Phosphorus... Essential for Life

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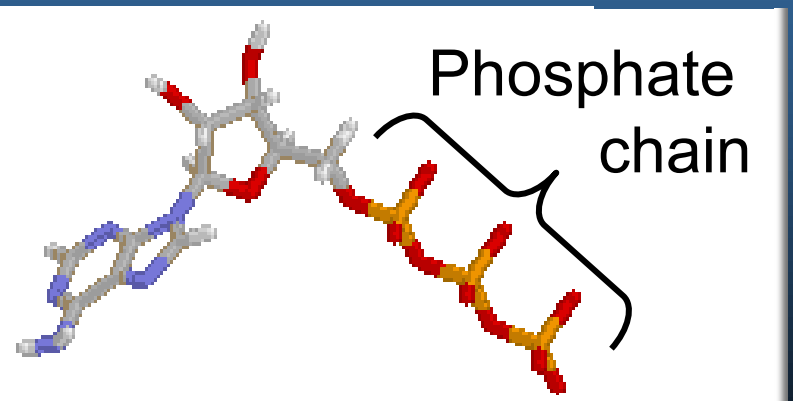
Phosphates are a vital ingredient in the diets of all living things…

- is the second most abundant mineral nutrient in the human body
- 80% of P in humans is in bones & teeth accounting for 20% of the mineral ash & 1% of total body weight
- The remainder is widely distributed throughout the body, in combination with fats, proteins and salts in every cell

Phosphorus is of universal importance to every living cell…

P is incorporated into…

- Nucleic acids (DNA, RNA, genes, chromosomes)
- Proteins
- Lipids
- Sugars
- Enzymes
- Energy rich P compounds (ATP, ADP)



ATP: Nature's energy store

P *is critical to basic plant physiology:*

- Energy storage & transfer for every biological process
  - photosynthesis
  - respiration
  - cell division, development, enlargement, gene transfer, reproduction

"Without phosphorus, there is no cell, no plant, and no grain…

Without adequate phosphorus, there is a lot of hunger…"

P *Impact on crops*

- Vigorous crop (Shoot/Root) growth
  - ✓ Improved resource utilization
    - water, nutrients
    - positive environmental implications
  - ✓ Better resistance to stress
    - disease, pest, moisture, temperature
  - ✓ Earlier maturity
    - good grain & fruit development
    - better crop quality, yield

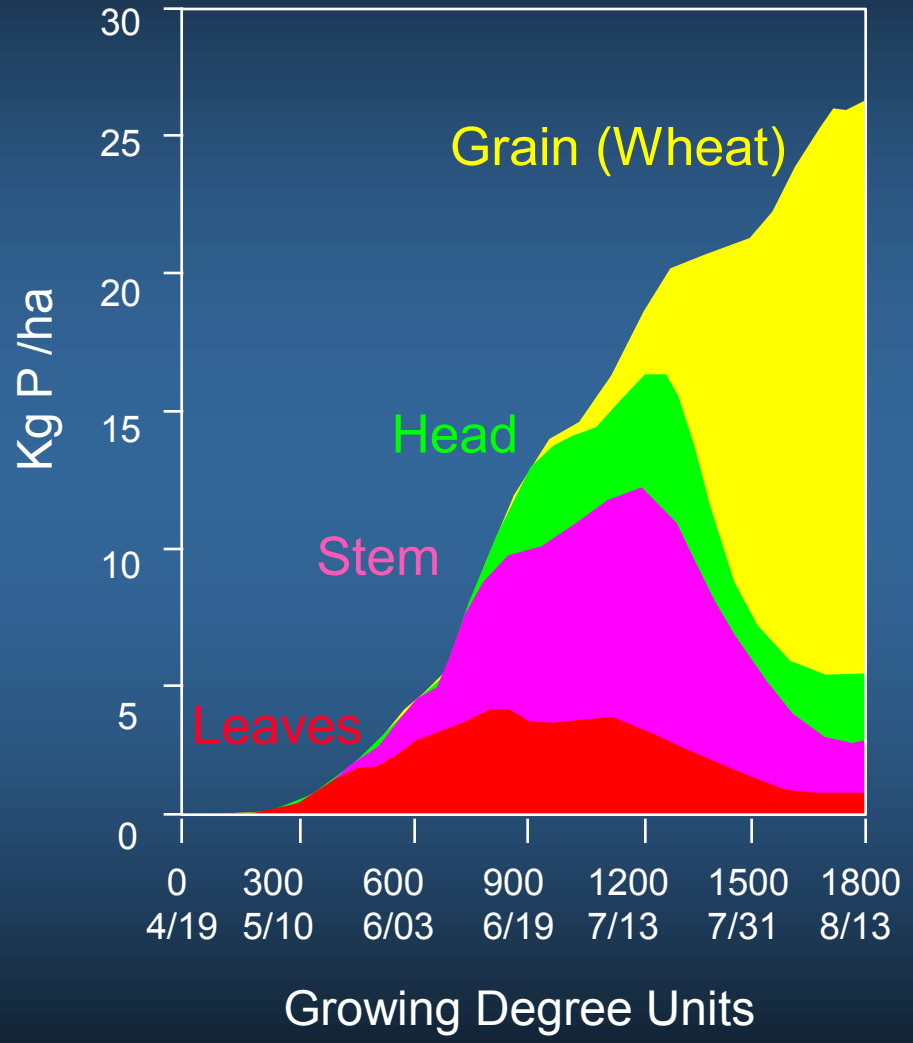
LOWERS FARMER RISK & RAISES PROFIT POTENTIAL

P

is mobile in the plant…linked to metabolic processes…
& is concentrated in the most active areas of growth

- the majority of P is removed in fruit/grain

Crop	Plant part	P content, %
Corn	Grain	0.22
	Stover	0.17
Cotton	Seed	0.66
	Stalks	0.24
Soybeans	Grain	0.42
	Straw	0.18
Wheat	Grain	0.42
	Straw	0.12



(Jacobsen et al. 1992)

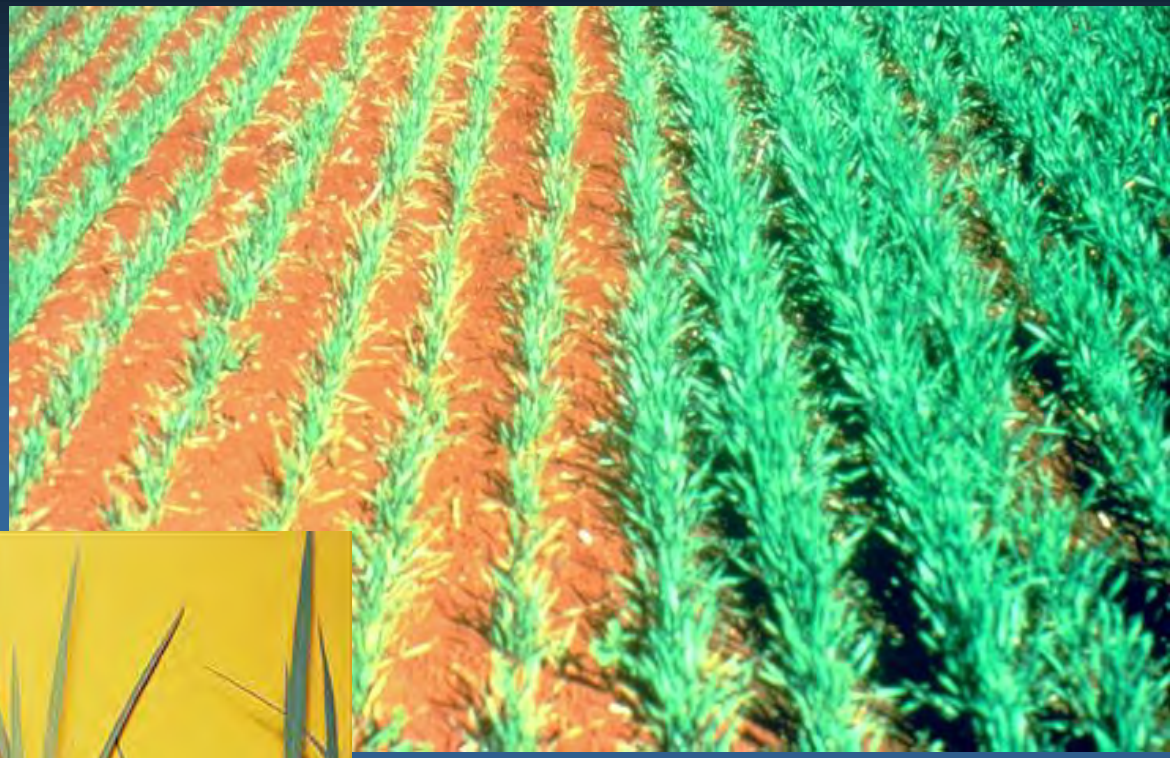
Agronomic characteristics of P deficiency

… darkened leaves

… purpling of leaves / stems

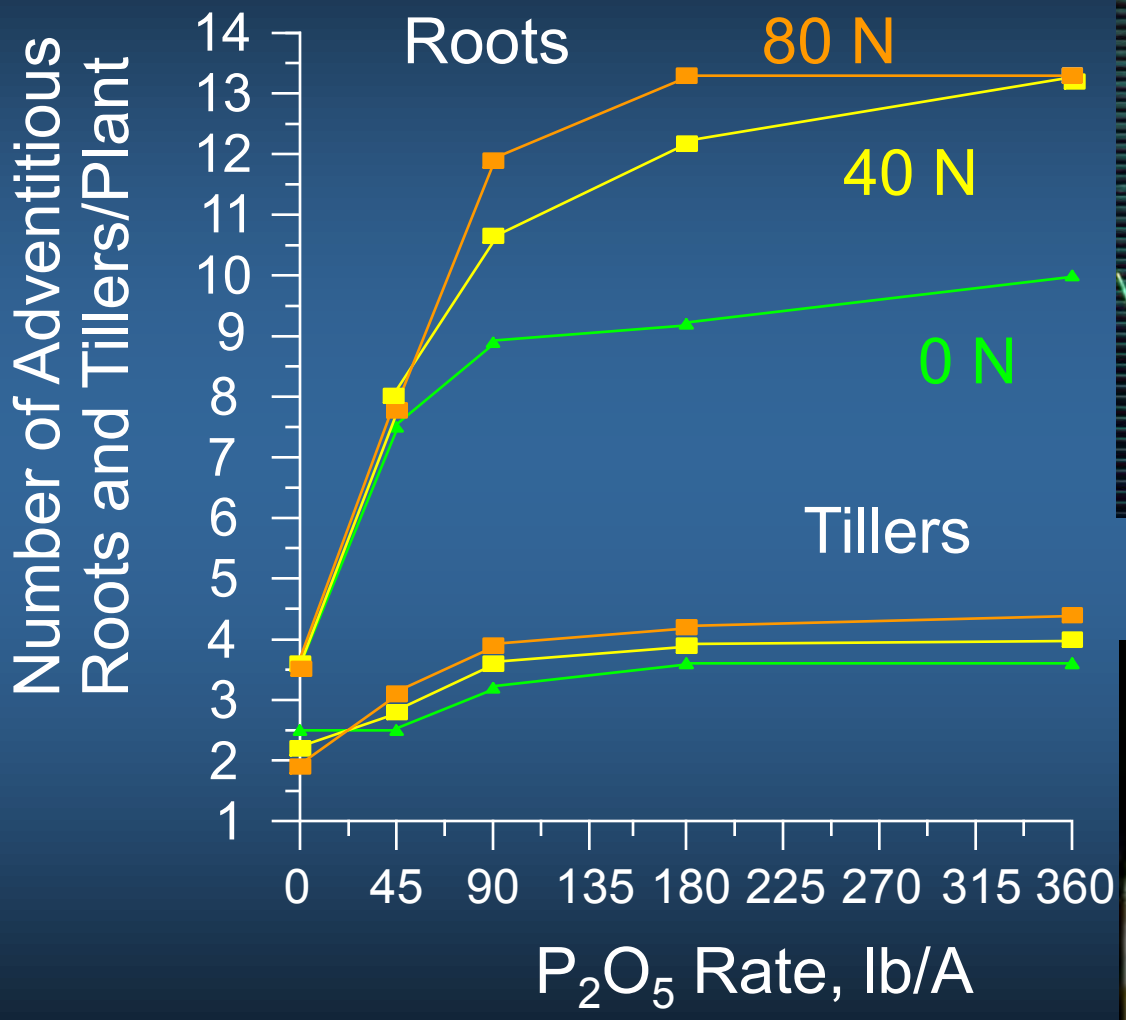
P *deficiency reflected in poor development at all stages…*

