

Fertilizers and the Food Challenge – Priorities for Technology Deployment

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With thanks to Sanjib Choudhuri

Today's Discussion

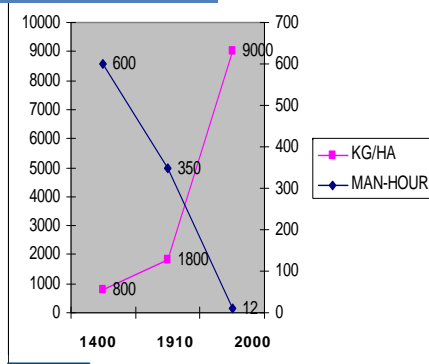
- **Megatrends in agriculture**
- **Understanding the food challenge – 2010-2050**
- **Technology opportunities for fertilizers**
- **An agenda for moving forward**

Today's Discussion

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Megatrends Agriculture

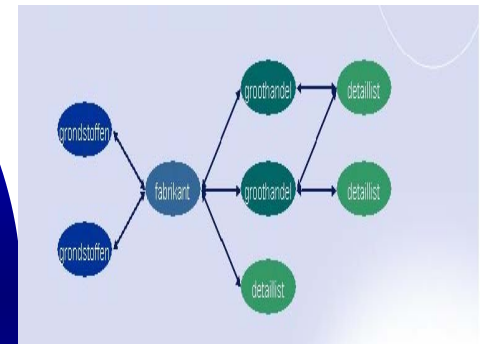
1: Productivity rise



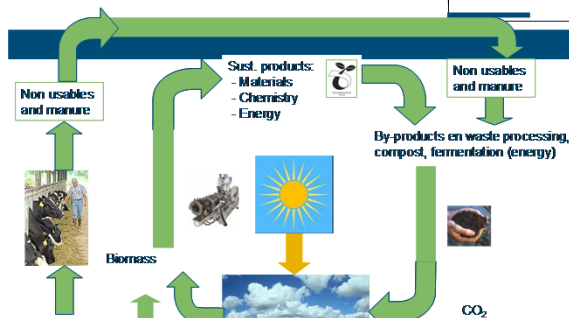
2: From craft to Industry



Megatrends



3: Chain approach

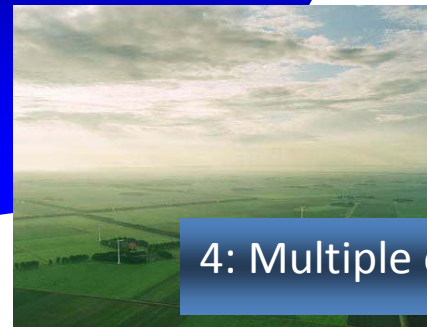


6: Bio-based economy



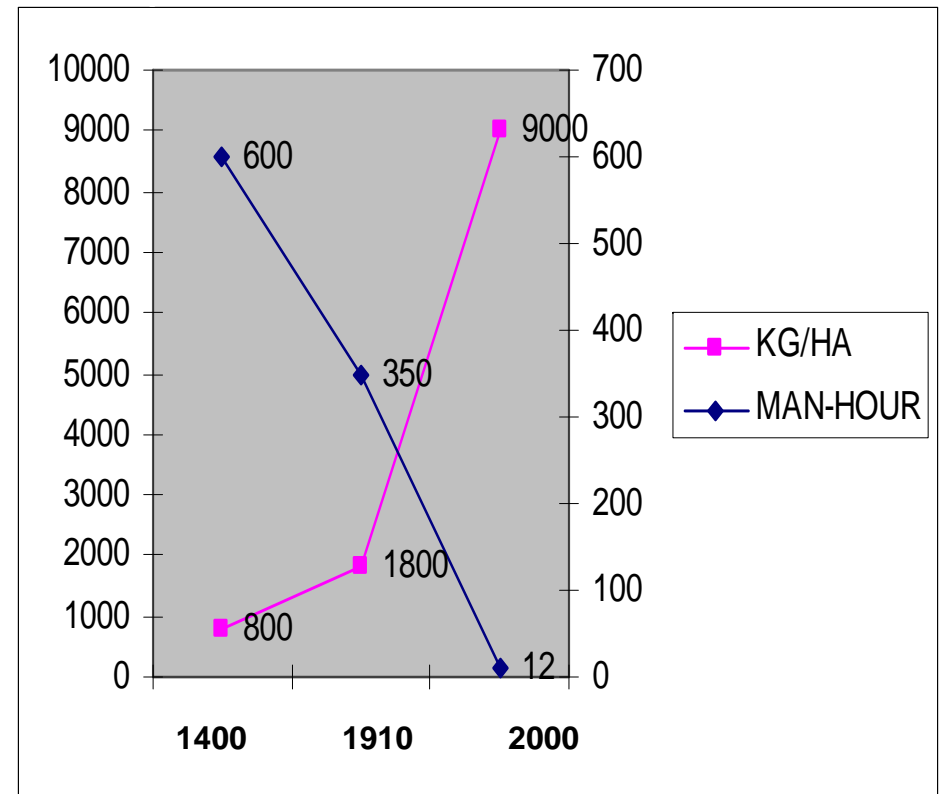
5: Food and health

4: Multiple objectives

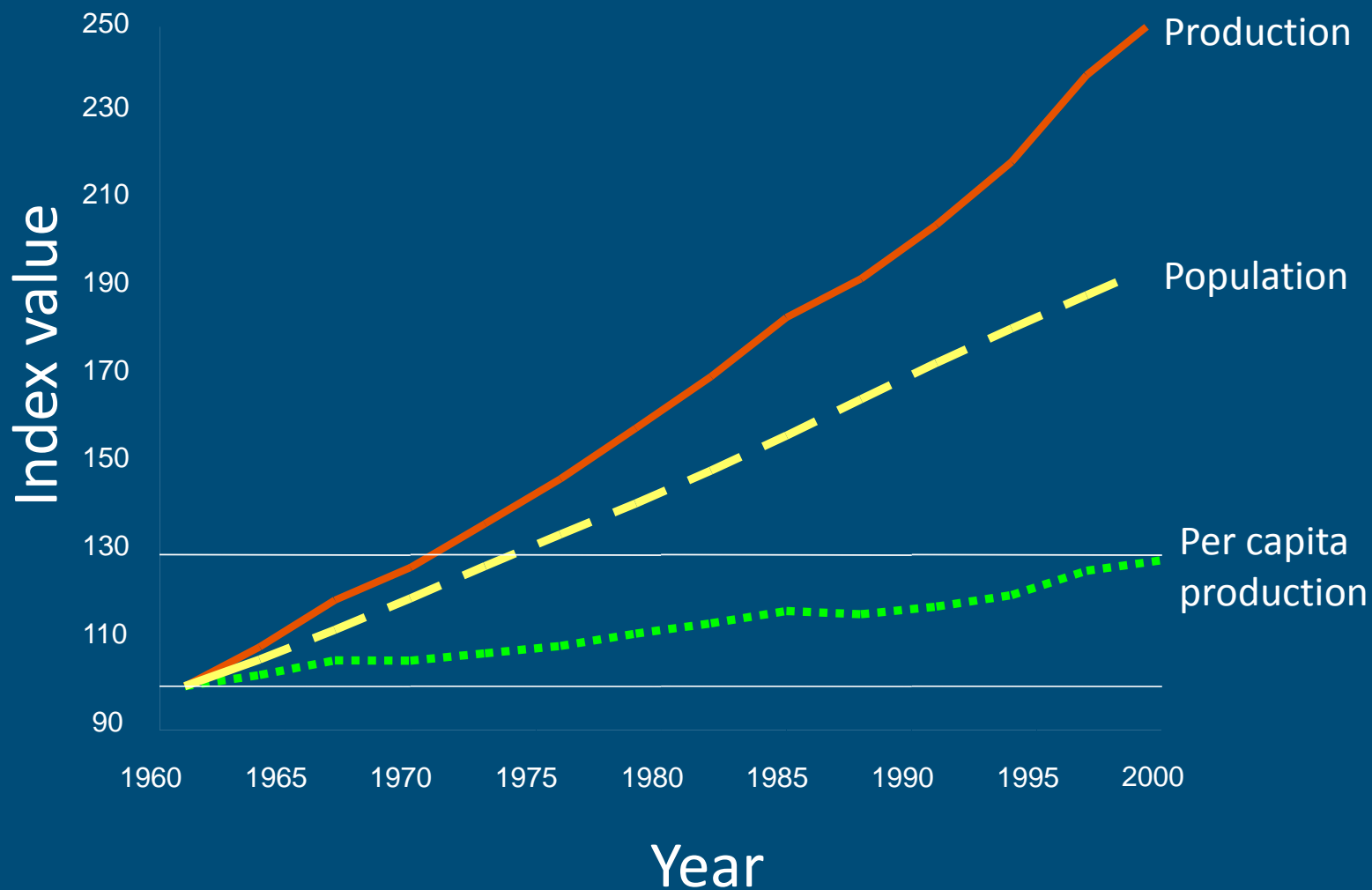


Megatrend (1): Productivity rise last century

- Land productivity
x 5 - 6
- Labor productivity
x 200 - 300
- Energy and other inputs
x 2 - 4

