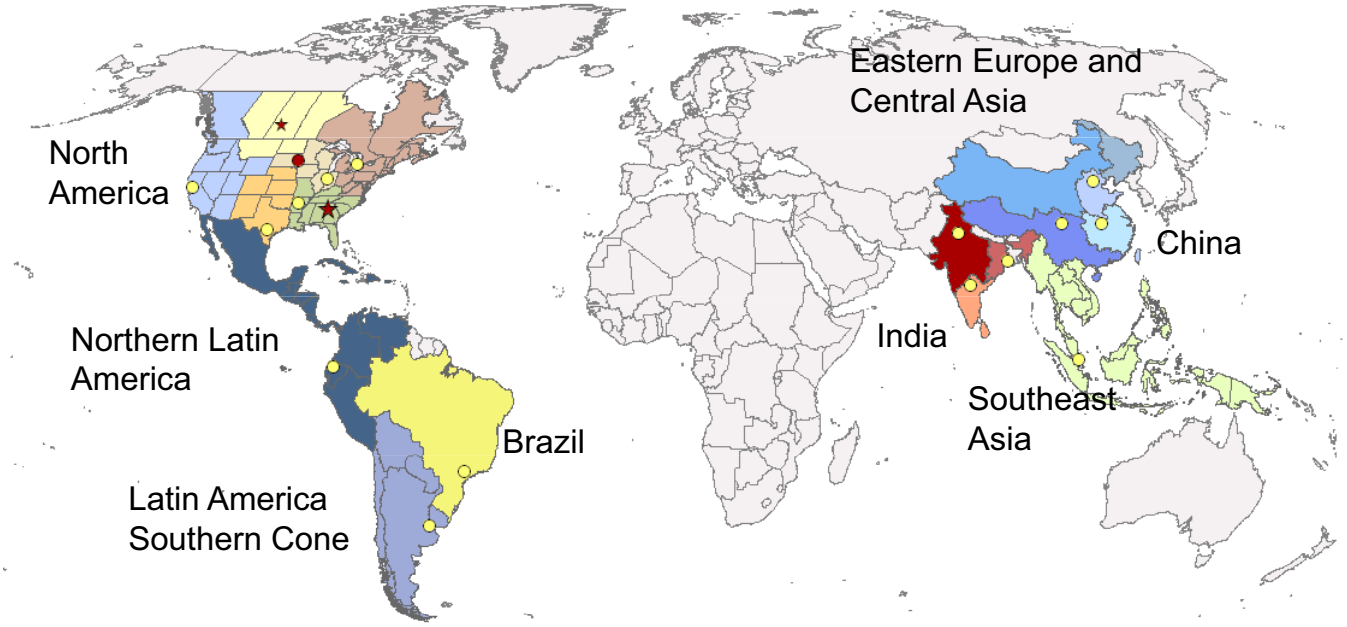
April 2007 Ref#

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

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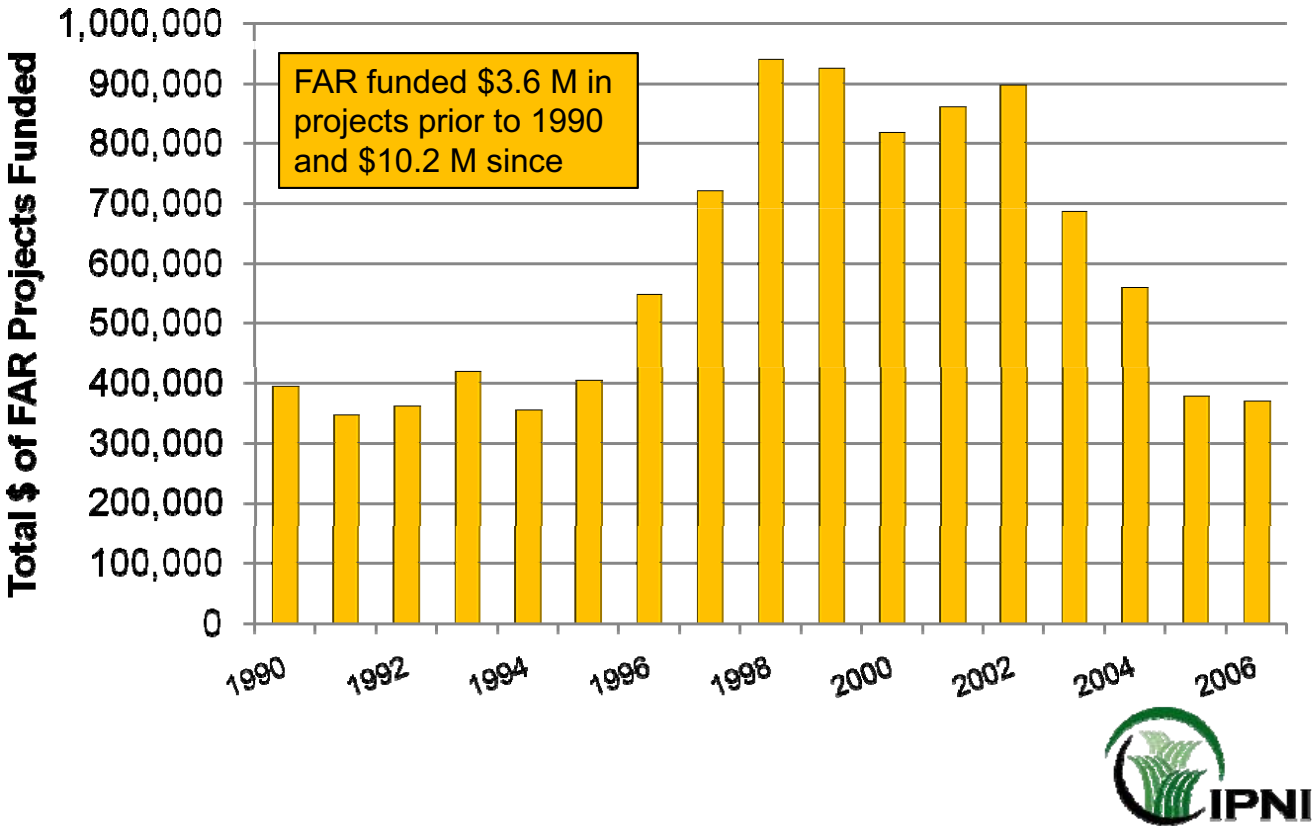
How do we accomplish this?

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

History of Project Funding by FAR



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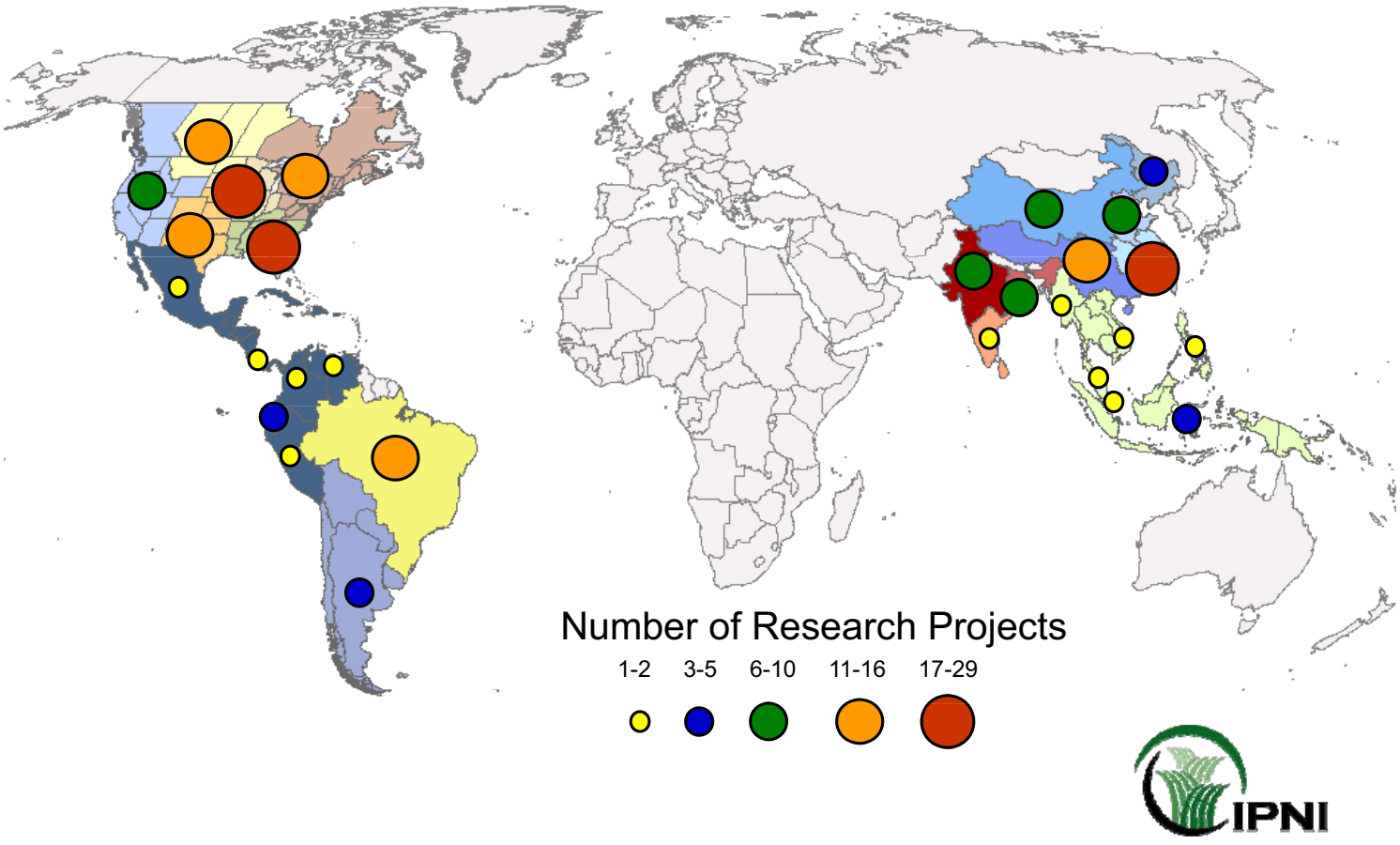
2007 Research Projects - 219