- stunted growth



- reduced leaf number, expansion & surface area

Impact on plant roots & tillers (wheat)

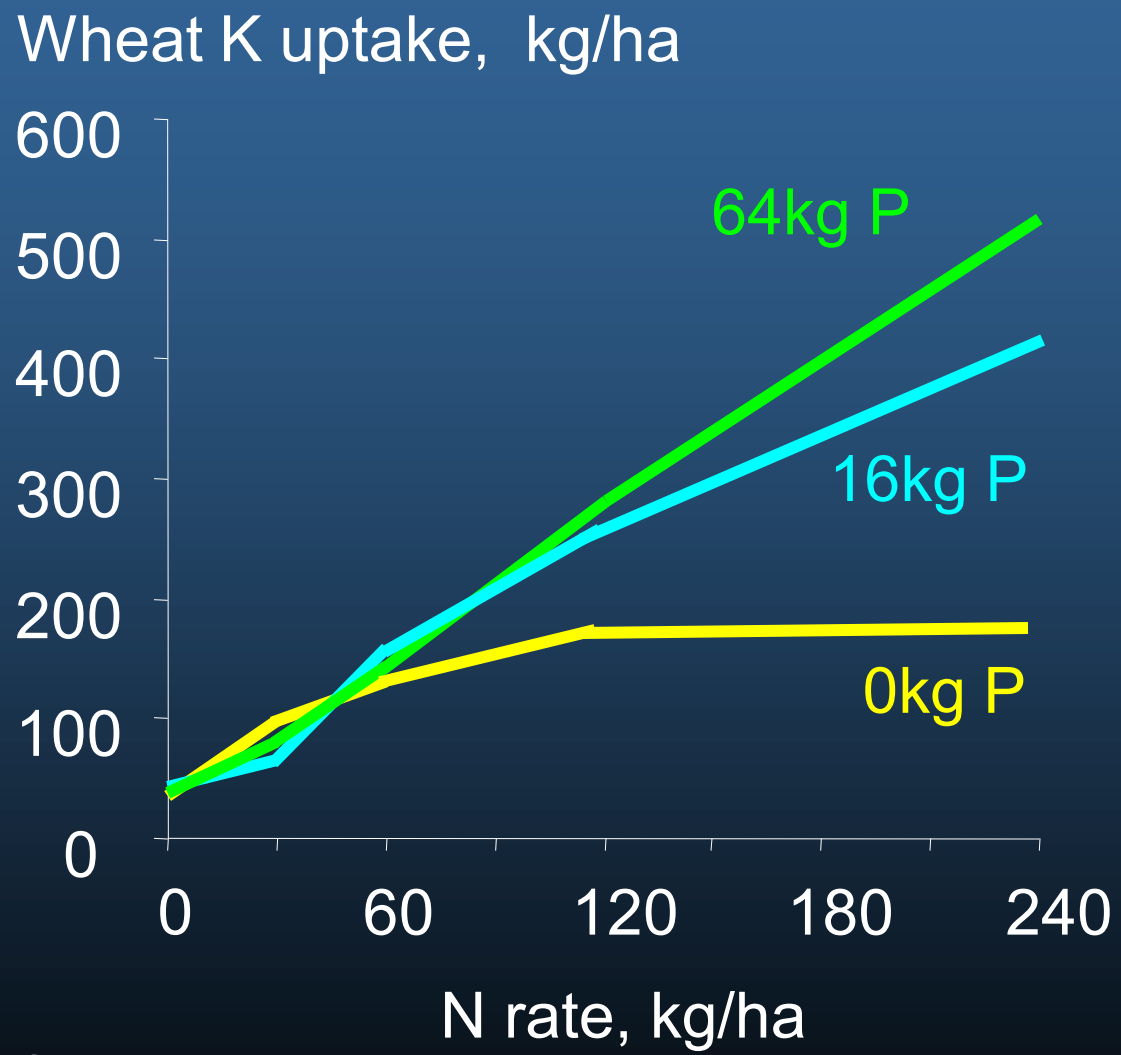


(Fanning and Goos 1992)

Impact on water use efficiency (wheat)

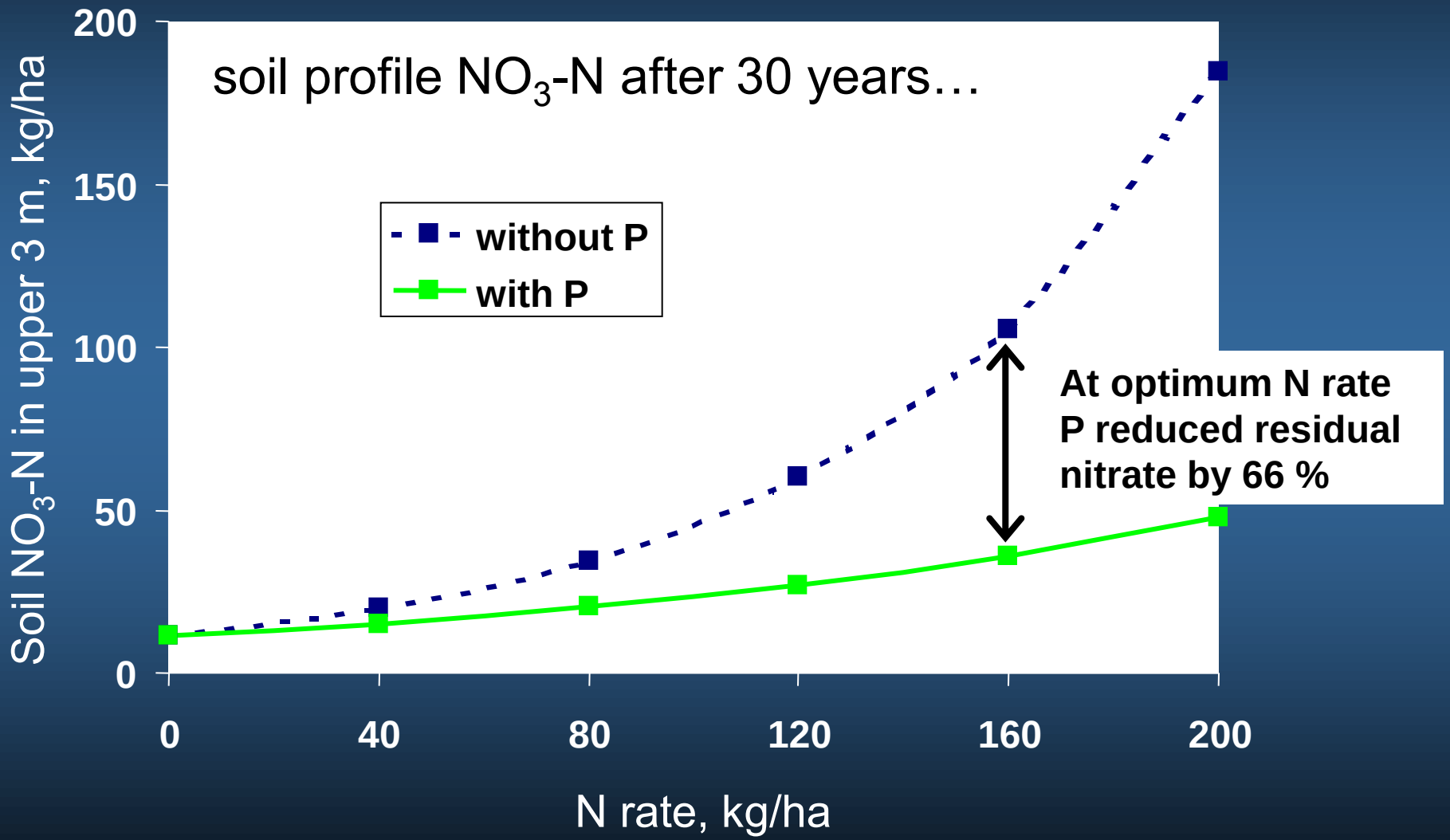
N	P_2O_5	WUE	Increase
kg/ha		kg/cm H_2O	in WUE, %
0	0	30	---
0	45	38	27
0	90	40	33
40	0	26	-13
40	45	42	40
40	90	49	63

Impact on nutrient use efficiency (wheat)



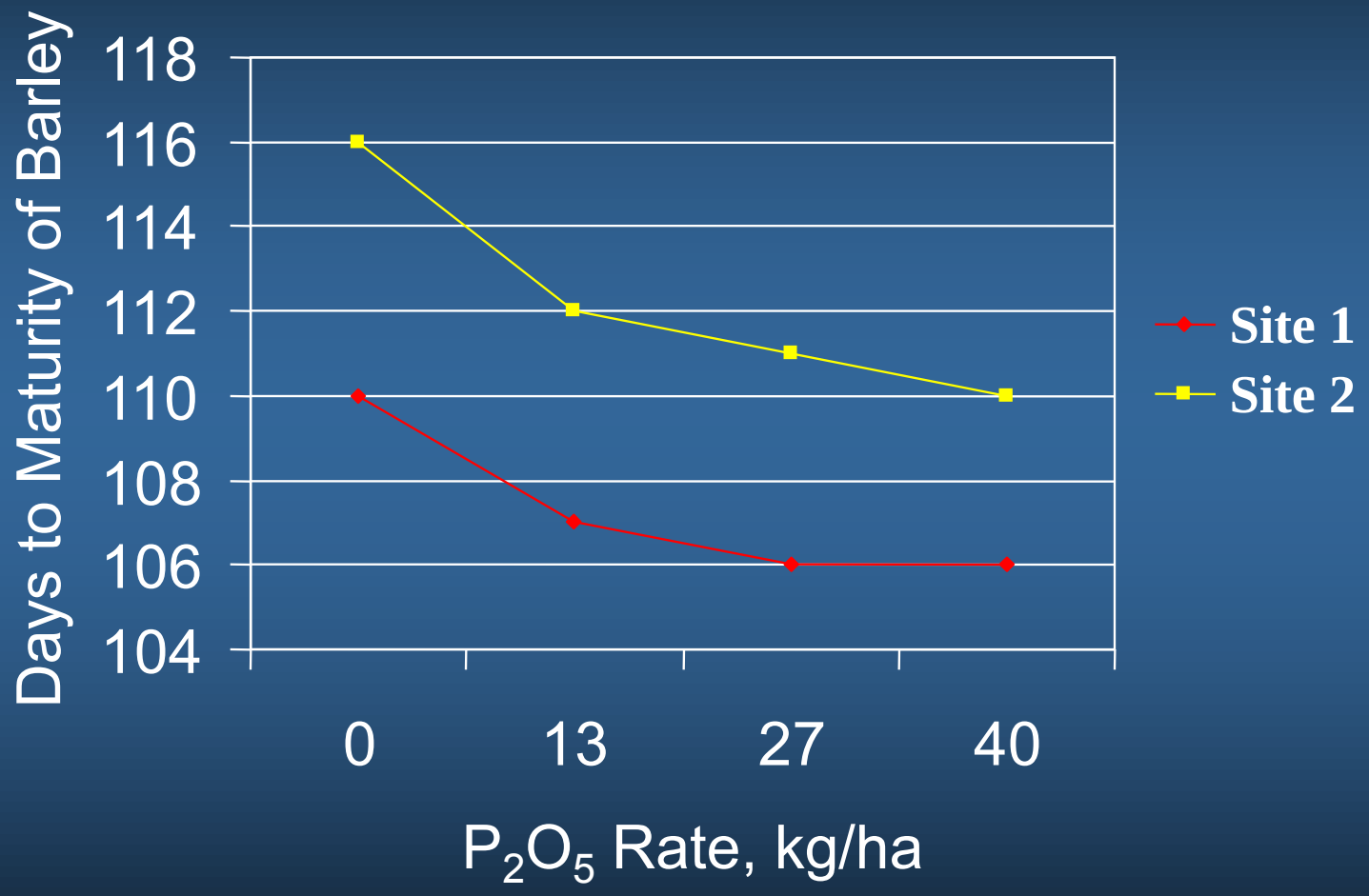
(Schwartz and Kafkafi)