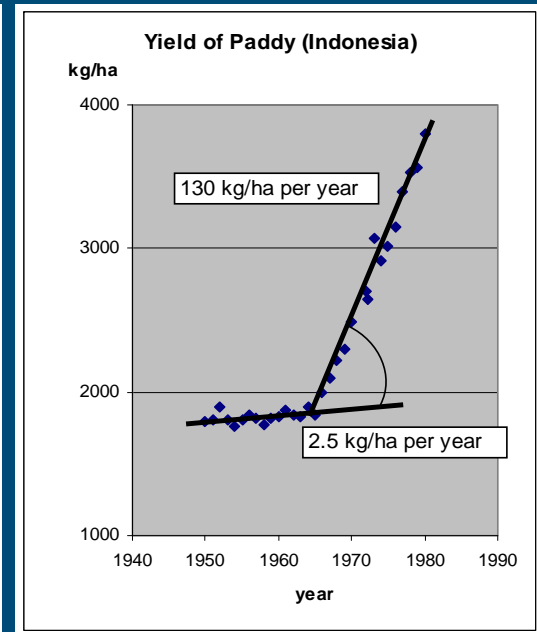
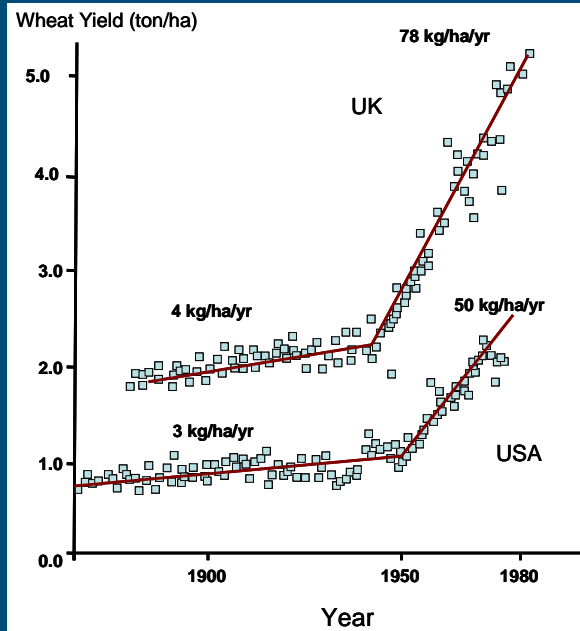
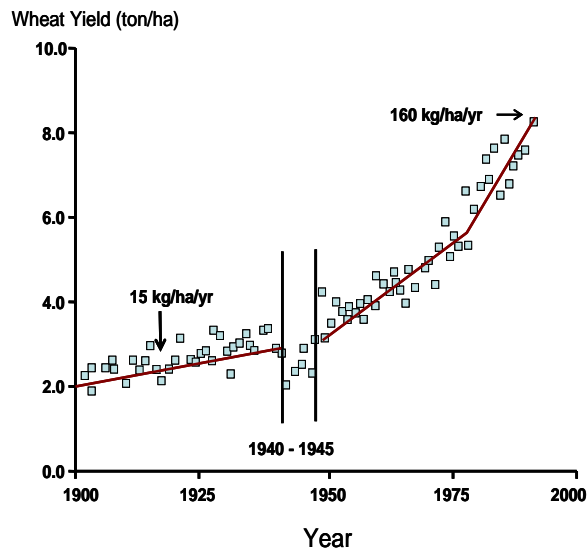