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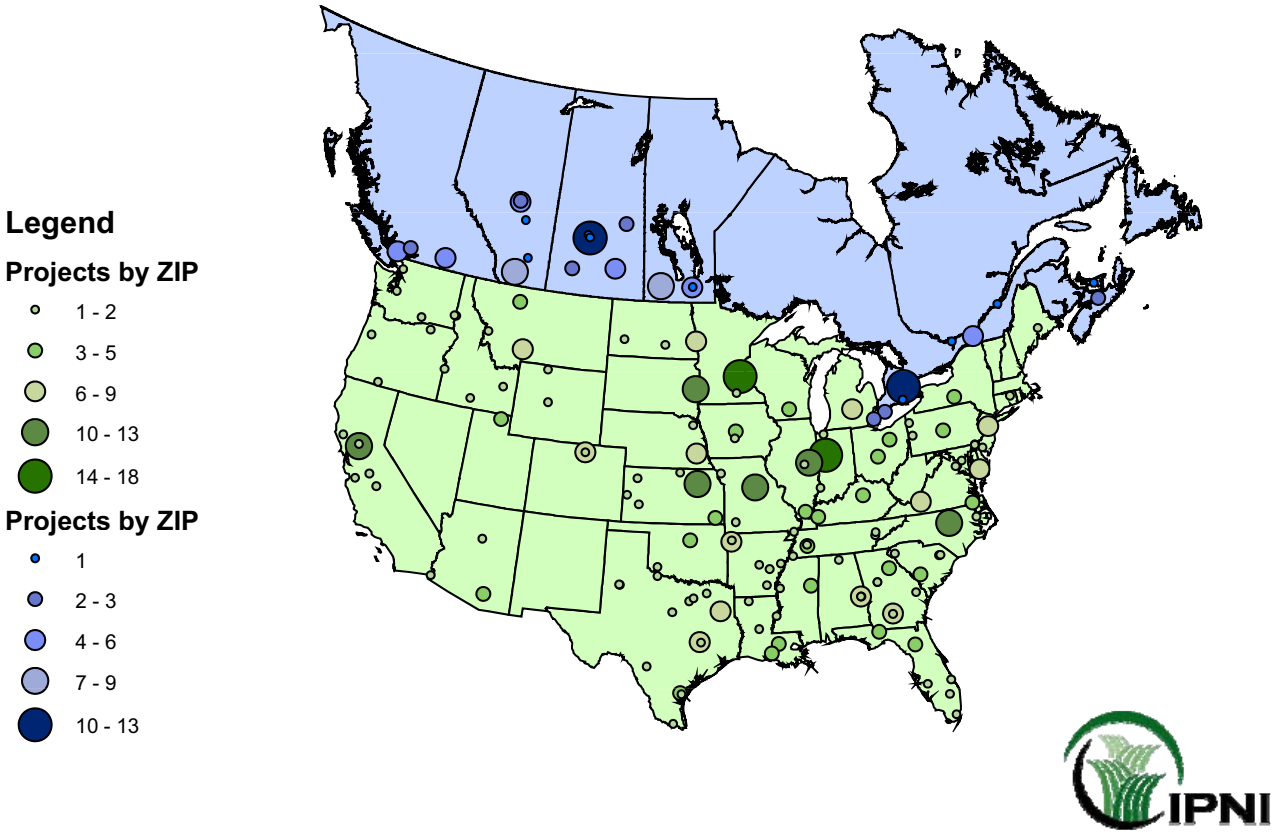
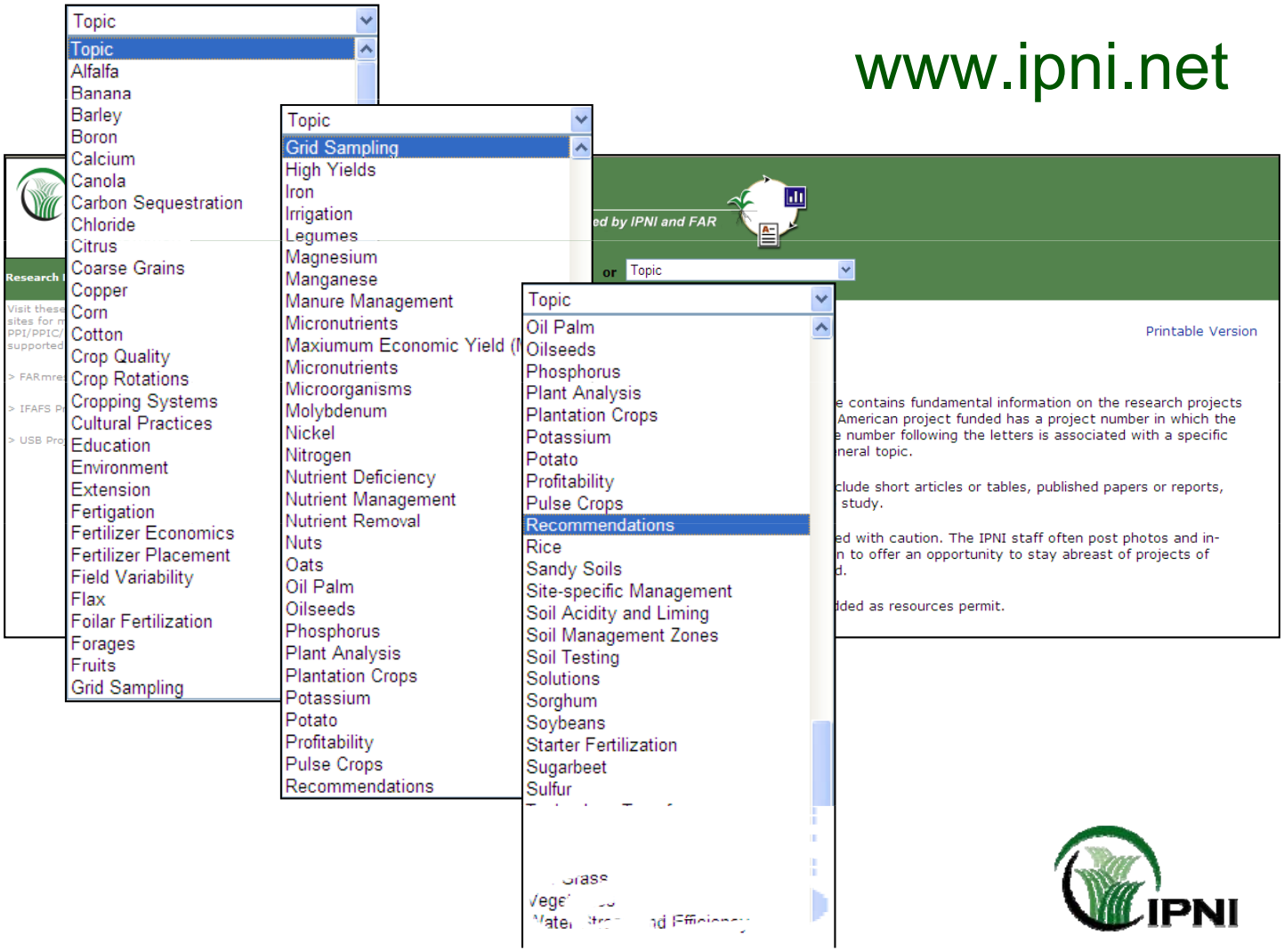
North American Research Projects