Impact on residual soil nitrate & leaching



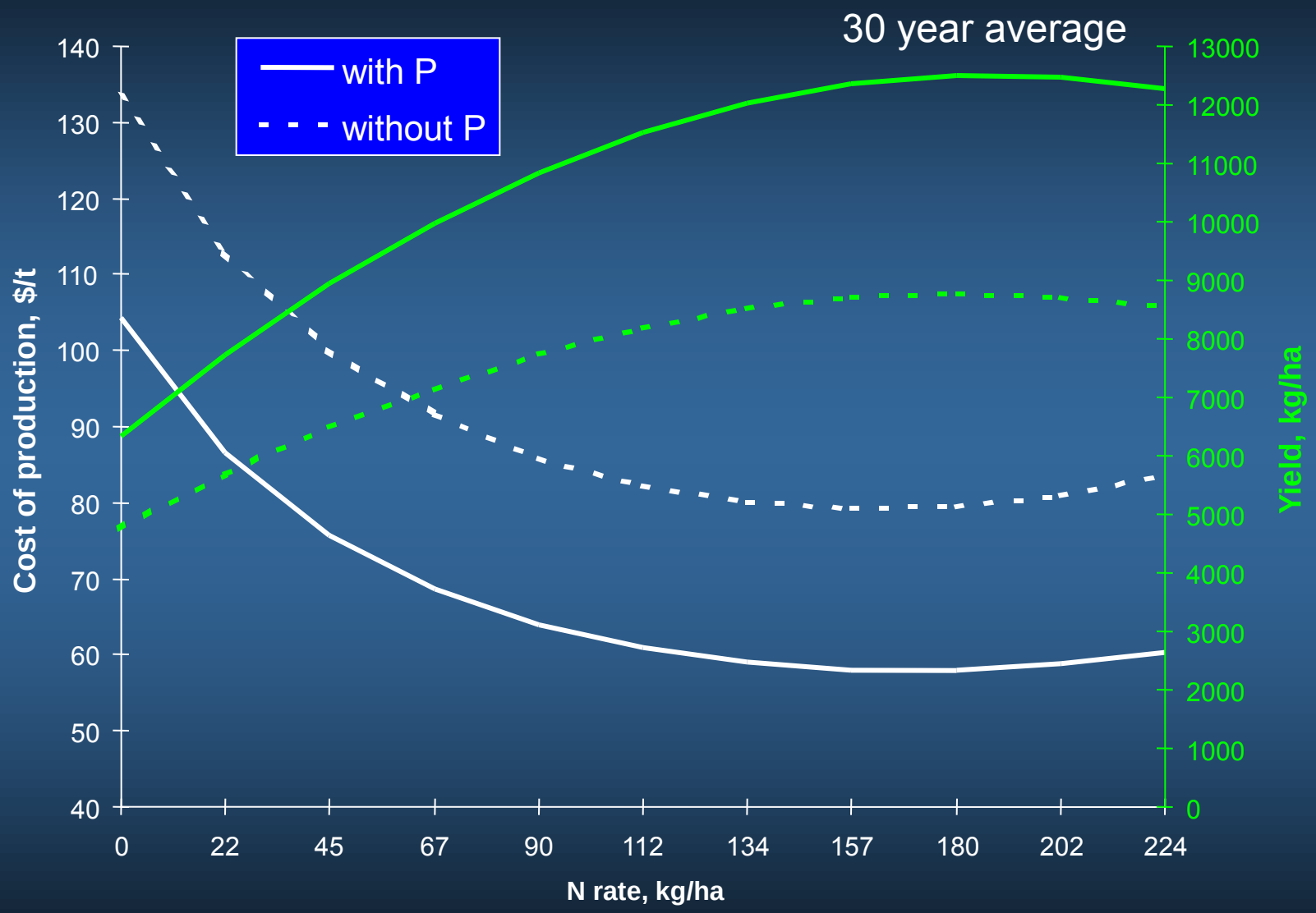
(Schlegel, Dhuyvetter, and Havlin, 1996)

Impact on crop maturity (barley)



(Westco – Alberta, Canada)

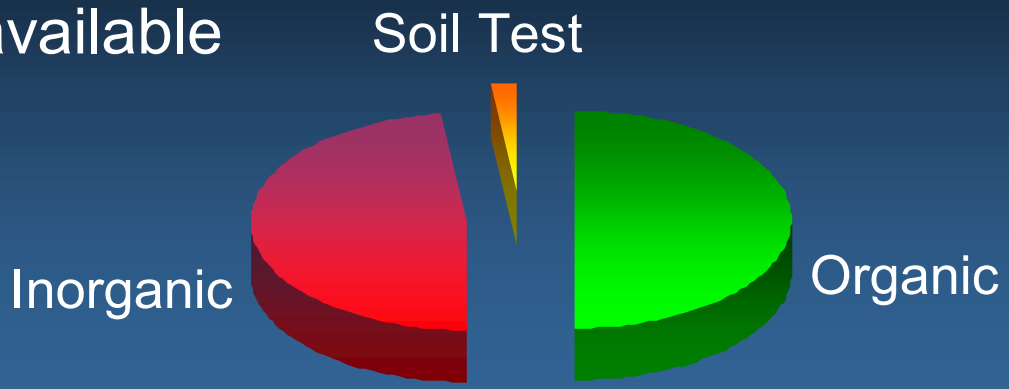
Impact on yield & cost of production



Schlegel, Dhuyvetter, and Havlin, 1996

How much P is in the soil?

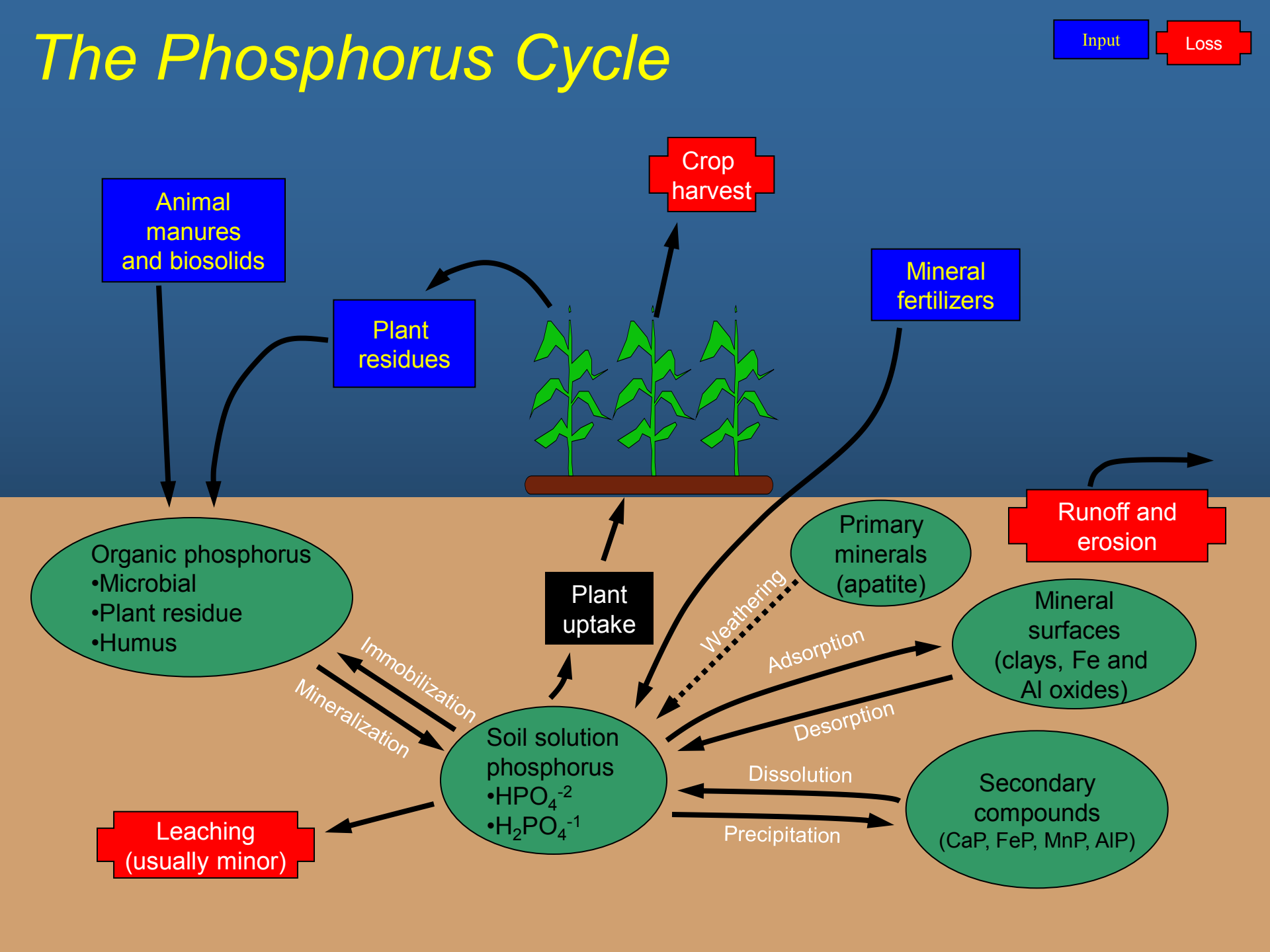
- 4 kg P/ha or less is plant-available in soil solution.



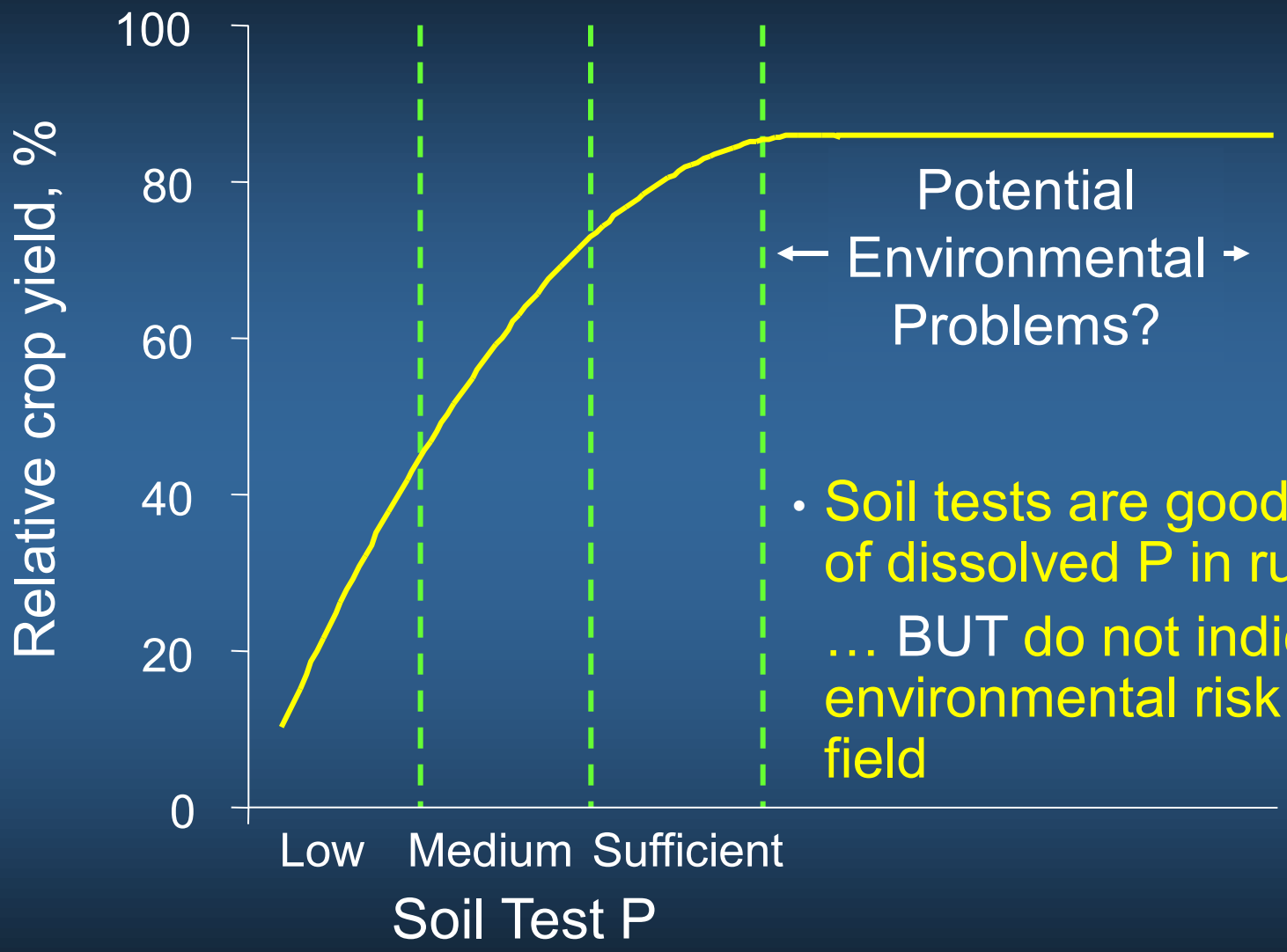
- An actively growing crop can use up all of the P in soil solution twice a day.