Global food production – 20th century



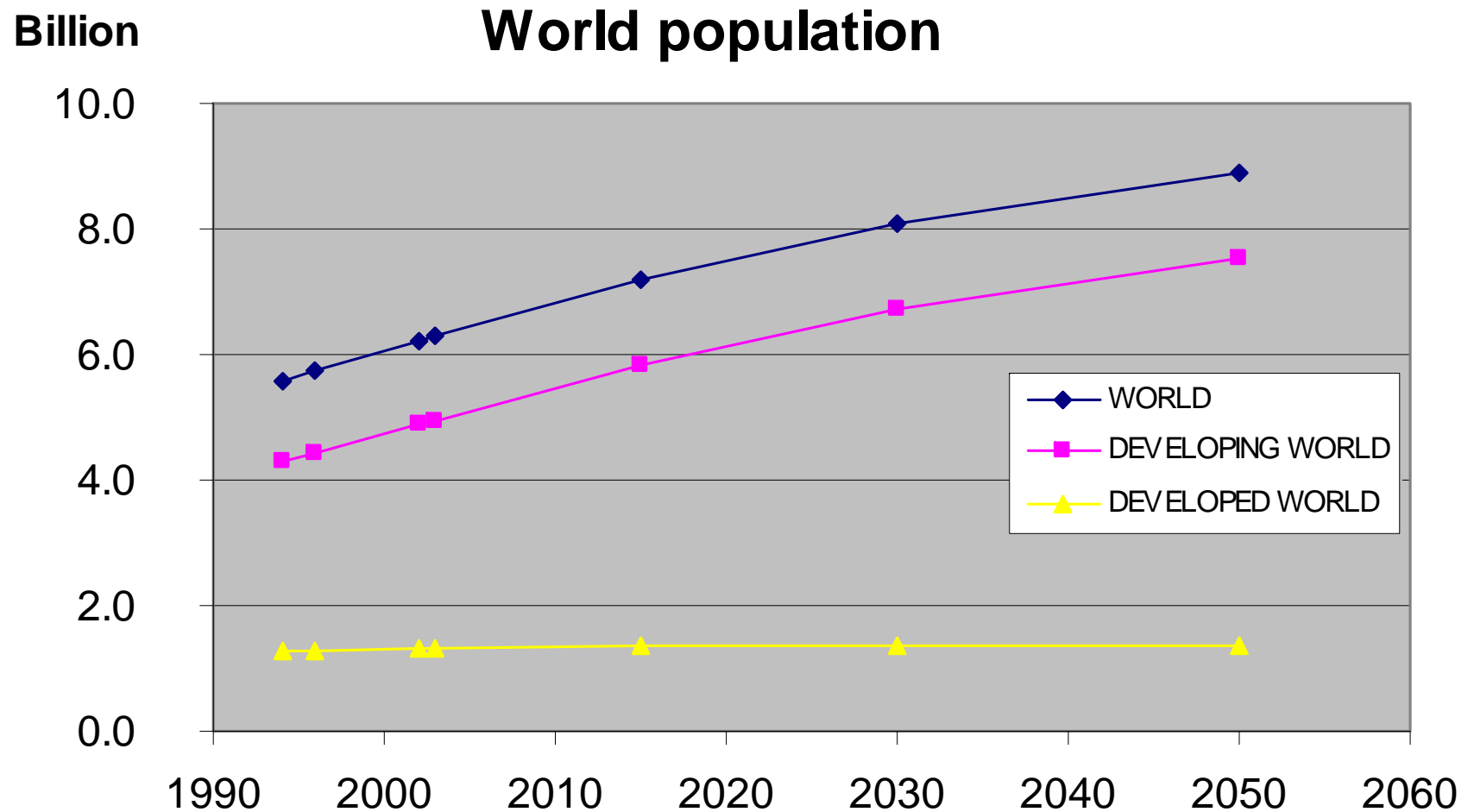
Discontinuities in production trends

Wheat Yields in the Netherlands from 1900 onwards

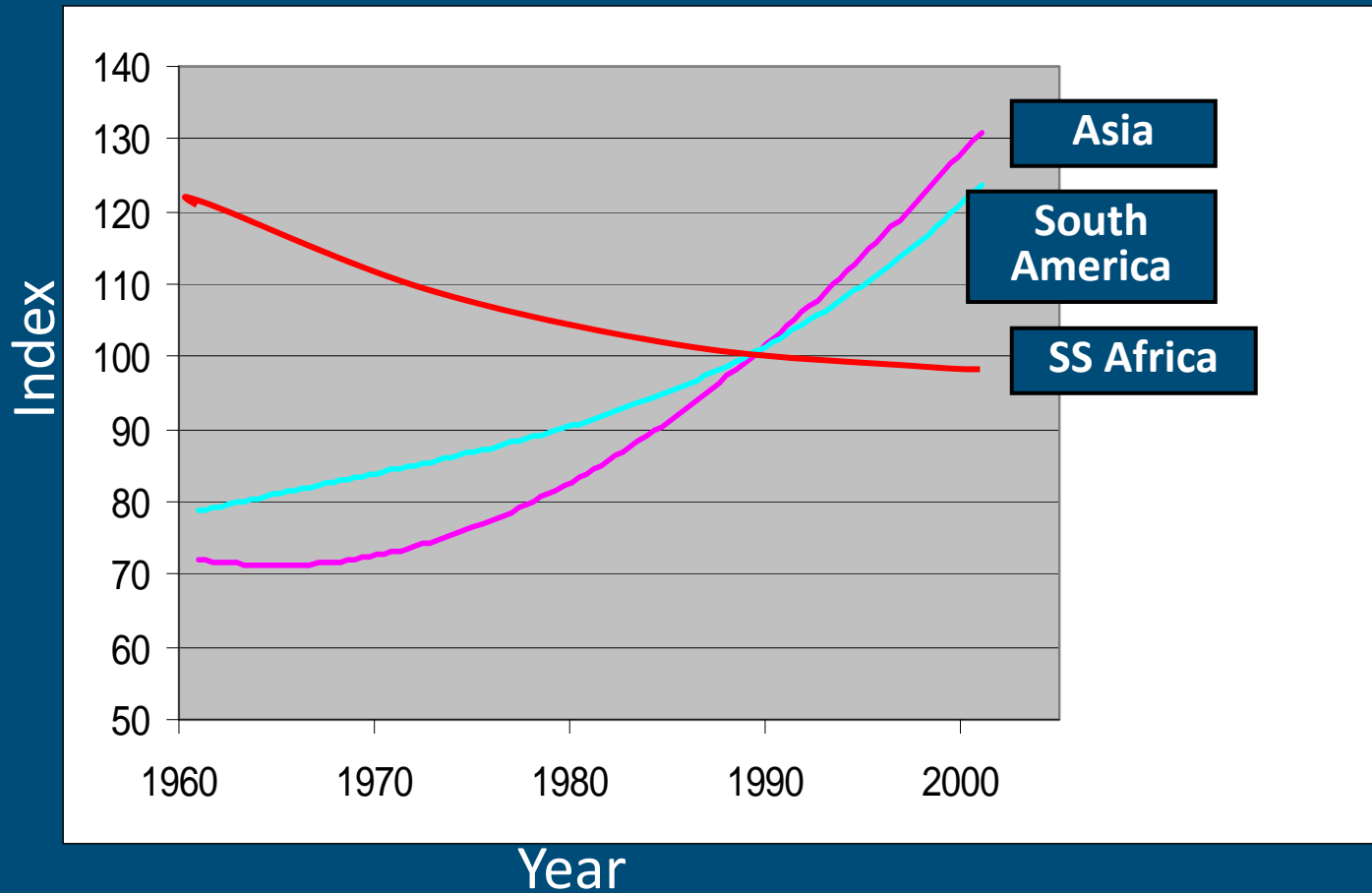


Green revolutions

Global population growth



Availability of food per capita



Source:
FAOstat

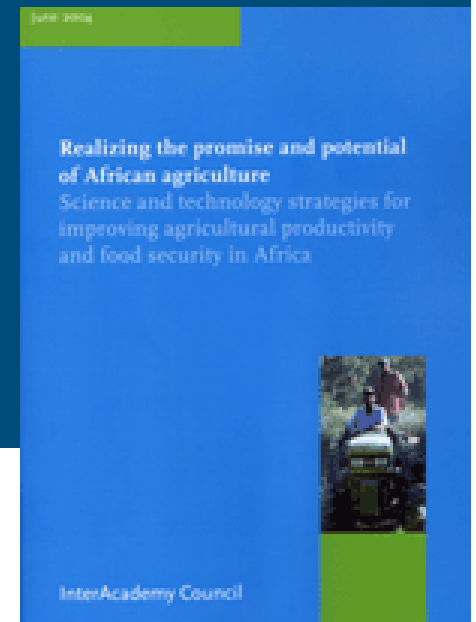
Why is Africa lagging behind?