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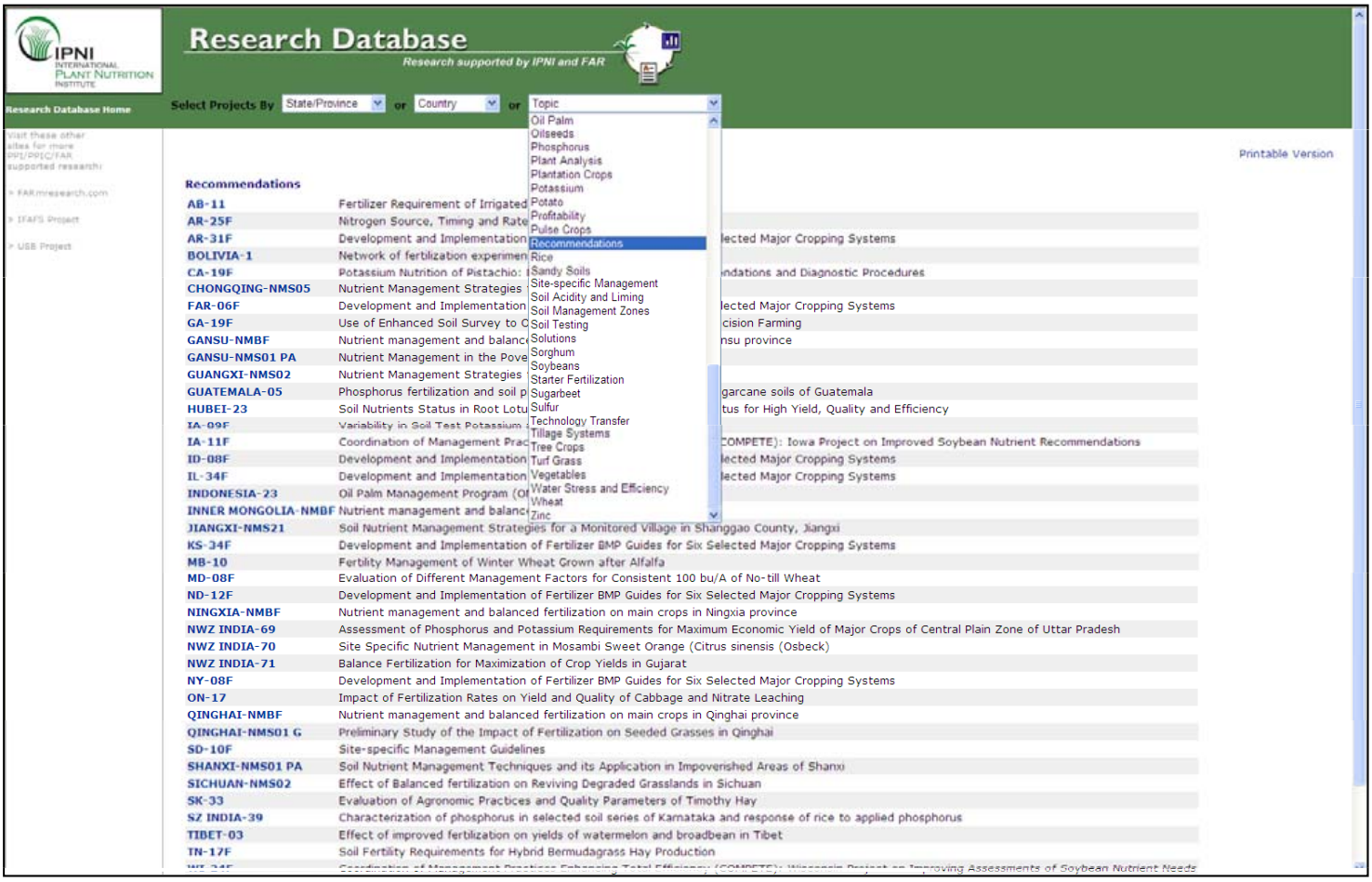
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Research Database
Research supported by IPNI and FAR
Research Database Home
Select Projects By
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Country
or
Topic
Oil Palm
Oilseeds
Phosphorus
Plant Analysis
Plantation Crops
Potassium
Potato
Profitability
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
Technology Transfer
Tillage Systems
Tree Crops
Turf Grass
Vegetables
Water Stress and Efficiency
Wheat
Zinc
Printable Version
Recommendations
AB-11 Fertilizer Requirement of Irrigated
AR-25F Nitrogen Source, Timing and Rate
AR-31F Development and Implementation lected Major Cropping Systems
BOLIVIA-1 Network of fertilization experimen
CA-19F Potassium Nutrition of Pistachio: ndations and Diagnostic Procedures
CHONGQING-NMS05 Nutrient Management Strategies
FAR-06F Development and Implementation lected Major Cropping Systems
GA-19F Use of Enhanced Soil Survey to C cision Farming
GANSU-NMBF Nutrient management and balanc nsu province
GANSU-NMS01 PA Nutrient Management in the Pove
GUANGXI-NMS02 Nutrient Management Strategies
GUATEMALA-05 Phosphorus fertilization and soil p garcane soils of Guatemala
HUBEI-23 Soil Nutrients Status in Root Lotu tus for High Yield, Quality and Efficiency
IA-09F Variability in Soil Test Potassium
IA-11F Coordination of Management Prac COMPETE): Iowa Project on Improved Soybean Nutrient Recommendations
ID-08F Development and Implementation lected Major Cropping Systems
IL-34F Development and Implementation lected Major Cropping Systems
INDONESIA-23 Oil Palm Management Program (Ot
INNER MONGOLIA-NMBF Nutrient management and balanc
JIANGXI-NMS21 Soil Nutrient Management Strategies for a Monitored Village in Shanggao 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


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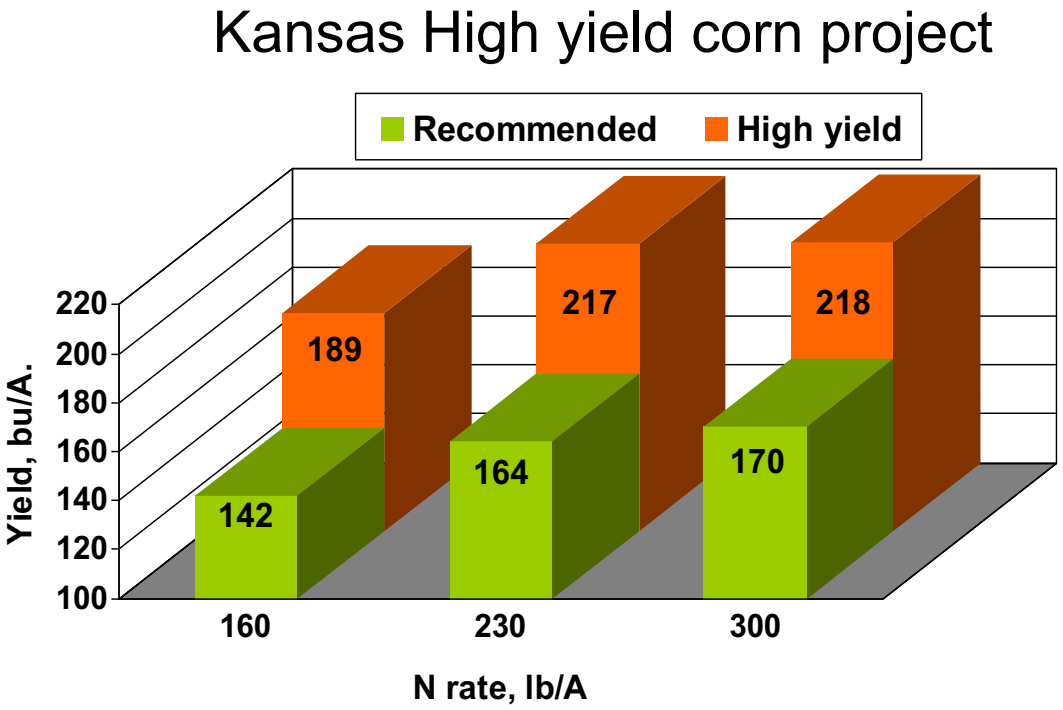
Key research area: maximum yield research …