- A soil's ability to <u>maintain</u> a plant-available P supply is the important factor.

The Phosphorus Cycle



Risk of environmental loss?



- Soil tests are good indicators of dissolved P in runoff …

… BUT do not indicate environmental risk for a given field

(Sharpley et al. 1993)

Phosphorus in the Watershed

Sharpley, Gburek, USDA-ARS; Beegle, Penn State University

Soil Test P Distribution

Sharpley, Gburek, USDA-ARS; Beegle, Penn State University

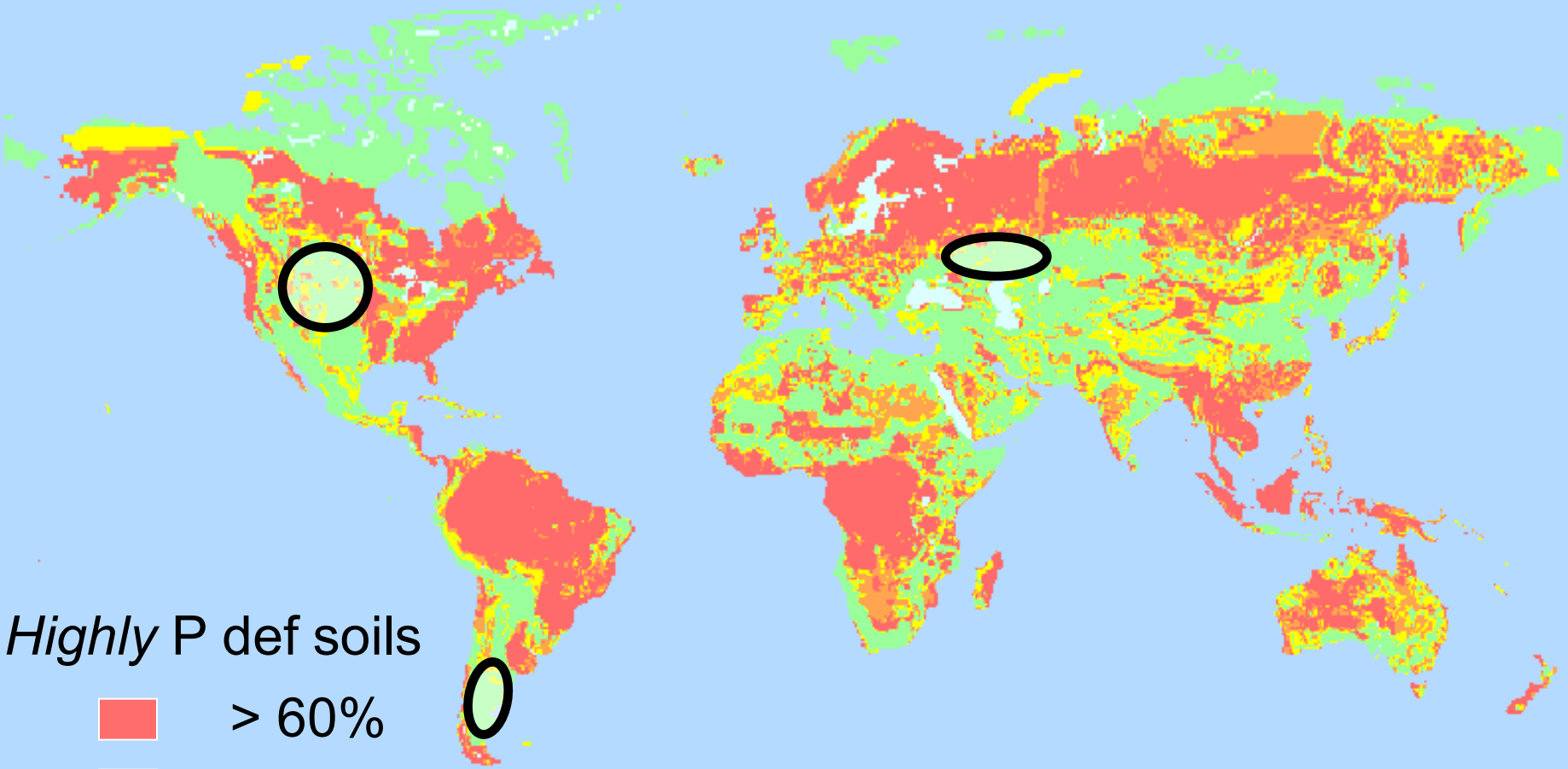
Vulnerability to P Loss

Sharpley, Gburek, USDA-ARS; Beegle, Penn State University

What Determines Phosphorus Fertilizer Need?

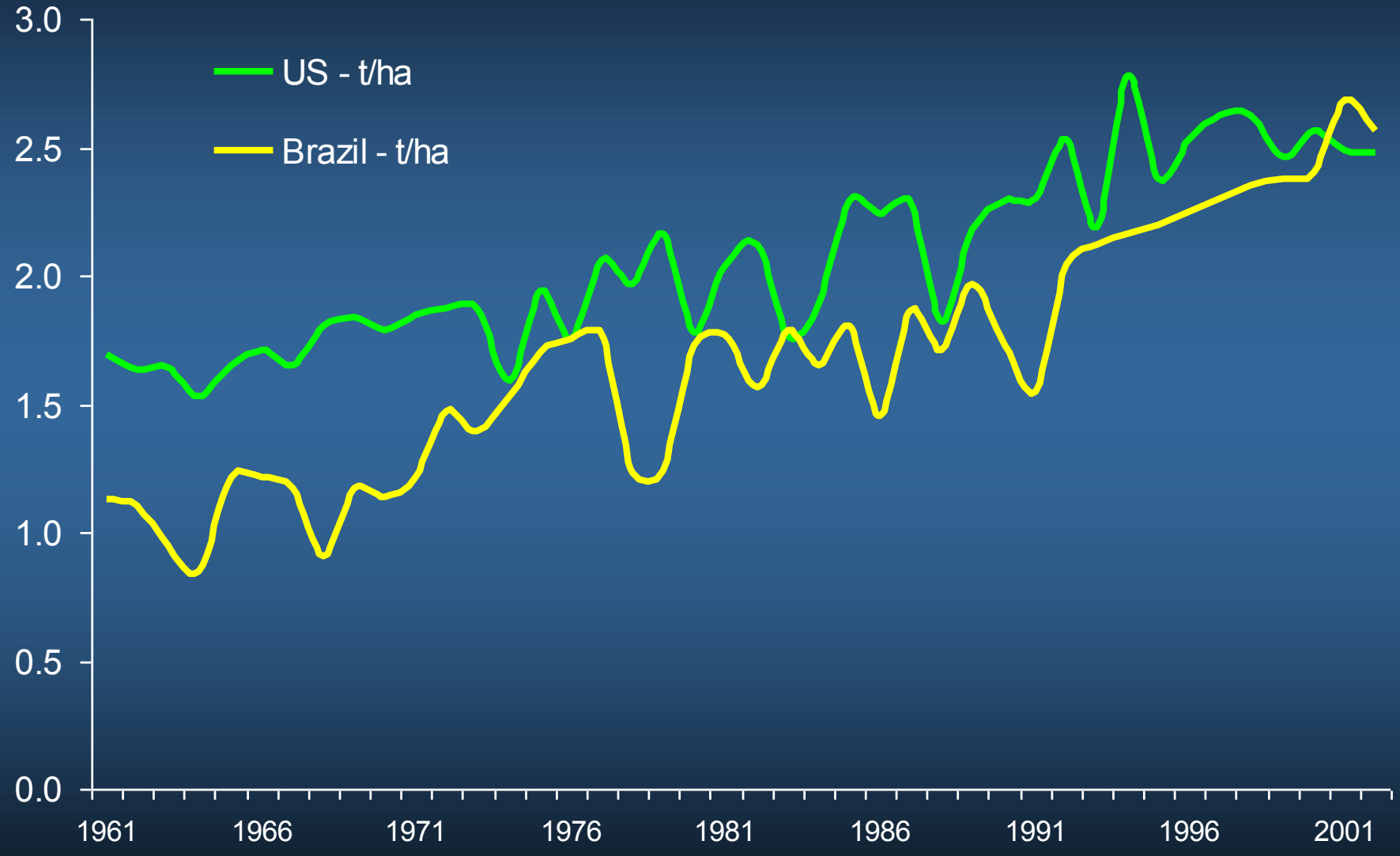
$$f\left[\text{Population, Land resources/fertility, Historic nutrient use patterns, Cropping diversity, Export versus domestic goals, Government policy, Current Economy…}\right]$$

Indigenous Phosphorus supply - the net effect?



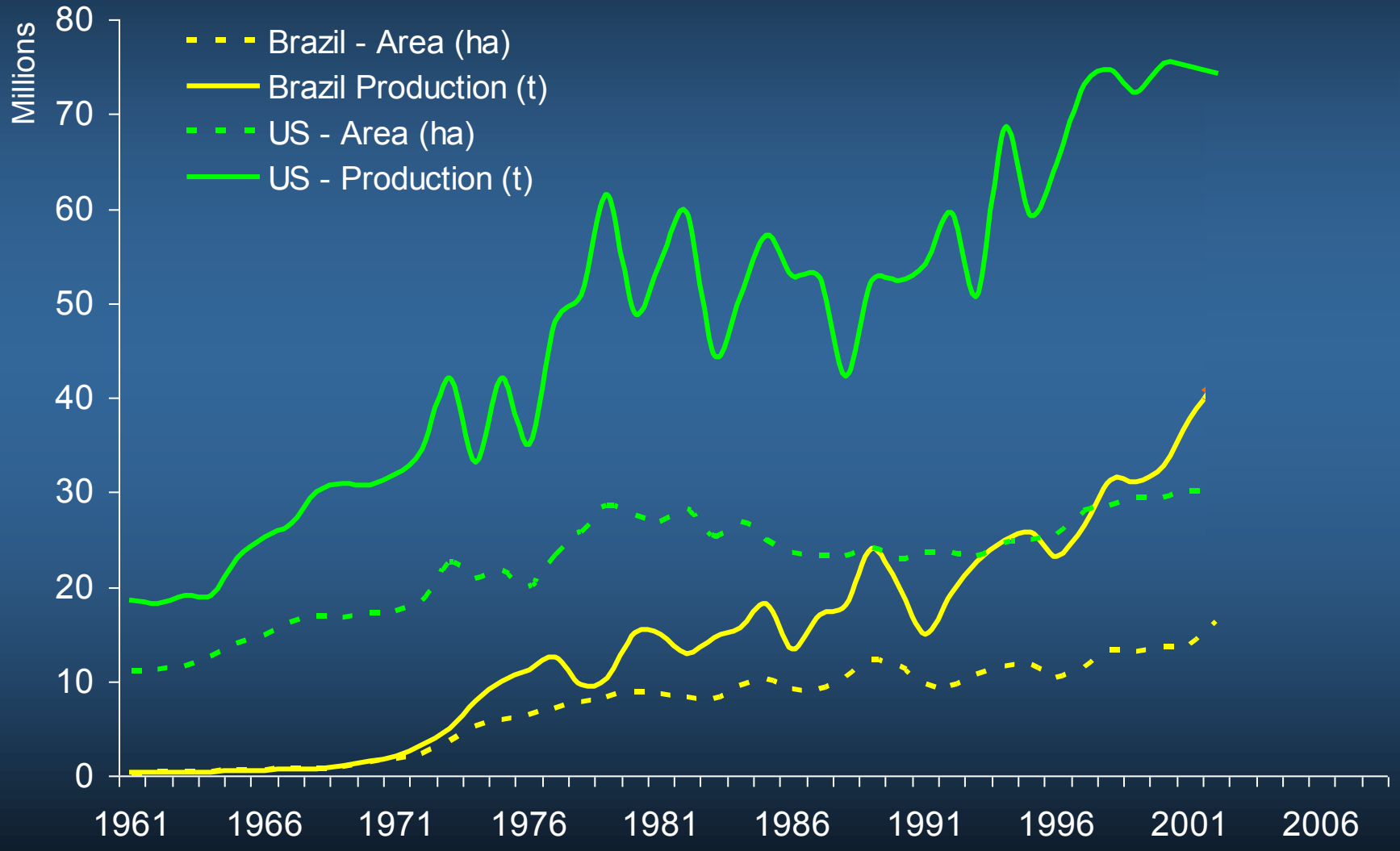
(Fairhurst et al., 1999)