Study by Inter Academy Council “Realizing the promise and potential of African agriculture”



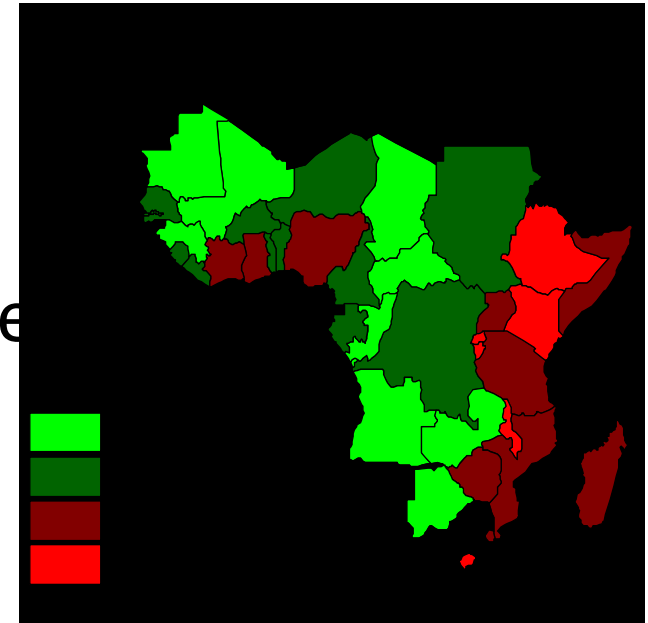
“I request the IAC a report providing a technological strategic plan to provide substantial increase in agricultural productivity in Africa”

Kofi Annan, March 2002

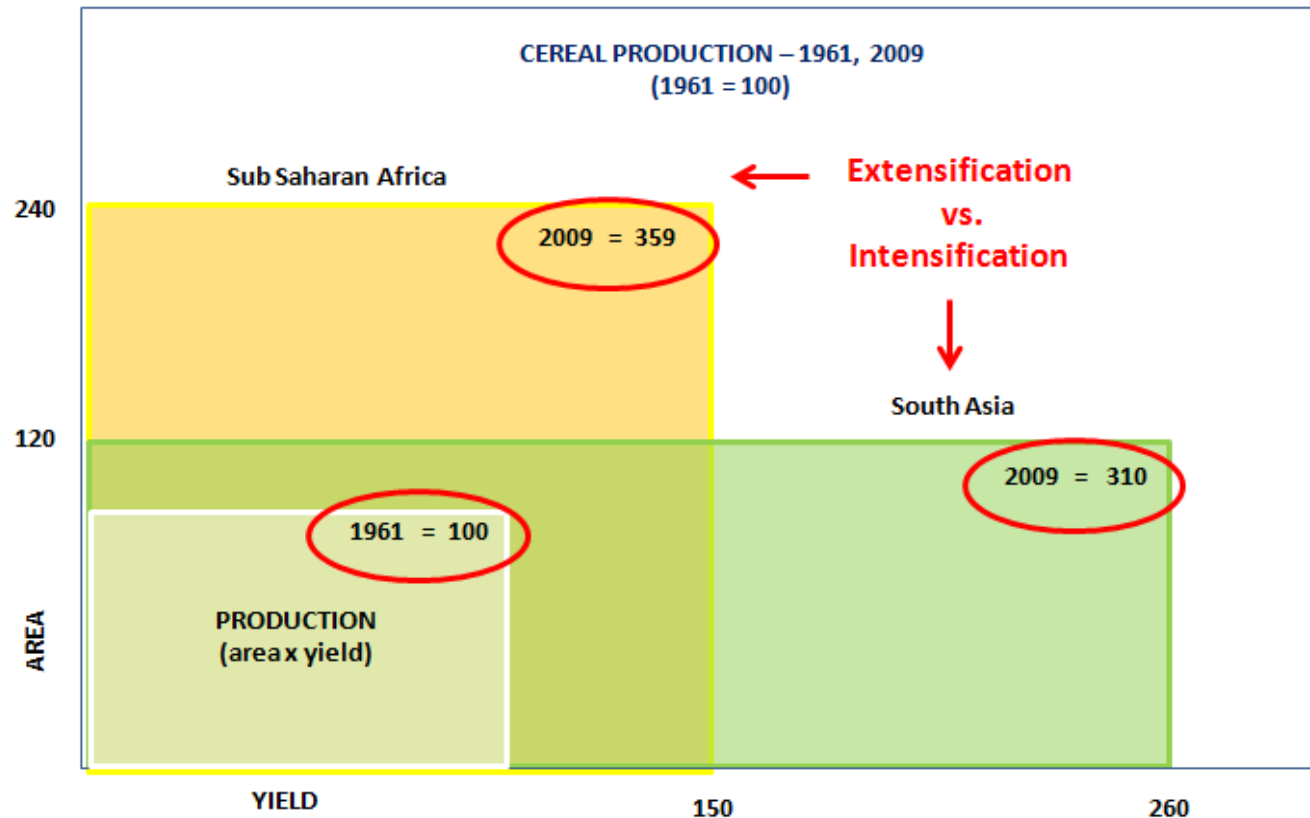


Study results (1) Problems of Africa

- Weathered soils
- Erratic rainfall
- Endemic plant and animal diseases
 - Poor resource base,
 - Vulnerable environment
- Absence of dominating food crops
- Multitude of farming systems
 - Need for many different technologies



Sub-Saharan Africa a special challenge...