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

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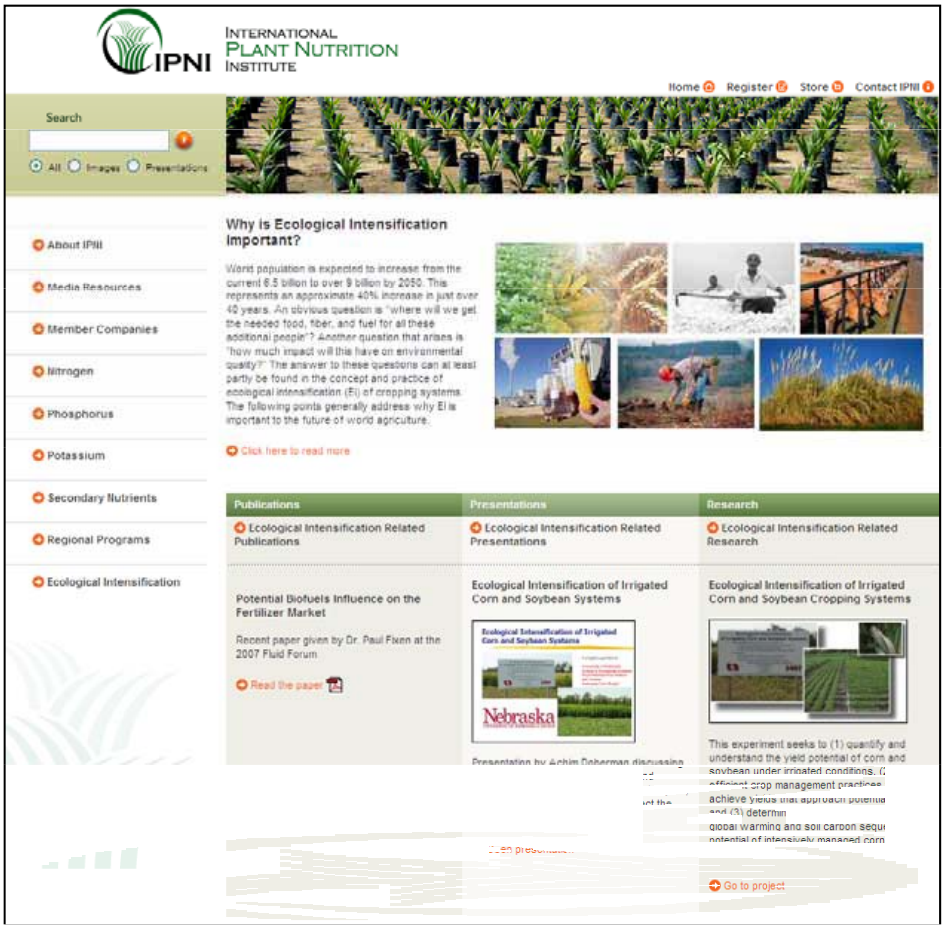
Key research area: maximum yield research … Ecological Intensification



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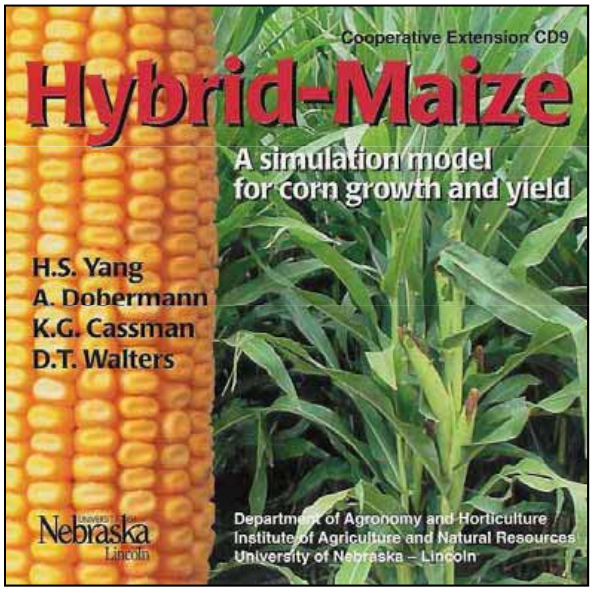
University Nebraska (UNL) Ecological Intensification study

- 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



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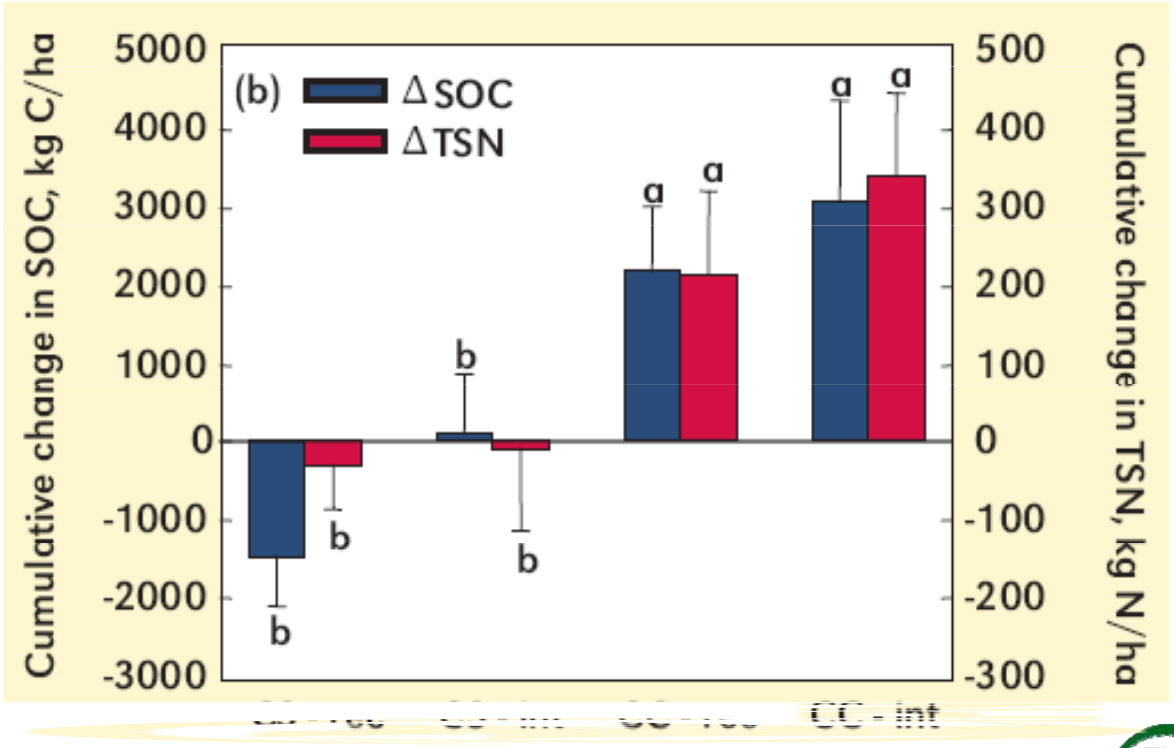
UNL EI project
Change in soil C and N after 4 years



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_2O[3]		320	570	250	340
Soil CH_4[3]		-30	-30	-20	-10
GWP[4]		540	840	1,020	1,020