Soybean yields – US/Brazil



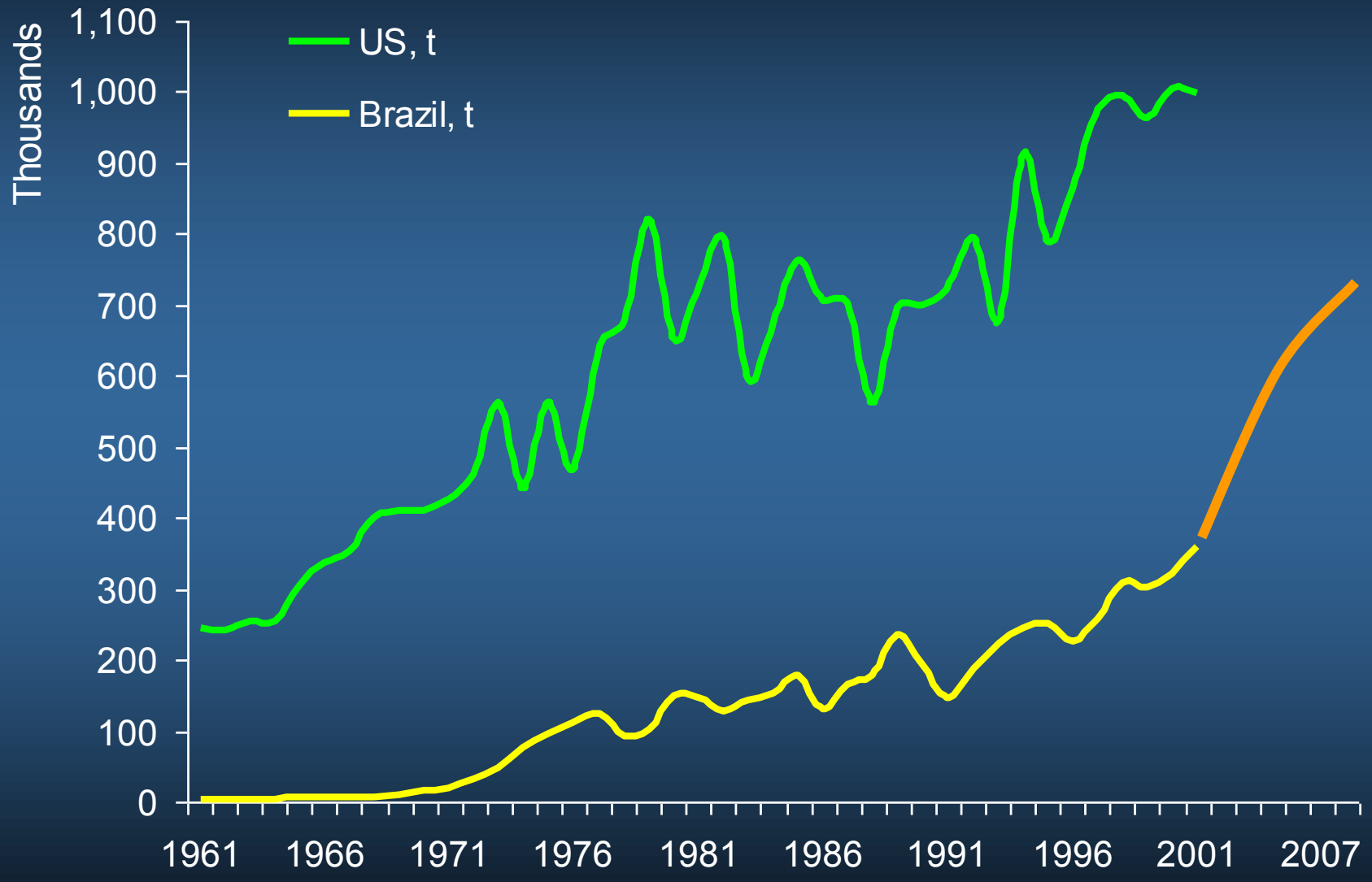
AgriStats, NASS

Soybean growth – US/Brazil



AgriStats, ANDA, NASS

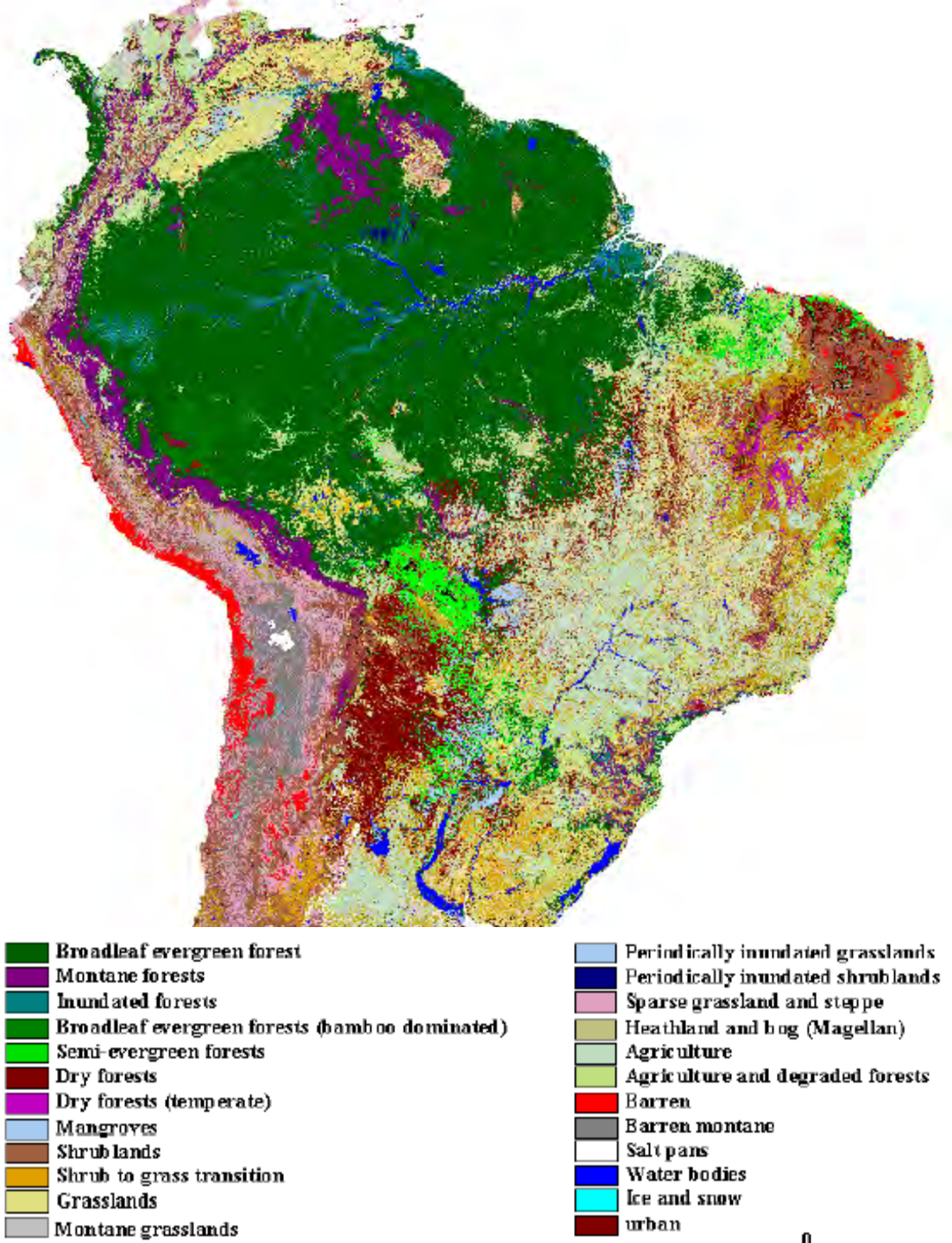
Soybean P removal – US/Brazil



AgriStats

Opportunities…

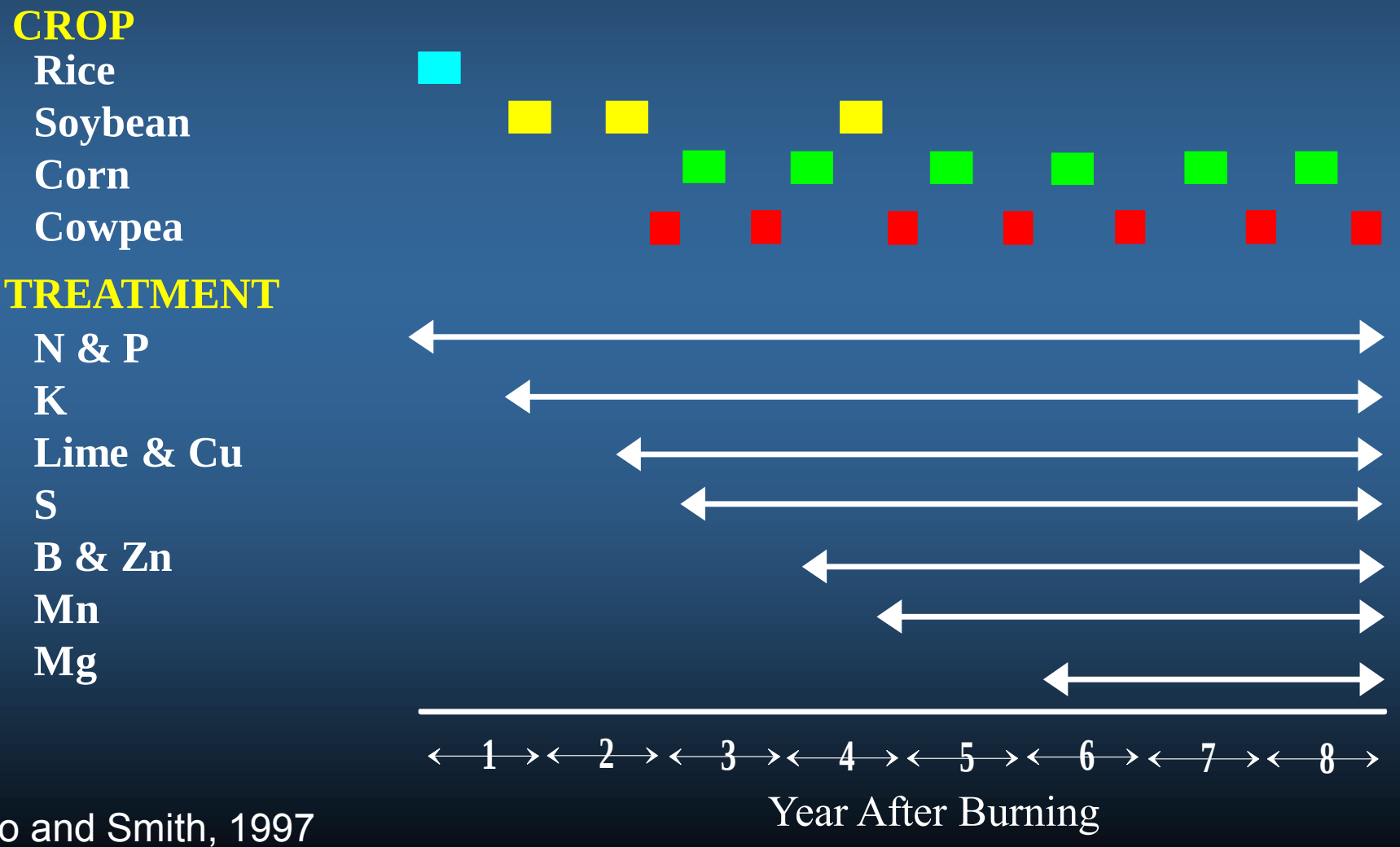
- World food demand
- Favorable climate
- Lower land price
- Low production cost
- High yields with fertility correction
- Improving infrastructure
- Political/economical stability