**Extensification no longer viable in Sub-Saharan Africa –
depleted land, diminishing per capita land advantage**

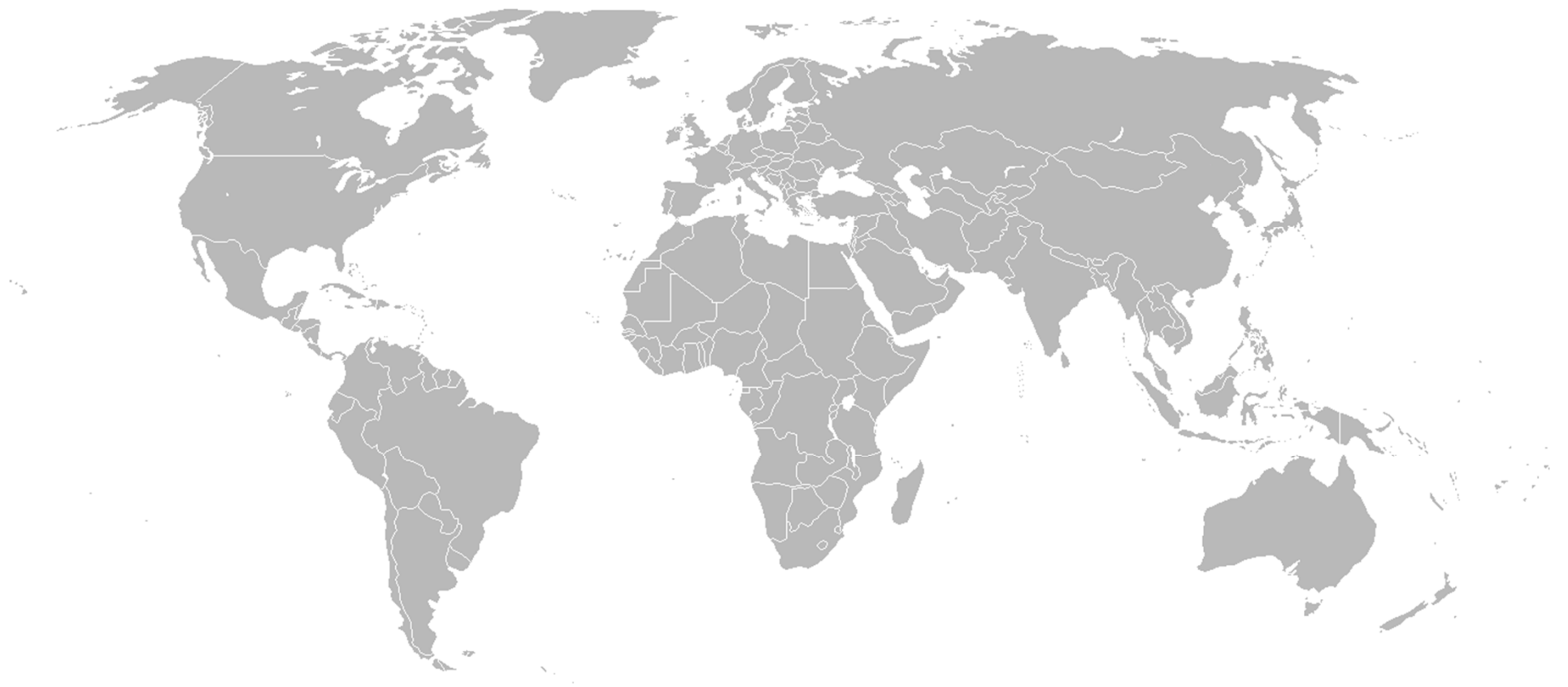
Study results (2) Problems of Africa

- Dominant role for women – limited access to resources
 - Land and Labor productivity low
- How to become competitive?

- Lack of investment in agricultural research
 - Lack of knowledge infrastructure
 - Lack of functioning academic institutions
 - Brain drain
- Need for investment in research and education

Study results (3) Problems of Africa

- Not functioning local and regional markets
 - Land entitlement inappropriate
 - No stimulating political and economic environment
 - Inadequate capacity to impact global policy formulation
 - Lack of good governance
- Need for renewal of institutional arrangements



A way forward

IAC report: Strategic recommendations

- Technology options that can make a difference (11)
- Building impact-oriented research, knowledge and development institutions (5)
- Creating and retaining a new generation of agricultural scientists (5)
- Markets and policies to make the poor prosperous and food secure (5)
- Increase investments in agriculture and infrastructure



