

Transitioning Cereal Systems to Adapt to Climate Change

November 13-14, 2015

Nutrient stewardship innovations for increased cereal system resilience

Paul Fixen Senior VP International Plant Nutrition Institute and 2016 ASA President

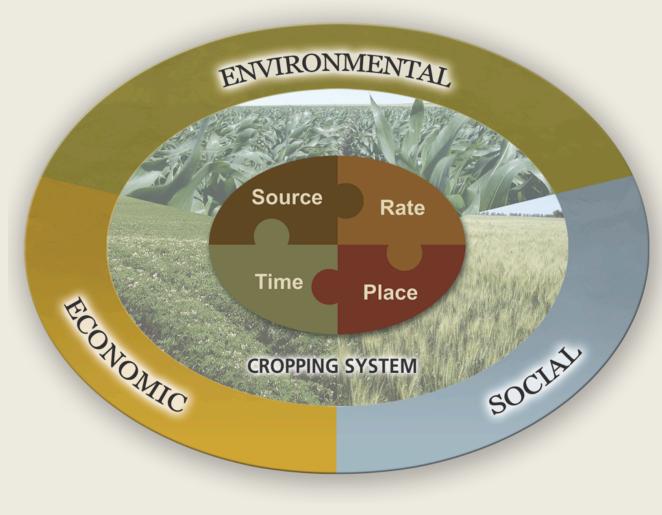




Can't manage what we can't measure

A global focus of fertilizer management on 4R Nutrient Stewardship

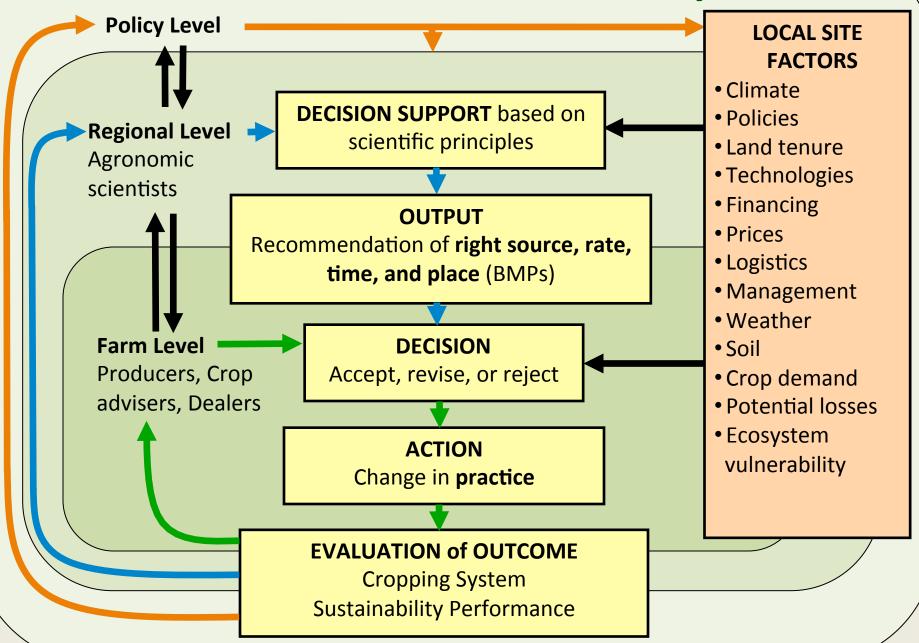
Right Source @ Right Rate, Right Time, Right Place



"Right" is influenced by contribution to sustainability goals

Knowing the contribution requires scalable performance indicators

4R Plant Nutrition – Decision Cycle





Outcomes resulting from nutrient management practices are greatly influenced by crop and pest management and by soil and water conservation practices

Food & Nutrition Security

SOCIAL

PH Quality

iodiversity

Pest

ECONOMIC Farmland Productivity

Source Rate
Nutrient
Time Place

Crop

momic Value

Water Quality

ENVIRONMENTAL

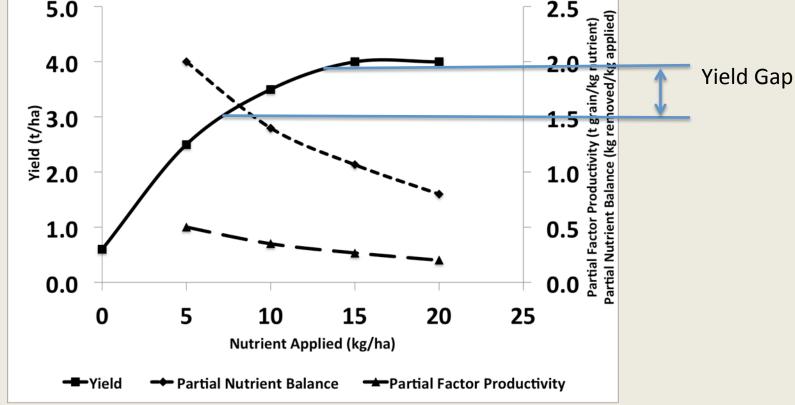
Nutrient use efficiency – a key indicator Defined and calculated in many ways ... examples