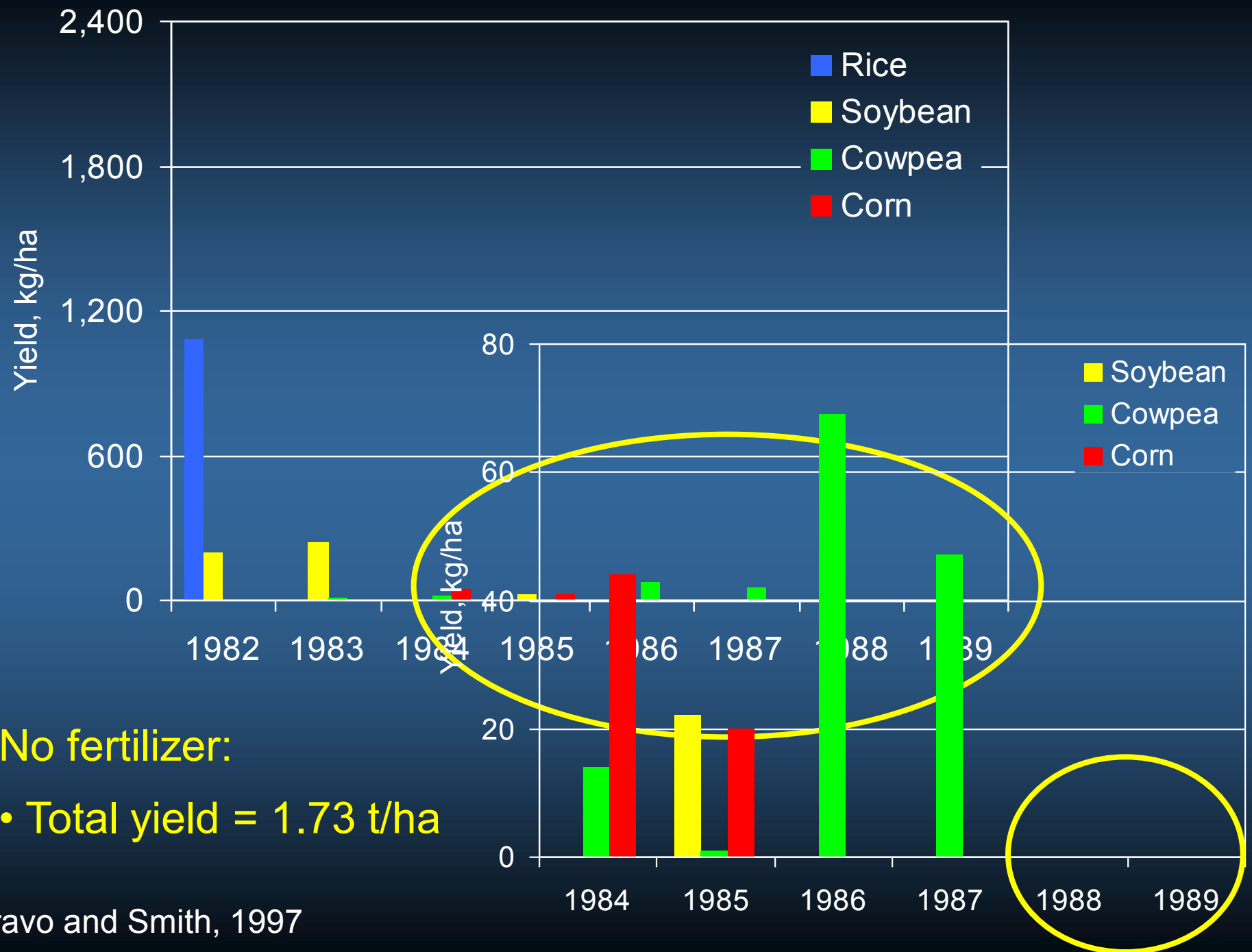
EC Joint Research Centre, 2002

Smallholder farms - Sustainability of Slash & Burn Systems – Oxisol, Manaus, Brazil

- 8 years of cultivation after initial slash & burn
- 17 consecutive crops



Cravo and Smith, 1997



No fertilizer:

- Total yield = 1.73 t/ha

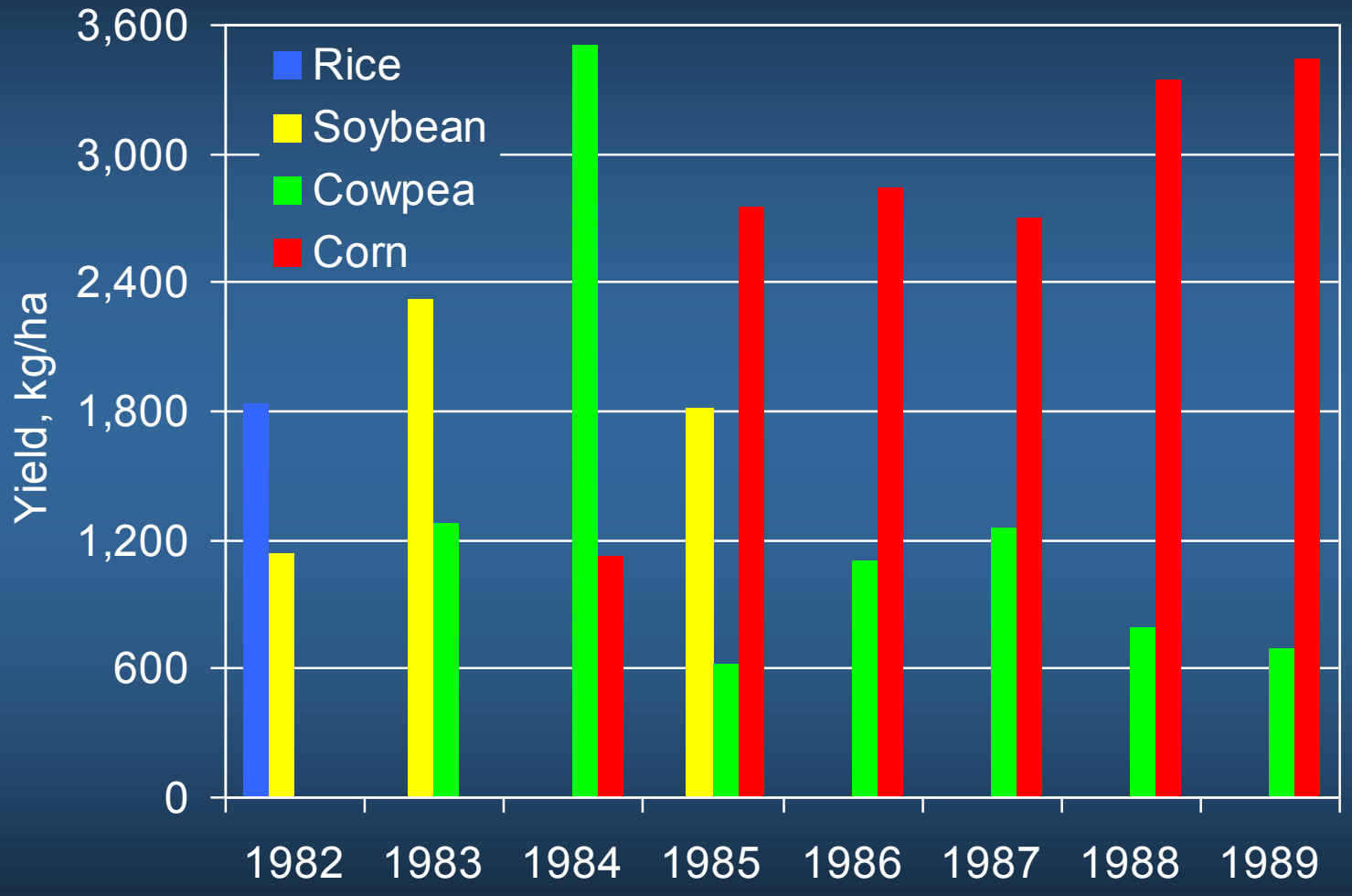
Cravo and Smith, 1997

Soil fertility decay pattern – No fertilizer

	Months till 50%	
	Decrease	Increase
Org C	134	-
Ca	23	-
Mg	15	-
K	5	-
Al	-	33
pH	-	29
Zn	21	-