Priority Farming Systems

Major Farming Systems

Middle East and North Africa








Sub-Saharan Africa



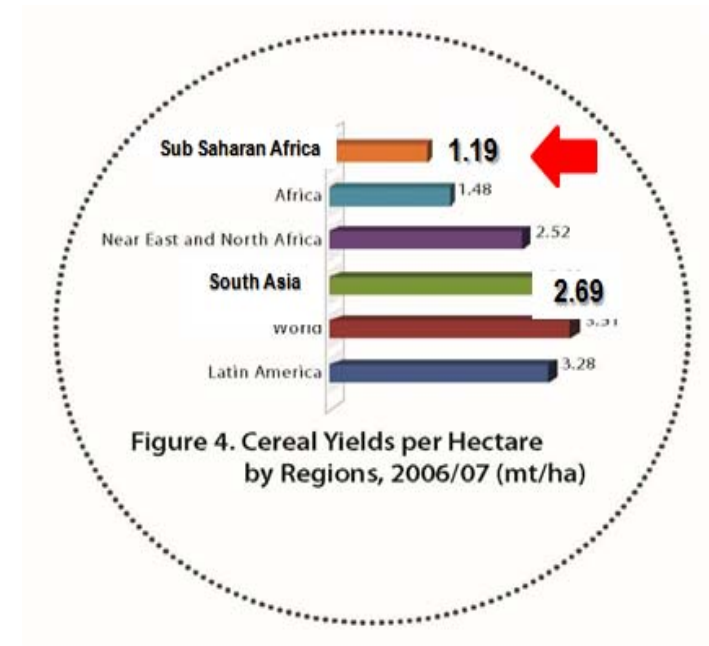
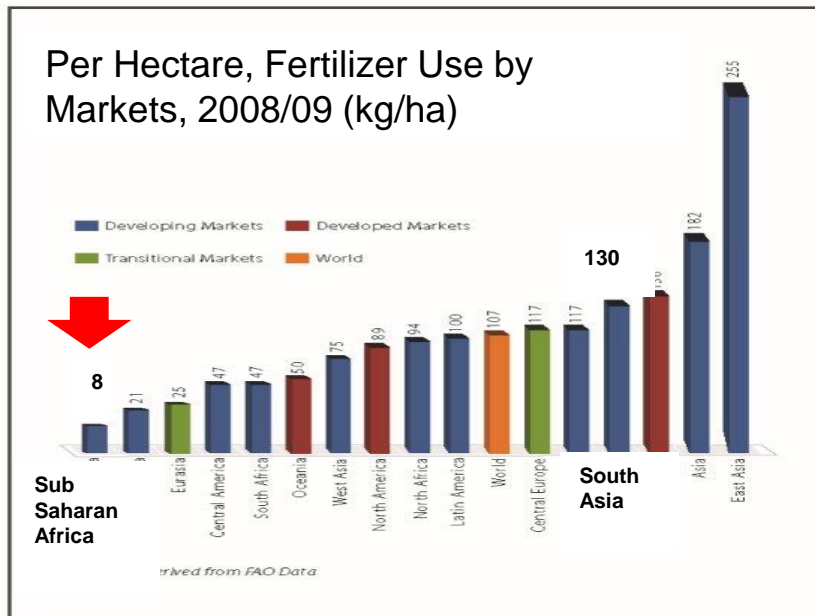
Notes:
Projection = Geographic (Lat/Long)

FAO Disclaimer

The designations employed and the presentation of the material in the maps do not imply the expression of any opinion whatsoever on the part of FAO concerning the legal or constitutional status of any country, territory or sea area, or concerning the delimitation of frontiers.

-  Irrigated system
-  Maize mixed system
-  Tree crop based system
-  Cereal root crop mixed system
-  Hunger Hotspot (CIESIN)

Sub-Saharan Africa a new fertilizer opportunity



- increased fertilizer usage needed in Sub-Saharan Africa - to reverse historical 'soil nutrient mining' impact, increase yield
- AGRA target (50kg/ha) = +25 MMT NPK/ \$35 billion FOB per year