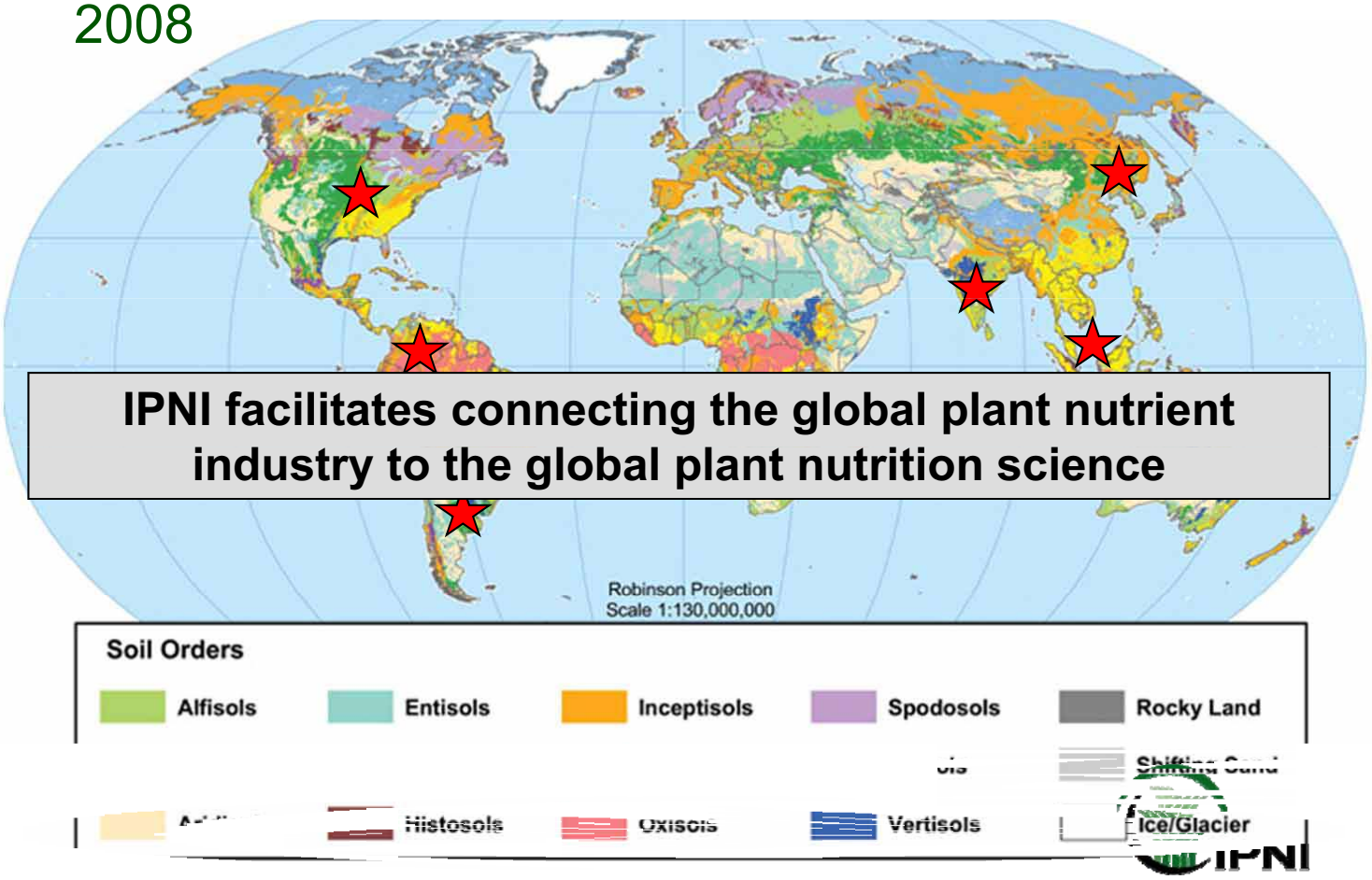
systems: v… …of two corn crops (2003-2004) and one soybean crop (2005).

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

EI Maize Evaluation Locations

2008



IPNI facilitates connecting the global plant nutrient industry to the global plant nutrition science

Key research area … Site Specific Nutrient Management (SSNM)

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

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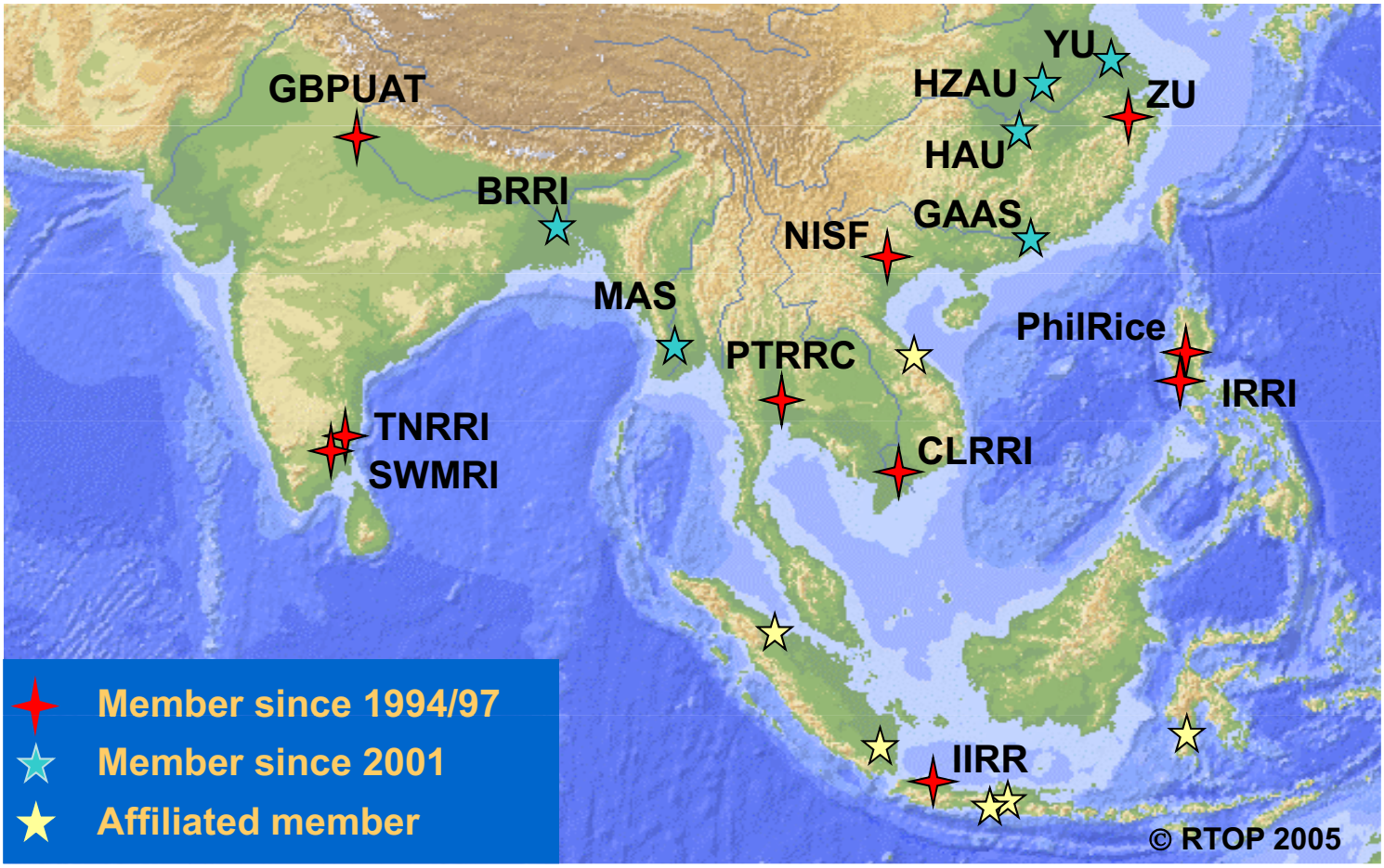
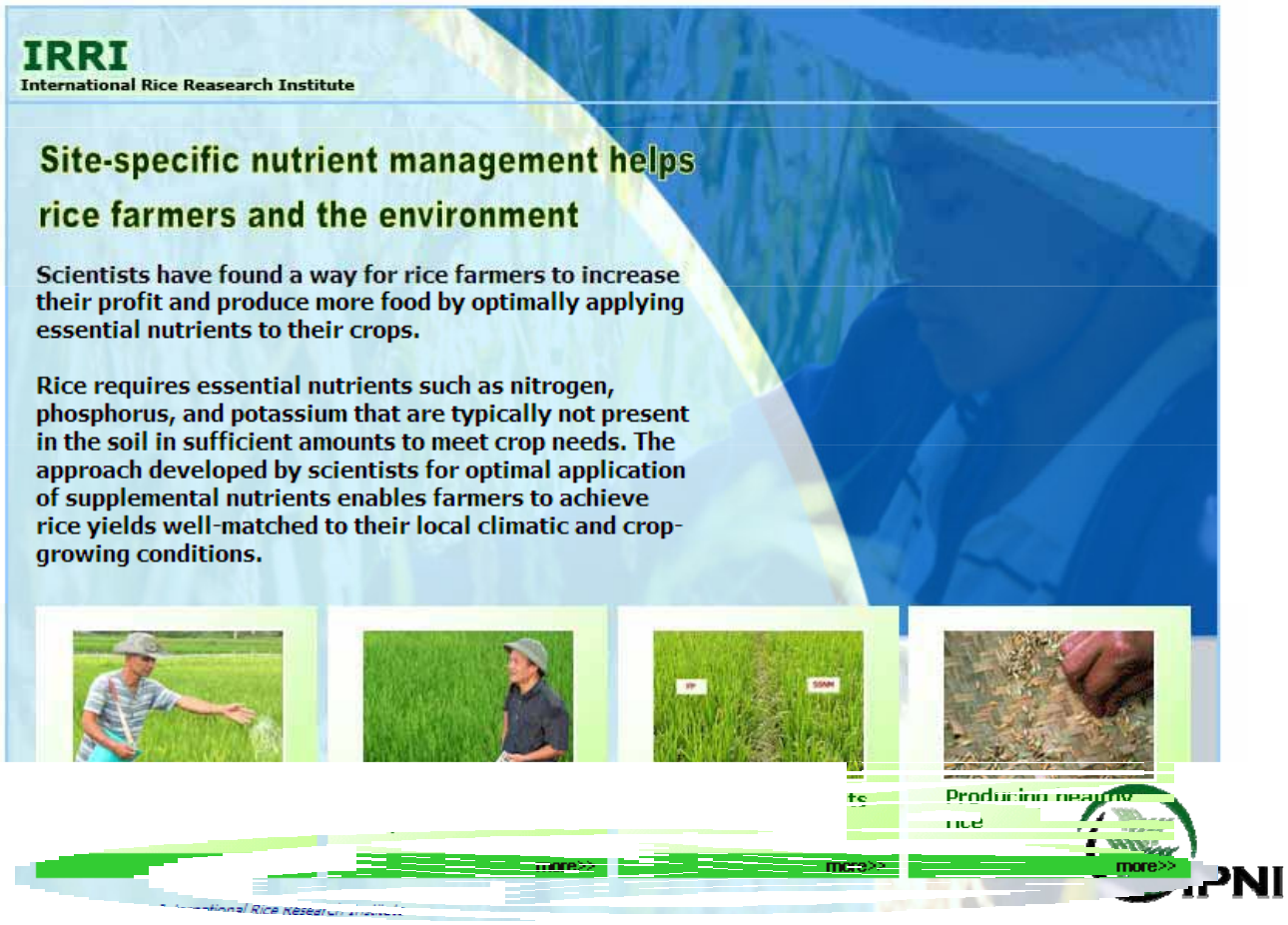
Irrigated Rice Research Consortium (IRRC) … SSNM for Rice