Cravo and Smith, 1997

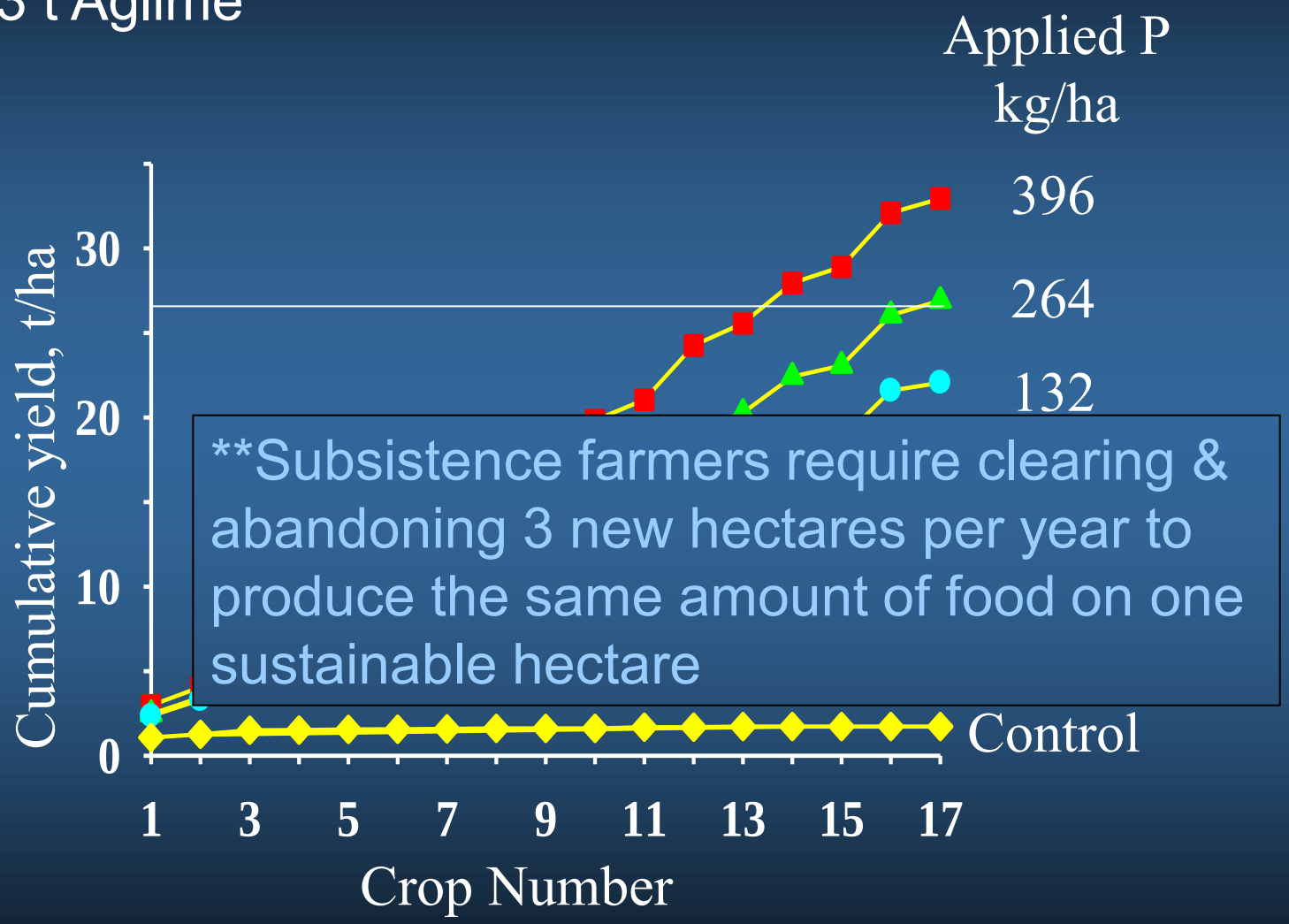
NPK plus Lime



Cravo and Smith, 1997

Yield Response to P

- plus 3 t Aglime

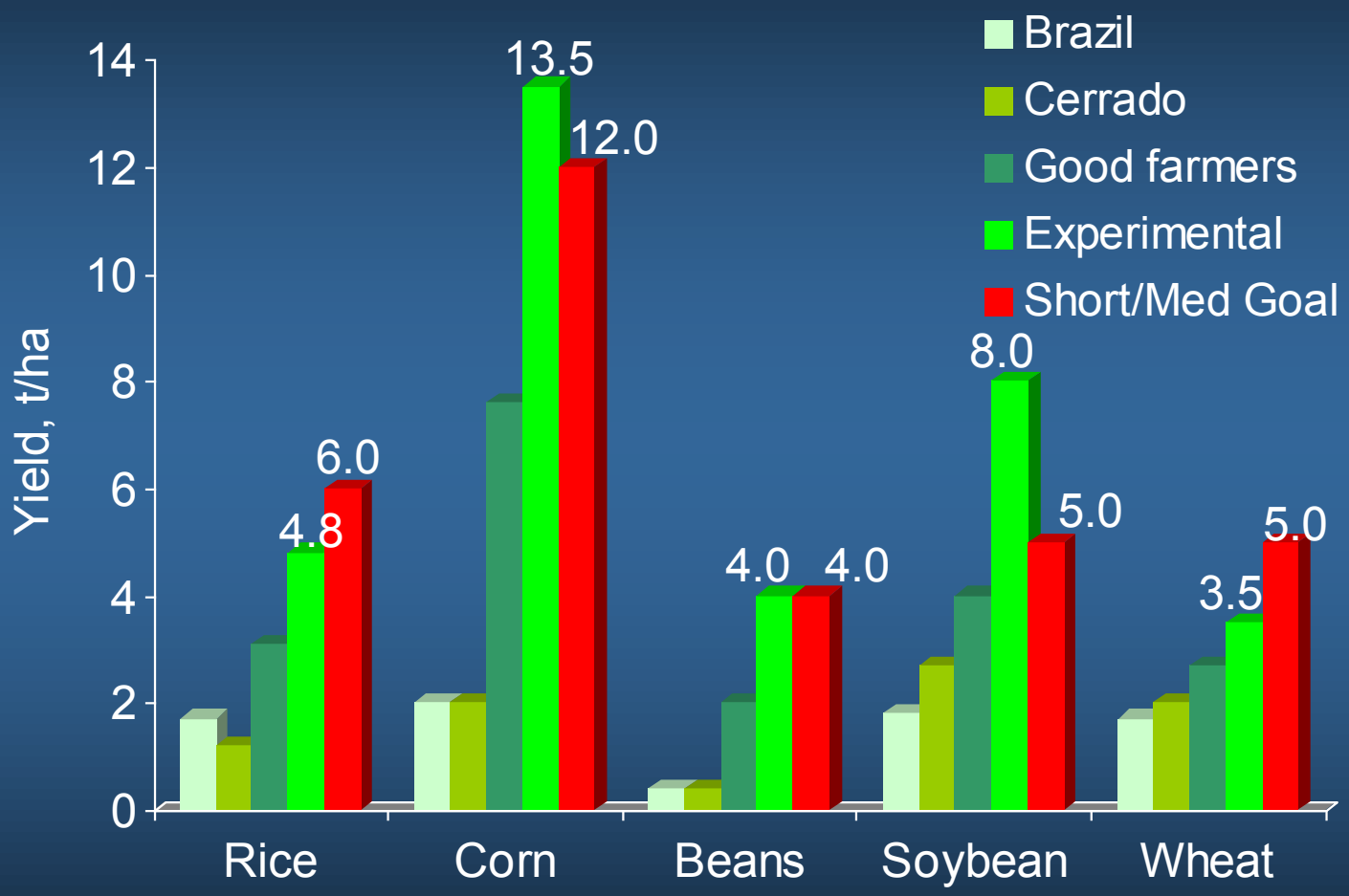


Cravo and Smith, 1997

Cerrado soil has poor fertility & can't produce without fertilizers

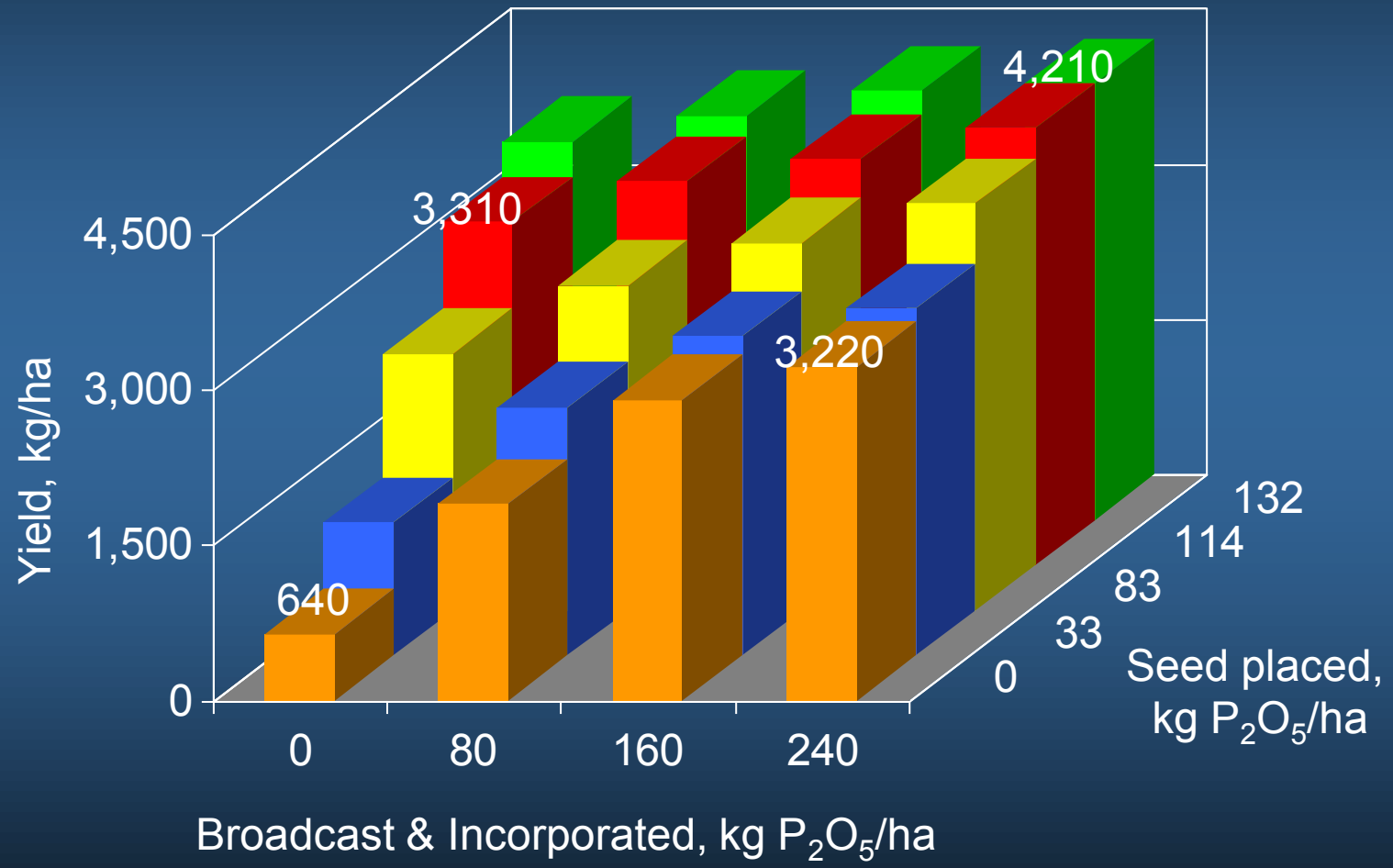
Dirceu Broch, Fundação MS

Grain production gaps



Compiled from Lopes, 1996 and Yamada, 2003

Soybean P response in Cerrado soil



Source: Fundação MT

TOP FARMER GROUPS: TO DEVELOP AND TRANSFER TECHNOLOGY

SEARCH
REGISTER
STORE

Quem Somos
- 1-Missao
- 2-Historia do PPI/PPIC
- 3-Empresas Filiadas
- 4-Equipe Regional
- 5-Equipe Mundial
- 6-Localizacao da POTAFOS
- 7-Mapa do Site

Profile
- 1-Estatisticas gerais da agricultura brasileira e do setor de fertilizantes

DRIS
- 1-Sistema de diagnostico nutricional para as culturas de algodao-cafe-citros-milho-soja e eucalipto

Eventos

Printable Version

What's New

Nova edicao do Informacoes Agronomicas - Dezembro de 2002

Seja o doutor do seu sorgo

01) Simposio sobre Fosforo na Agricultura Brasileira

02) IV Simposio sobre Rotacao Soja/Milho no Plantio Direto

IMAGE GALLERY

PRESENTATIONS

Regional Update

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Fax: 55-19-3433-3254
Email: yamada@potafos.org
Dr. T. Yamada

November 2002 - Agricultural Sector Update The new planting season is bringing signs of another bumper year, with the production of 108 million tons of grains or 11.7% higher than last year. >more

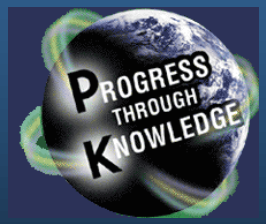
Past Updates

SORGO É BOA OPÇÃO PARA SUBSTITUIR MILHO

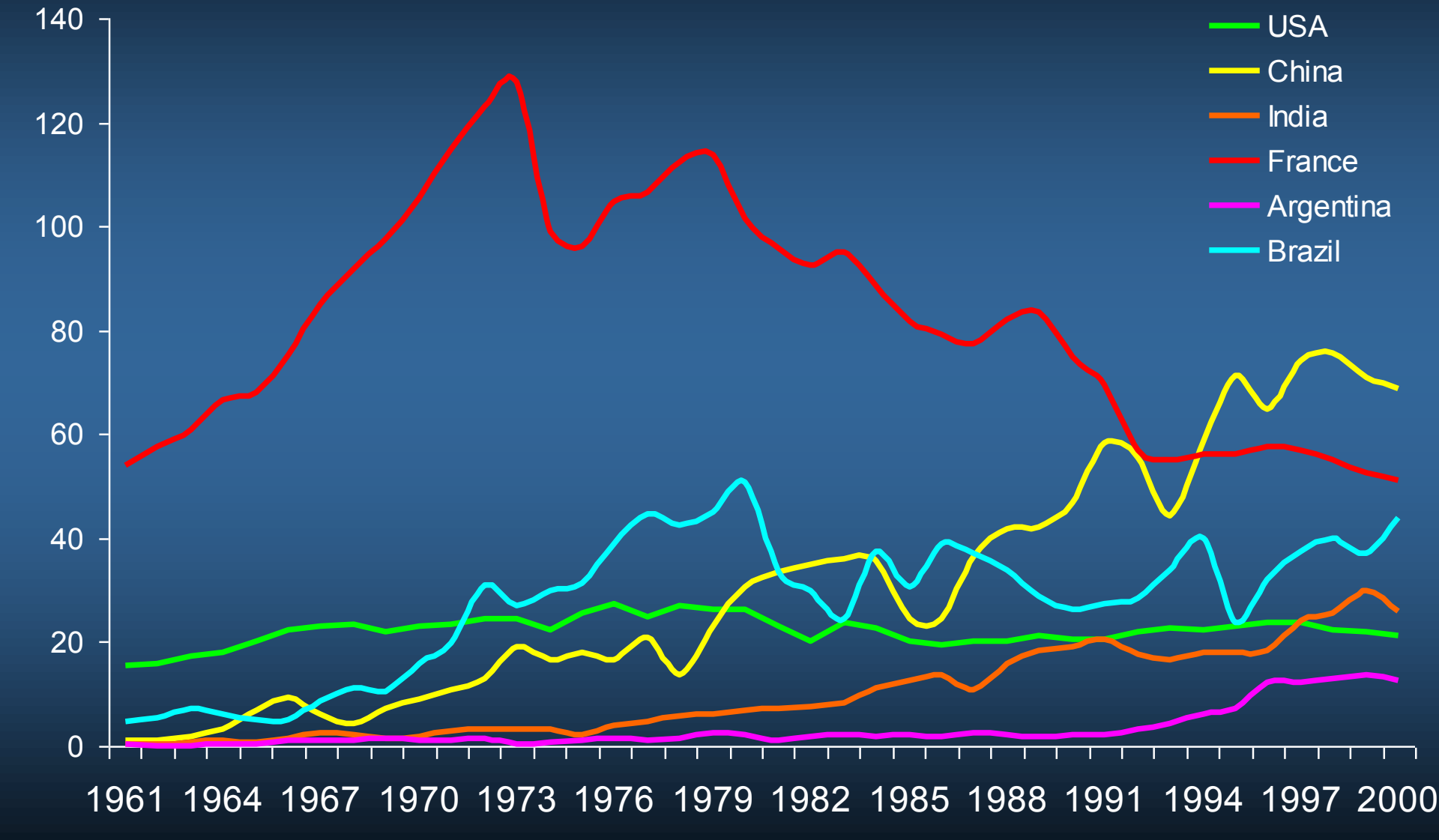
O sorgo é o quinto cereal mais importante do mundo, após trigo, milho, arroz e cevada, apresentando grande potencial para produção de grãos, forragem e álcool. A produção de sorgo na América do Norte, América do Sul, Europa e Austrália se destina principalmente à alimentação animal, ao passo que na Ásia, África, Rússia, China e América Central o grão é importante como alimento humano básico. Nos países industrializados cultiva-se sobretudo como planta forrageira. No Brasil, o sorgo tem mostrado grande potencial de produção, não somente por sua comprovada capacidade de suportar estresses ambientais mas, também, por ser mecanizável do plantio à colheita, por apresentar