NUE term	Calculation			
Partial factor productivity	PFP = Y/F			
Agronomic efficiency	AE = (Y-Y ₀)/F			
Partial nutrient balance	PNB = R/F			
Recovery efficiency	RE = (U-U ₀)/F			

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

In all cases a ratio of output/input

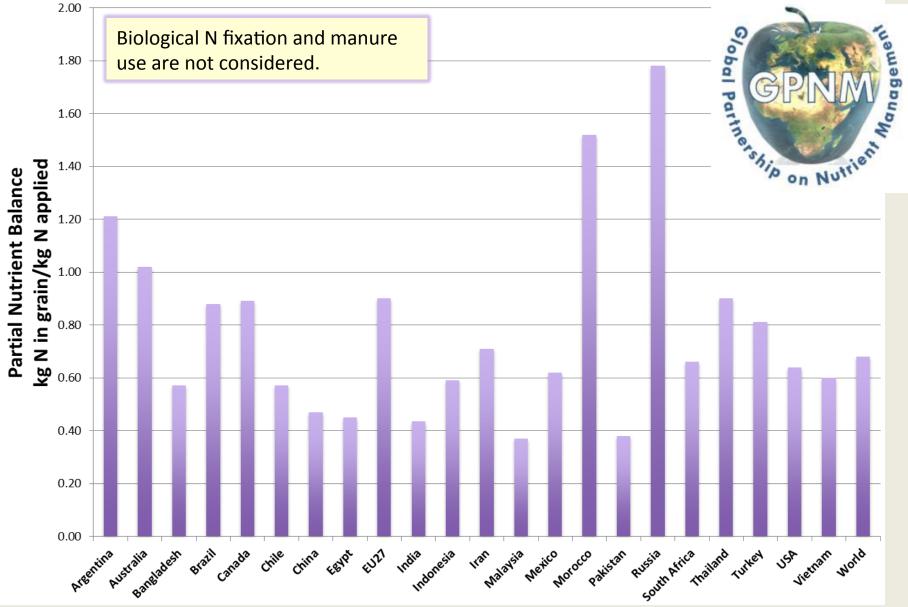
Efficiency & effectiveness ... Nutrient performance



- Efficiency is one aspect of performance; effectiveness drives farmer decisions
- Nutrient performance encompasses impacts on:
 - productivity, potential losses to the environment, change in soil nutrient status

IPNI Issue Review Ref #14061, August 2014

All cereals N PNB by country



GPNM Task Team Tech Paper 01/2015.

N output versus N surplus (input-output) Global Parine for cereals in selected countries hip on Nutrien 160 **Biological N fixation and manure** use are not considered. Cereal Input-Output N (surplus N, kg/ha/y) **PNB=0.5** Farmer Loses Farmer Wins Environment Loses Environment Loses WK M CHL US/

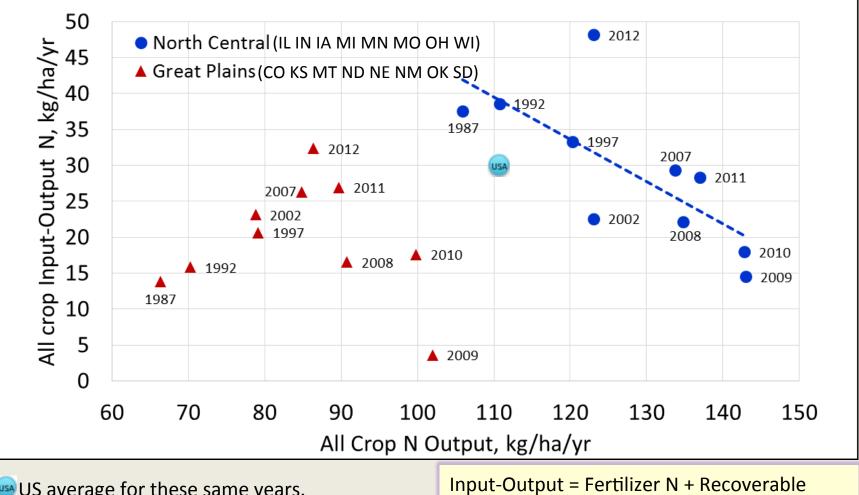
 0
 20
 AUS
 Farmer Wins Environment Wins
 PNB=0.9

 0
 20
 AUS
 60
 AUS
 Farmer Loses
 PNB=1.3

 -40
 Soil Loses
 Cereal Output N (yield N, kg/ha/y)
 PNB=1.3

GPNM Task Team Tech Paper 01/2015.