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 Reasearch Institute

Home | Presenting improved management for rice | Developing a new approach | Widespread benefits | Producing healthy rice

A better match

SSNM provides g
specific manage
potassium, and c
optimize supply
nutrients.

The guidelines e
well-matched to
growing conditio
effective use by
nutrients supplie
materials, and ir

Divers

IRRI
International Rice Reasearch Institute

Home | Presenting improved management for rice | Developing a new approach | Widespread benefits | Producing healthy rice

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.

Determining the need for nitrogen fertilizer using the LCC

Image: International Rice Research Institute

The right practice at the right time | Ensuring the best for farmers

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

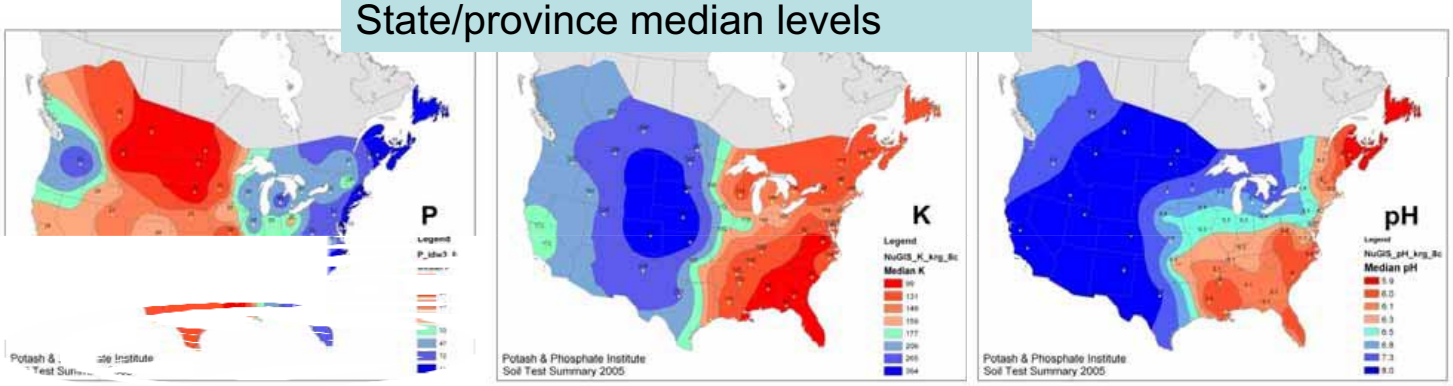
Leaf Color Chart from rice being adapted to corn

Key Research area … soil testing and fertilizer recommendations

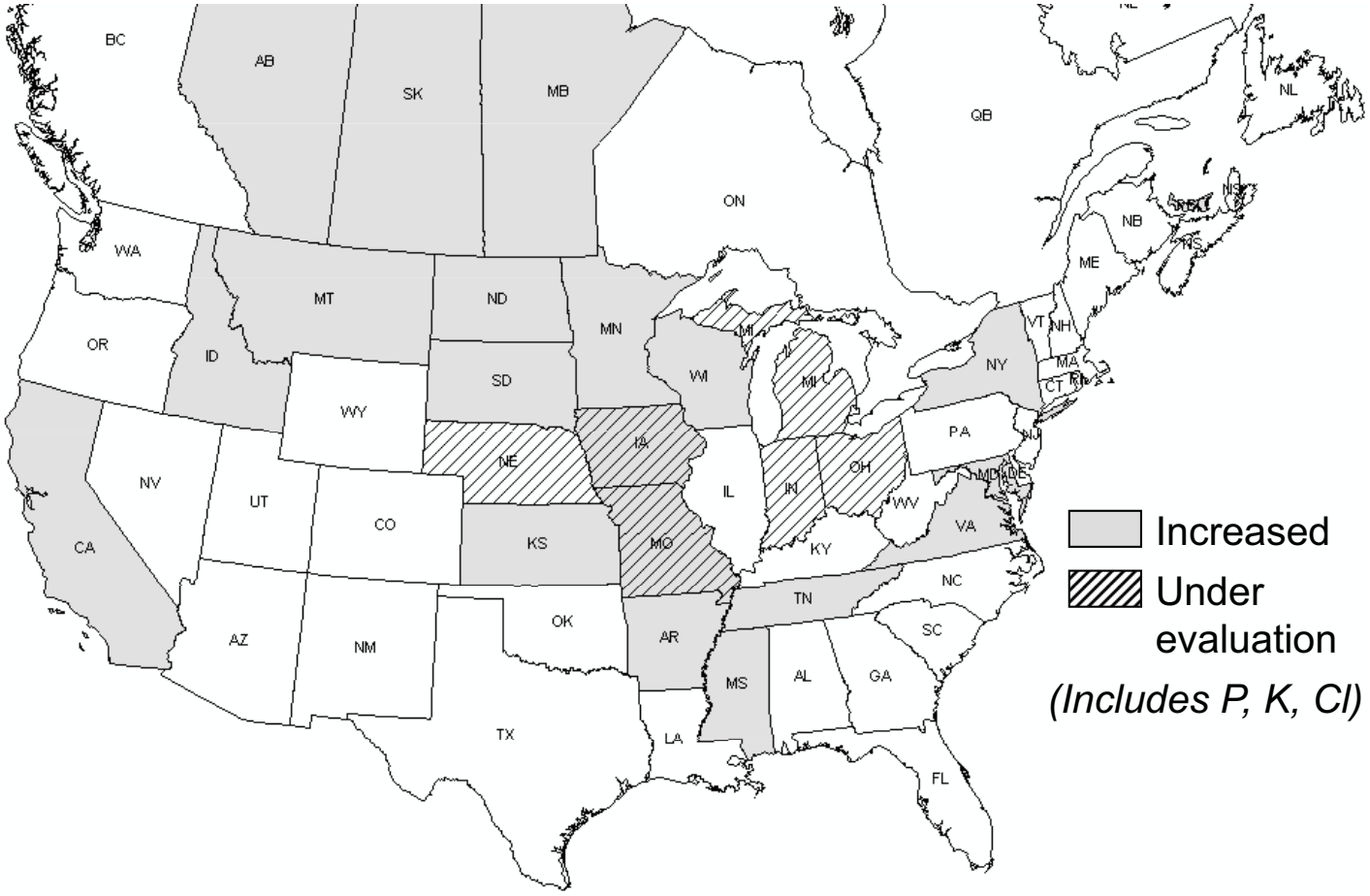
Soil test summaries:

- 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

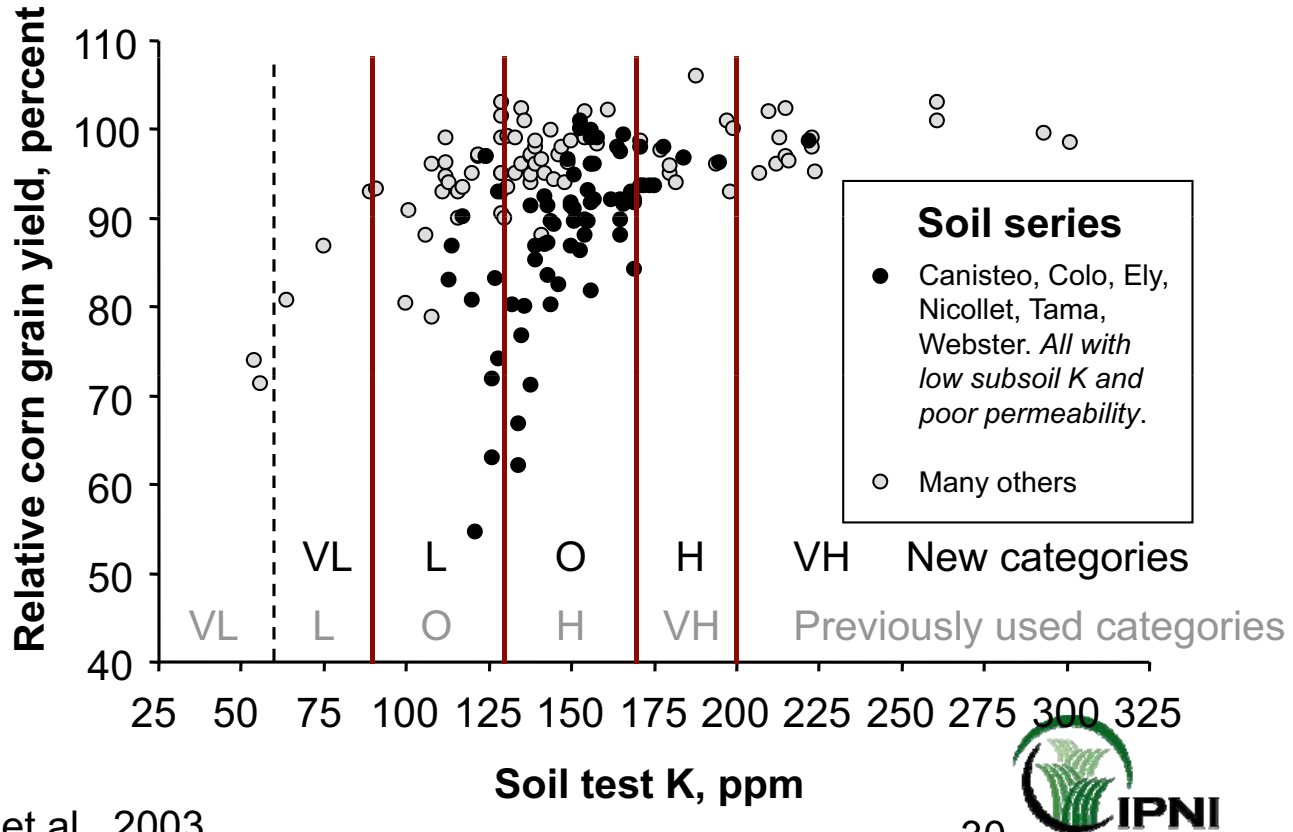
State/province median levels



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.

Mallarino et al., 2002

K recommended or used in Iowa (1000 tons K_2O)

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

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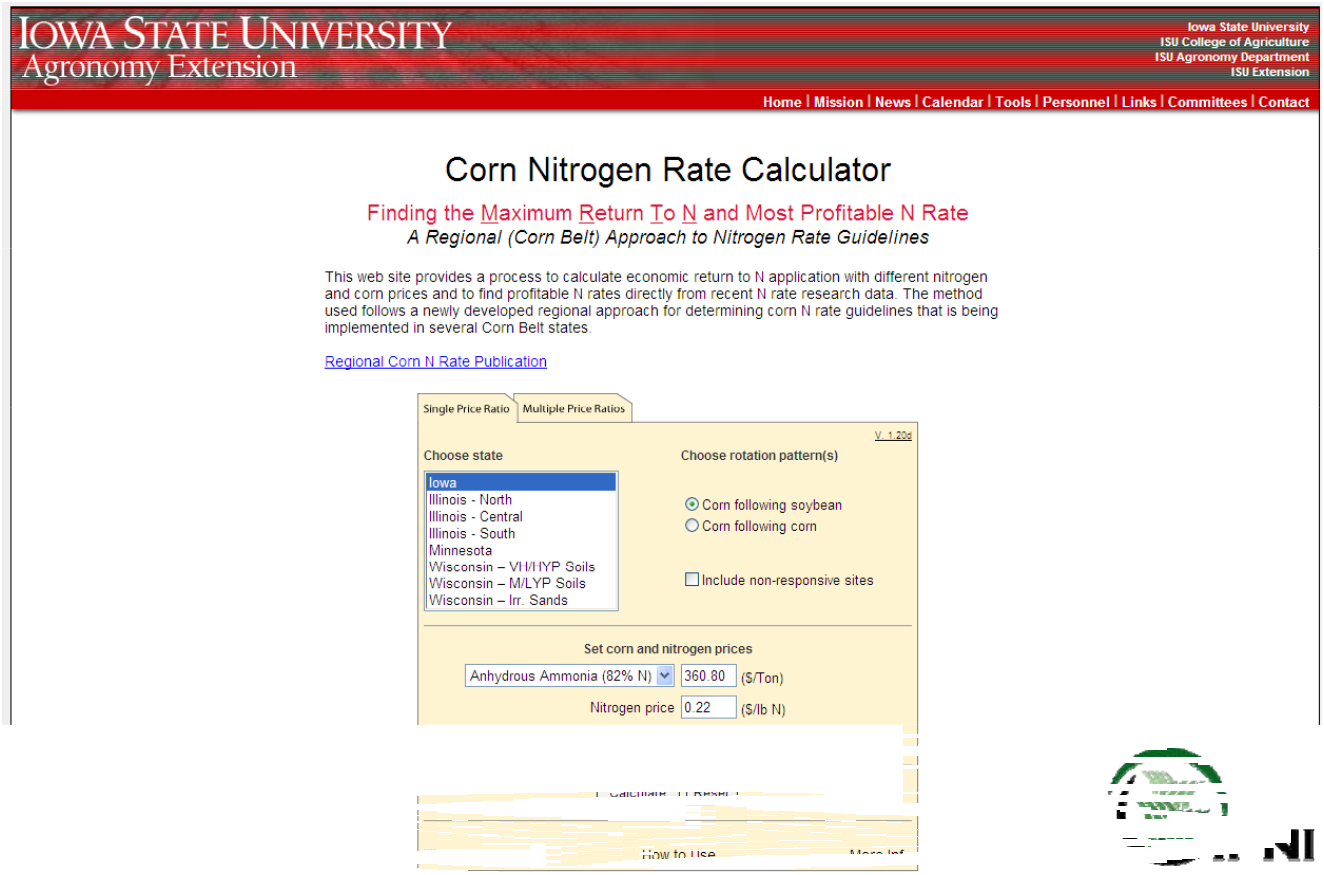
Trends in N Recommendations … Decoupling of rate recommendations and crop yield



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**

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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					

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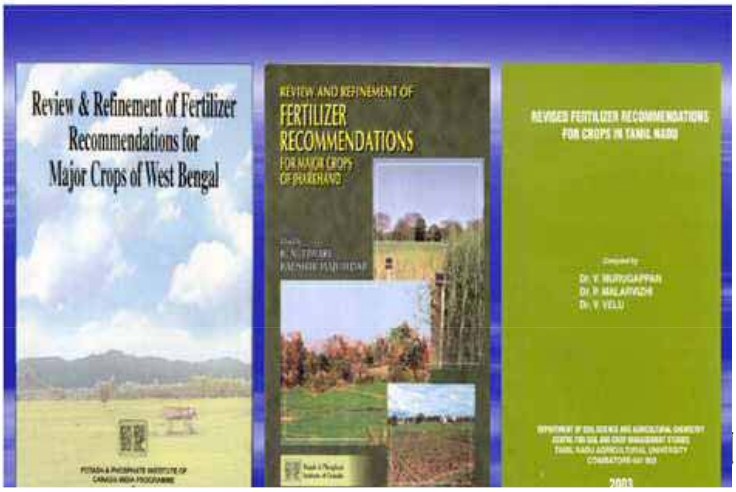
IPNI research has changed official fertilizer recommendations in 6 states

- 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.