Challenges

- Potential for agricultural expansion is great
- Projections for future production are bold
- How sustainable is this production?
- Maximum economic yield is always the desired goal
- Adequate P is a crucial part of the yield equation responsible for reaching this goal

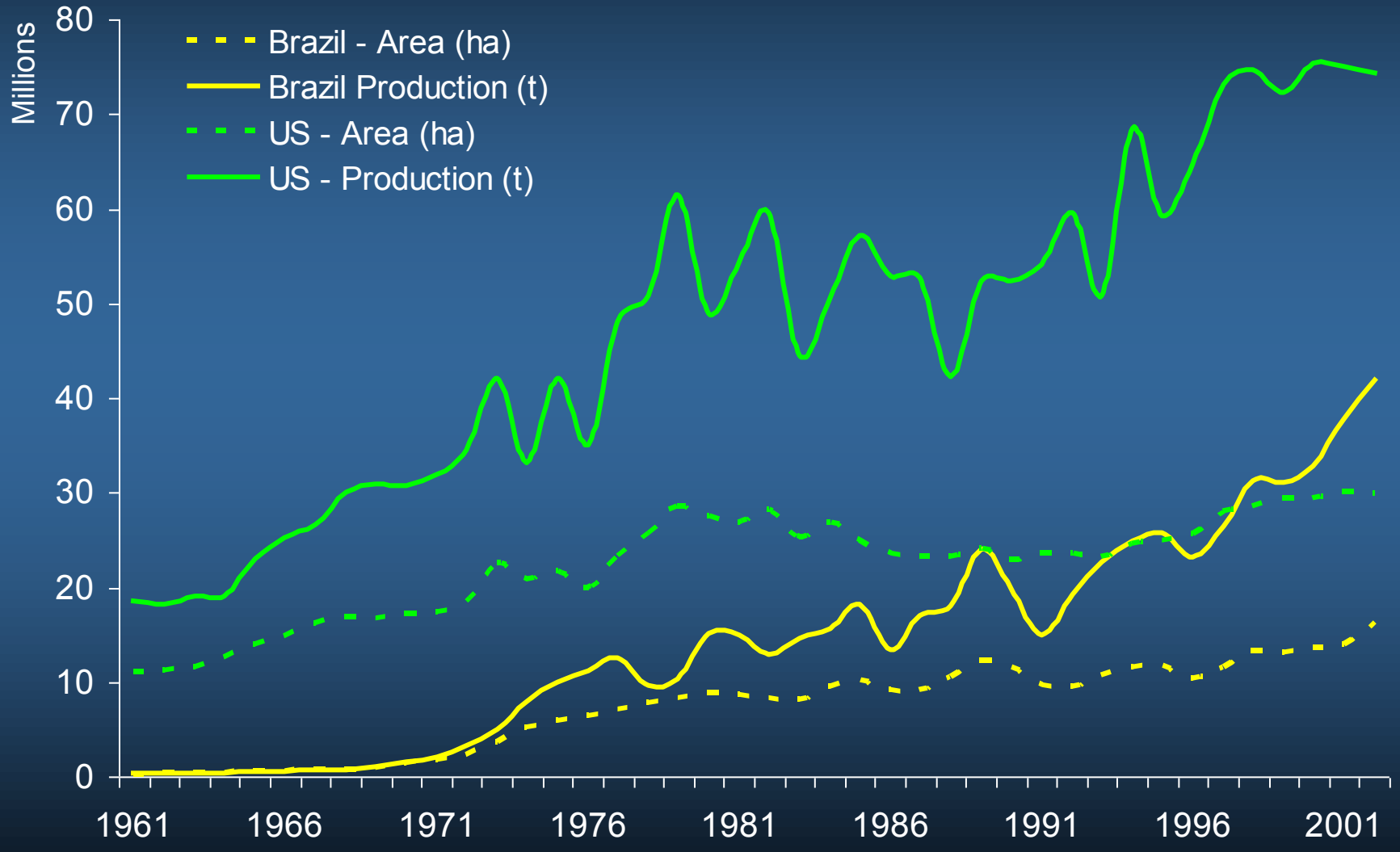


P consumption – world comparisons (kg per arable ha)



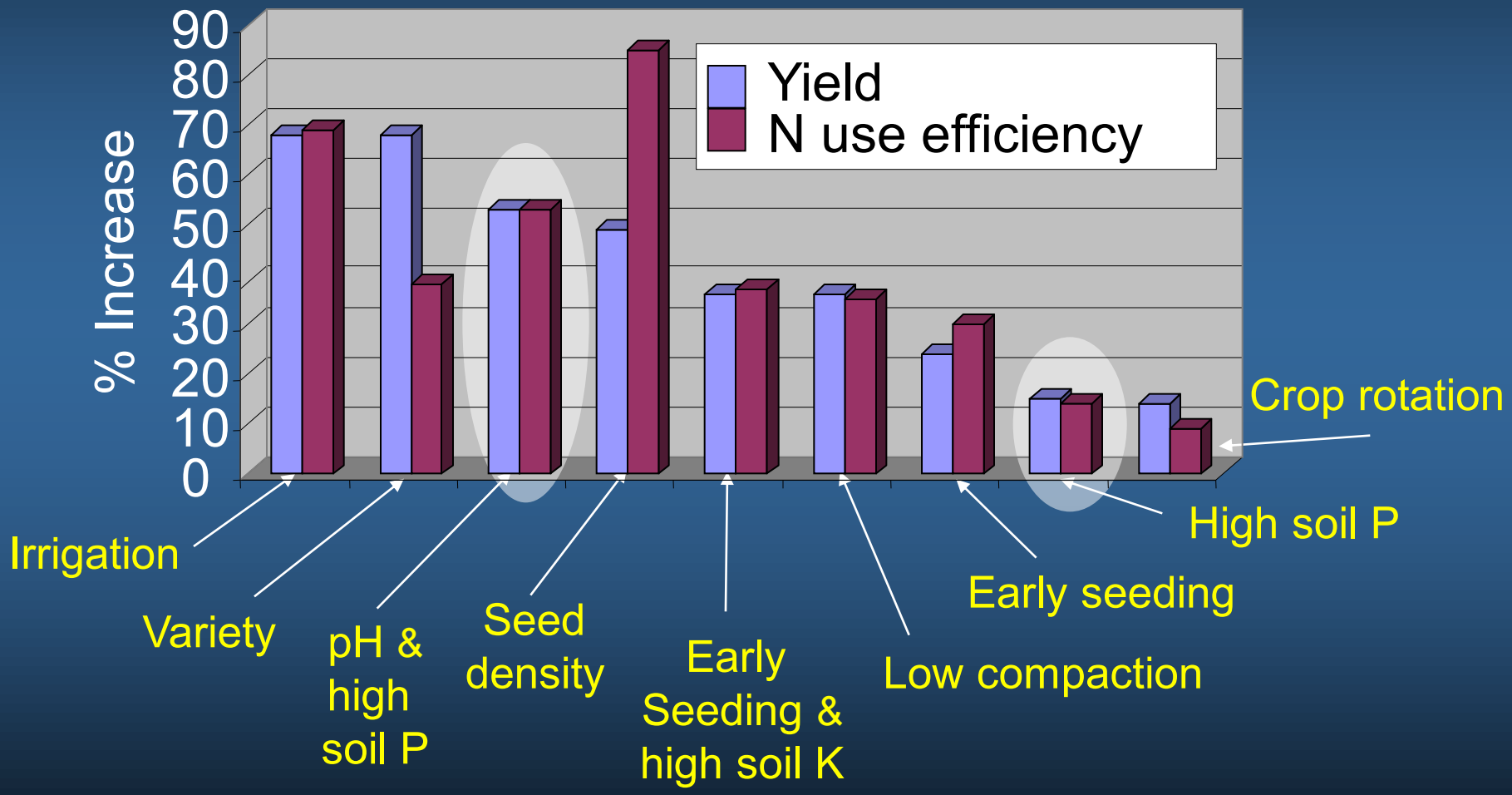
AgriStats

Soybean growth – US/Brazil



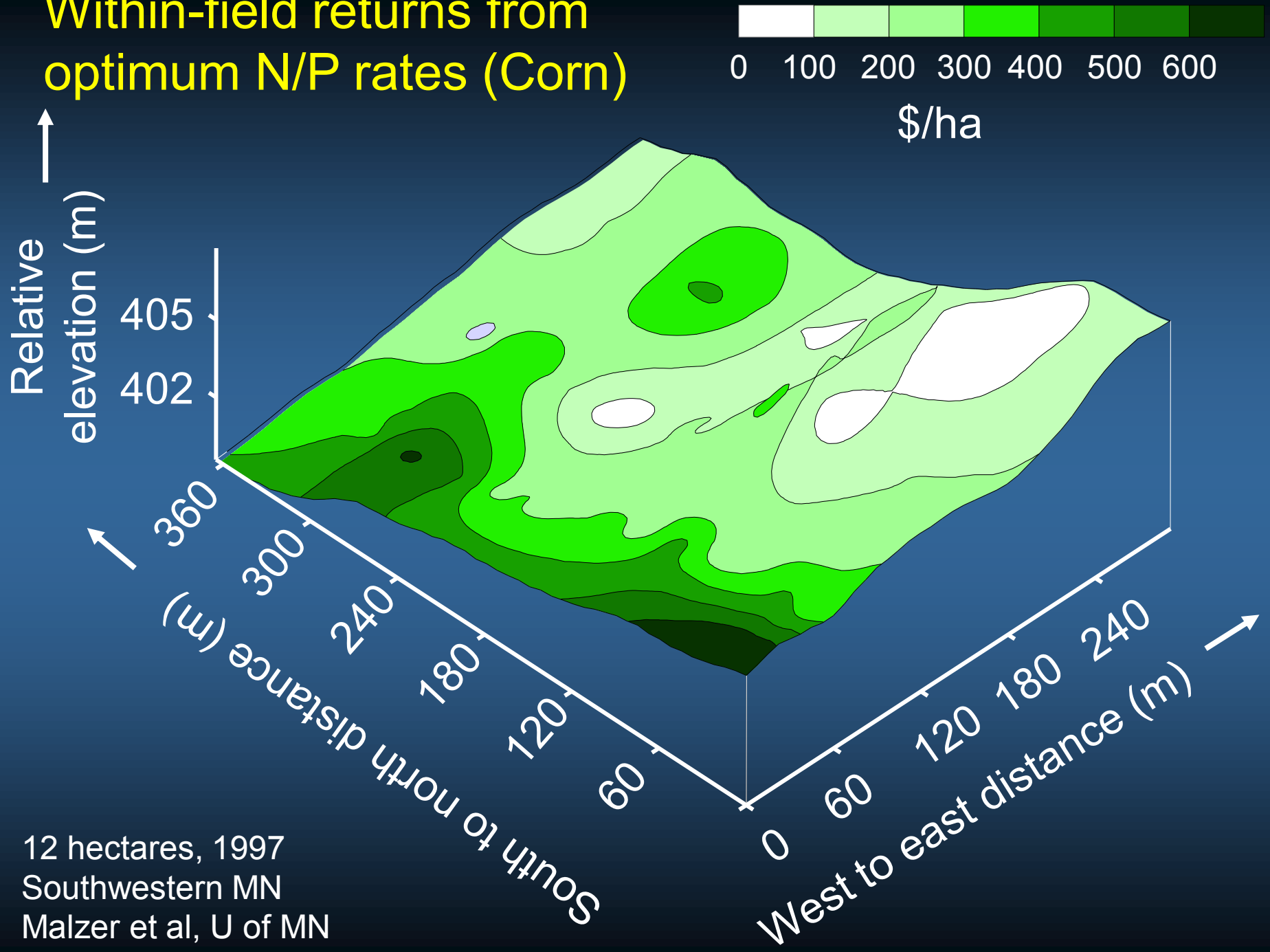
AgriStats, ANDA, NASS

Best management practices



(Corn results from several U.S. state's)

Within-field returns from optimum N/P rates (Corn)



12 hectares, 1997
Southwestern MN
Malzer et al, U of MN