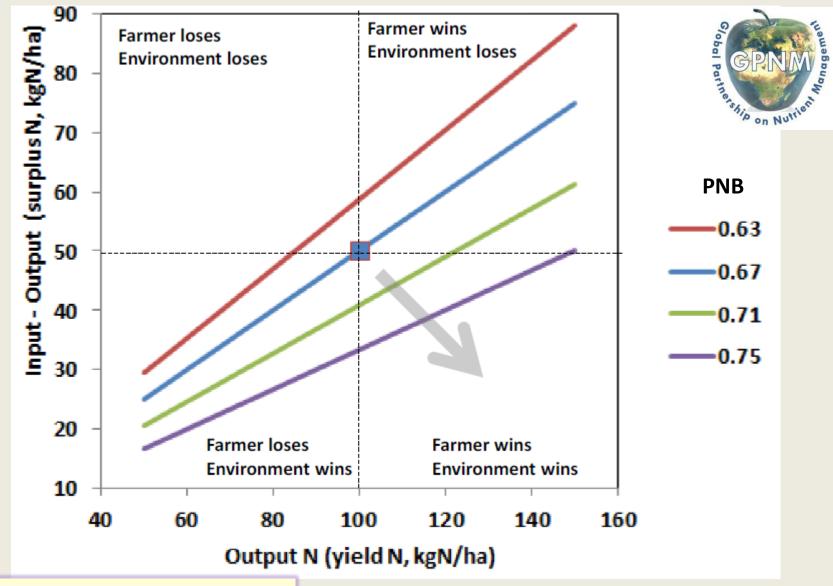
Regional and yearly variation in N output versus N surplus (input-output) in the US



US average for these same years.

manure N + BNF – Harvest removal.

Tracking efficiency and productivity relative to a benchmark ... approaching performance



GPNM Task Team Tech Paper 01/2015.

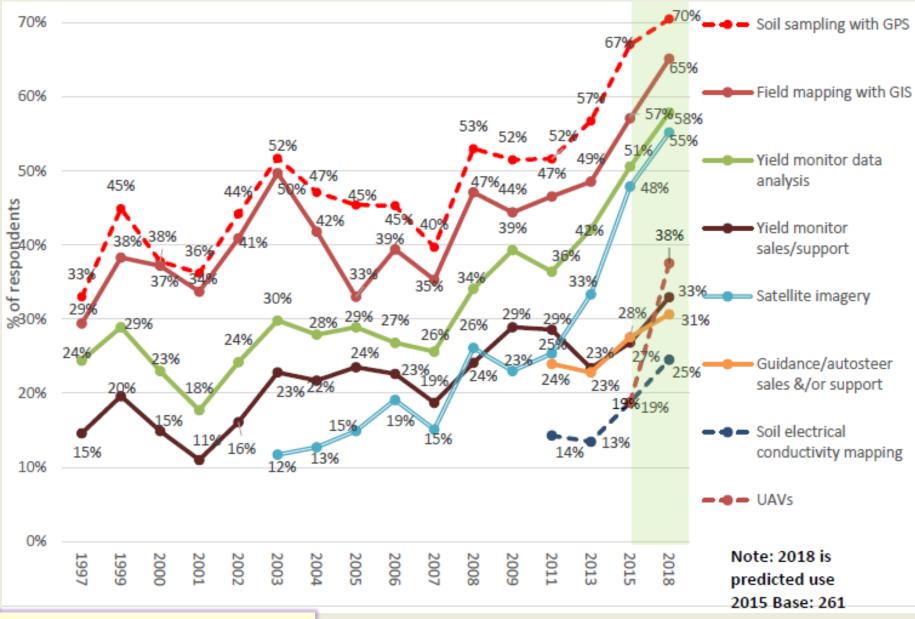
The ultimate is to scale down to the environment of individual plants ... recognizing the role of genetics, culture, and available technology

Source Rate Time Place

Managing **soil** conditions & **nutrition** of each plant

Photo by Bill Pan

Precision services offered by US input suppliers



Purdue Univ. and Crop Life, 2015.

Adapting nutrient management to climate change

Encirca[™] Yield Stand and Nitrogen Management Services

Nutrient Expert® - A Decision Support Tool for Site-Specific Nutrient Management

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Target Yield	250 bu/ac	Edk					0	P
Sail	Sitty Citry Loam	Edk					~	U. 10
Planting	DKG-123456, 38,000 se	EdR		•		1		30
Practices	Com on Beans Rotation	Edit		Part				5

Adapt-N

Cornell University

A tool for adaptive nitrogen management in corn



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04/10/2015 **Field Name**



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Adapt-N chosen 2012 Top Product of the Year

Adapt-N was selected as the Best New Product of the Year 2012 by AgProfessional m publication related to agronomic and business management for agricultural retailers/di managers and crop consultants. Adapt-N took a huge 52 percent of the vote, and it is t commercial organization received the award. "The [...]

Adapt-N is now available for the 2013 season

Hello Adapt-N Users. The conversion to 2013 was completed over the weekend, and the 2013 season. Retrospective runs for 2012 remain available as well. As always questions and feedback. Bianca Moebius-Clune bnm5@comell.edu





Top Product of the Year, 2012 – Ag Professional



Scalable performance metrics can facilitate adoption of nutrient management practices with the potential for adapting cereal systems to climate change

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Thank you!

University of Idaho











United States Department of Agriculture National Institute of Food and Agriculture



Pacific Northwest Farmers Cooperative

Monsanto