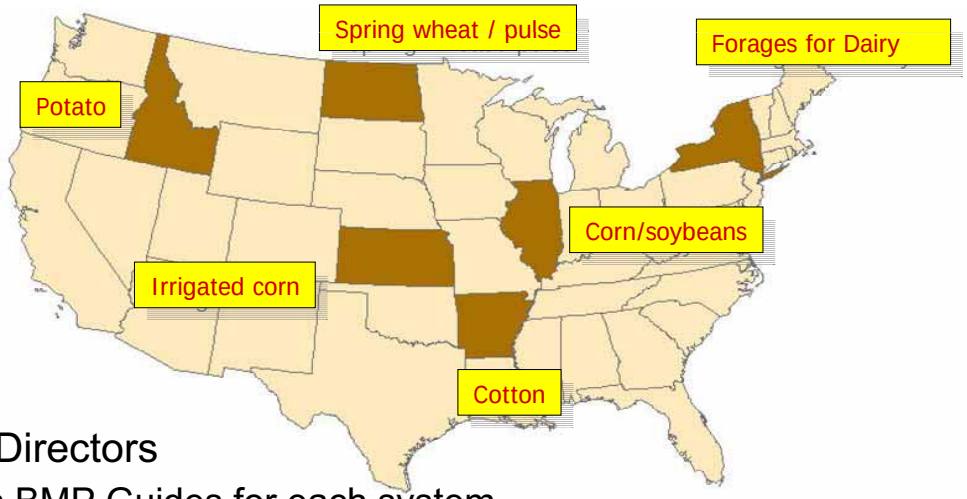
Other key research areas

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

BMP Project

NRCS Conservation Innovation Grant

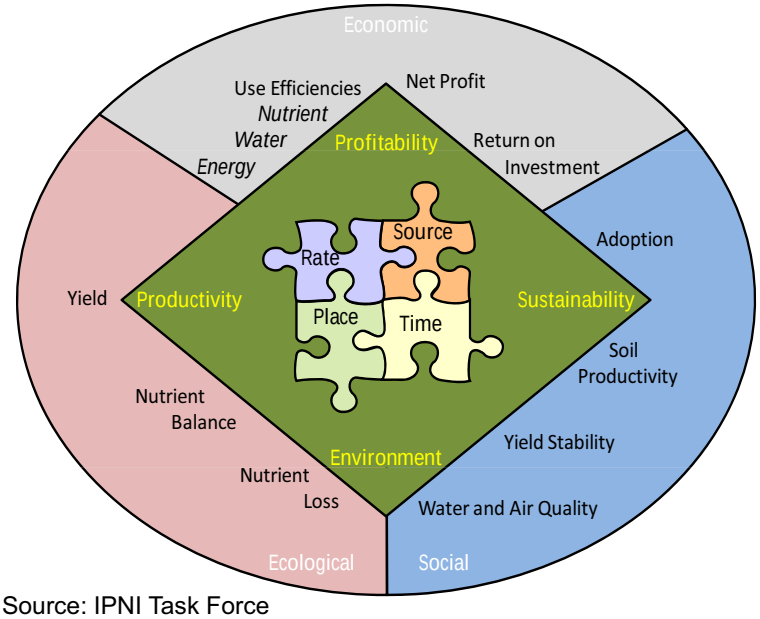
- ***BMPs for Fertilizer Management***
- ***2005--3yr project funded @ $482,000***
- ***6 cropping systems in 6 states***



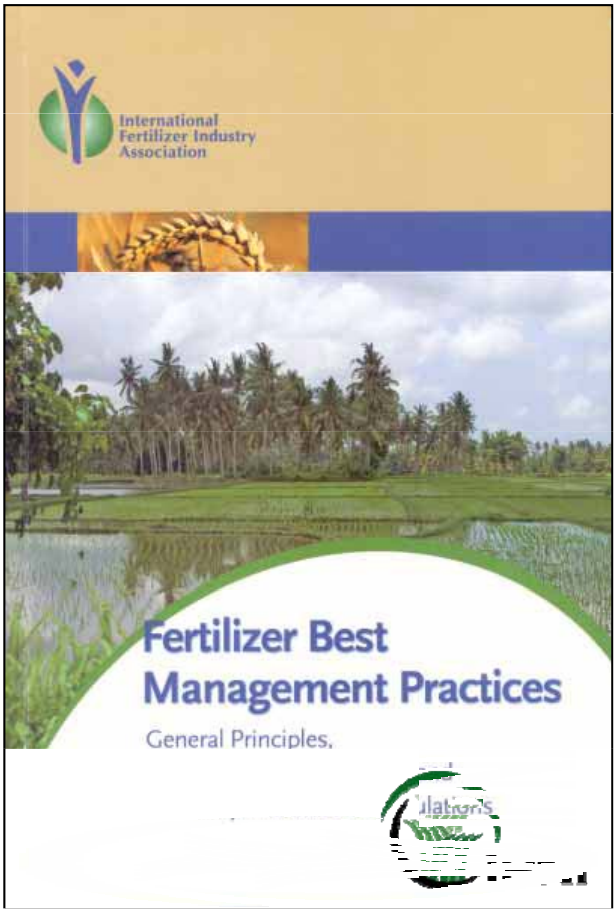
- Lead by IPNI Regional Directors
  - Developed straw-man BMP Guides for each system
- Stakeholder teams in each region
- Train-the-trainer sessions for NRCS, Extension, CCAs, etc.
- Developments featured in InfoAg 2007
- On-line delivery of BMP Guides and training materials (2008)

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

- Global framework for fertilizer BMPs



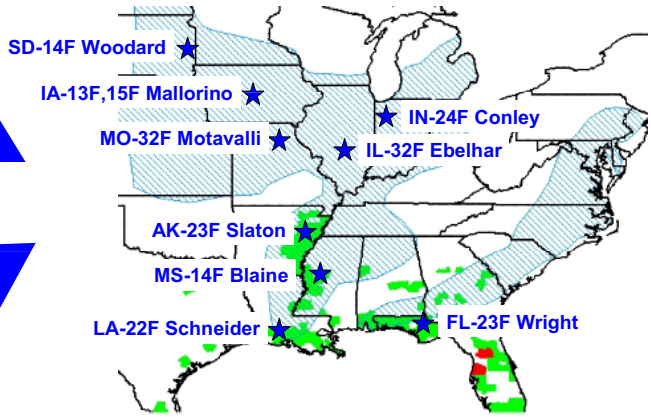
Source: IPNI Task Force



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 ?

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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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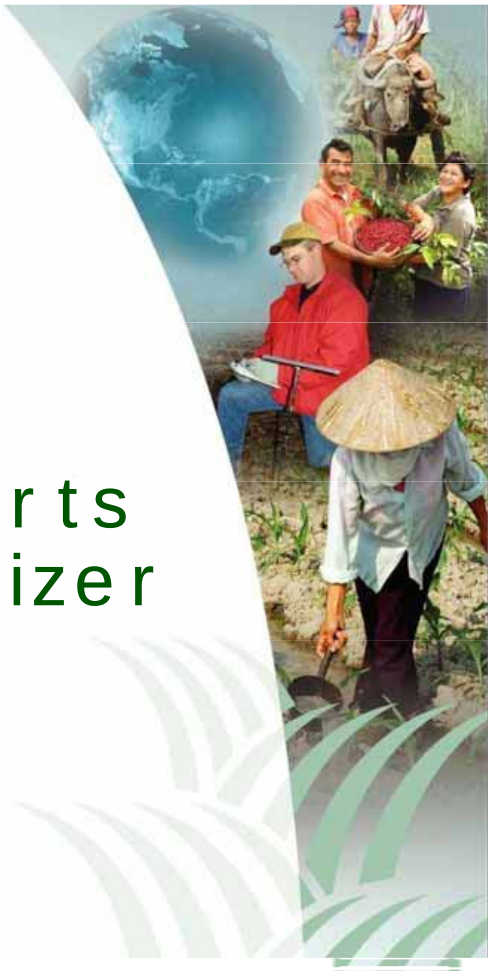

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