Today's Discussion

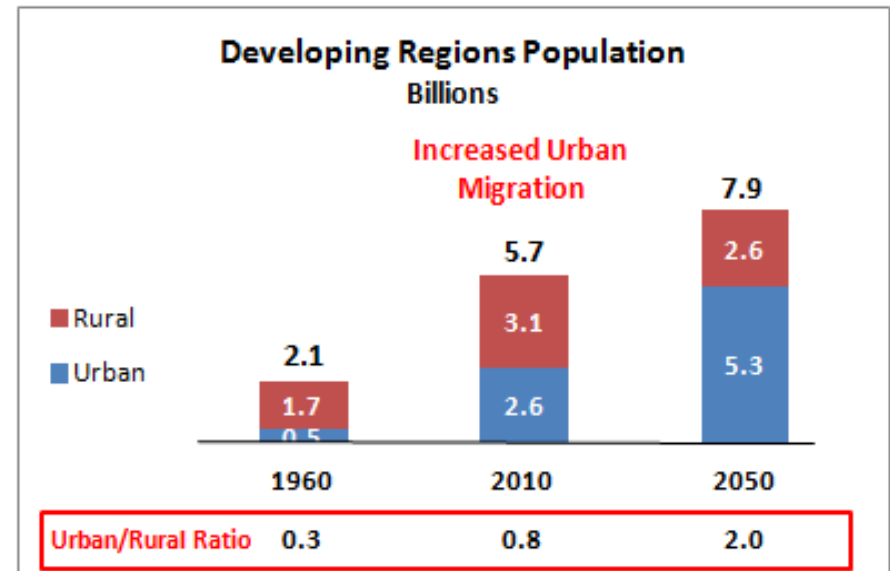
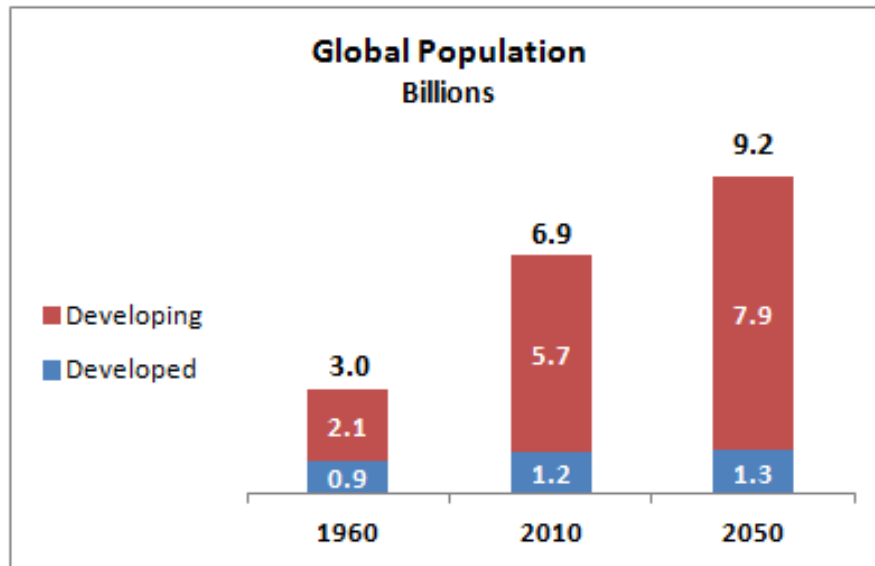
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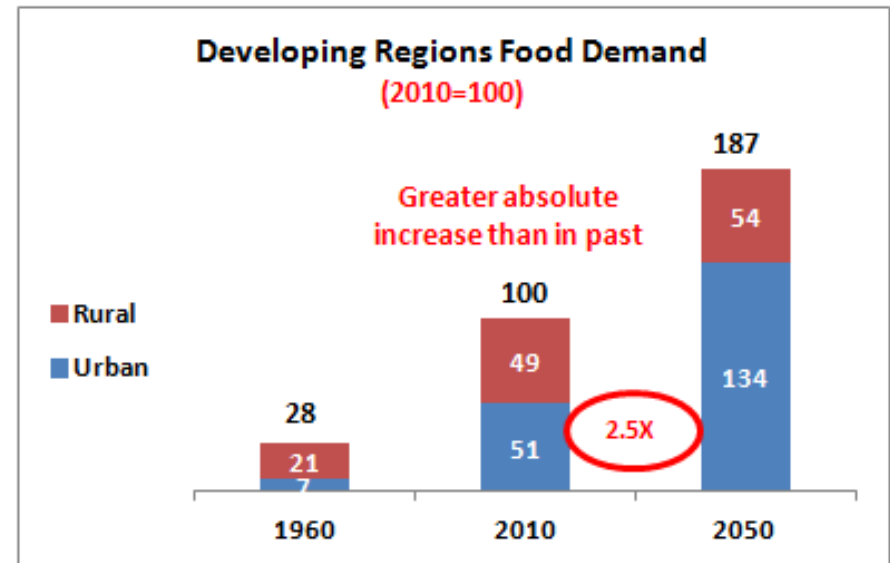
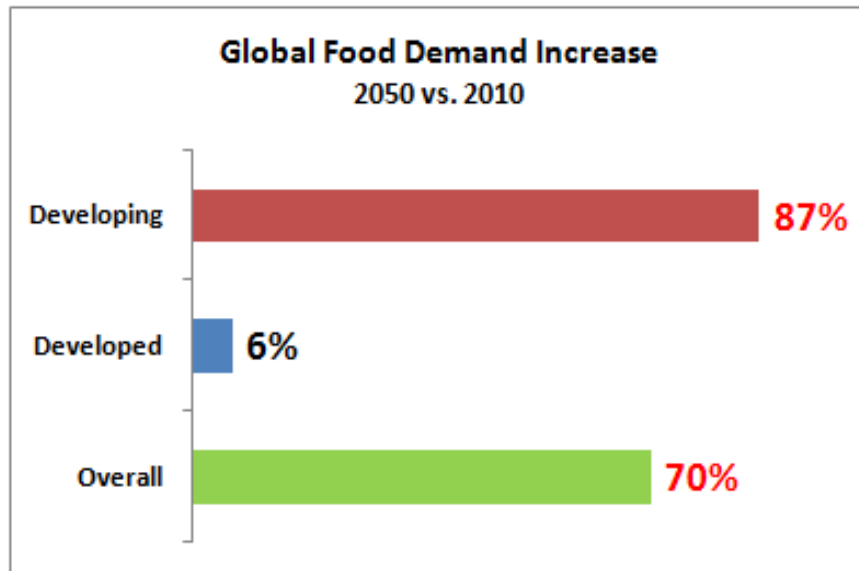
Population in developing regions - urban doubling, rural slowdown



Implications:

- Increased competition for already scarce resources – land, water
- Challenging farmer productivity - 1.5x more urban mouths per farmer
- Must avoid 'starving rural' being substituted by 'hungry urban'

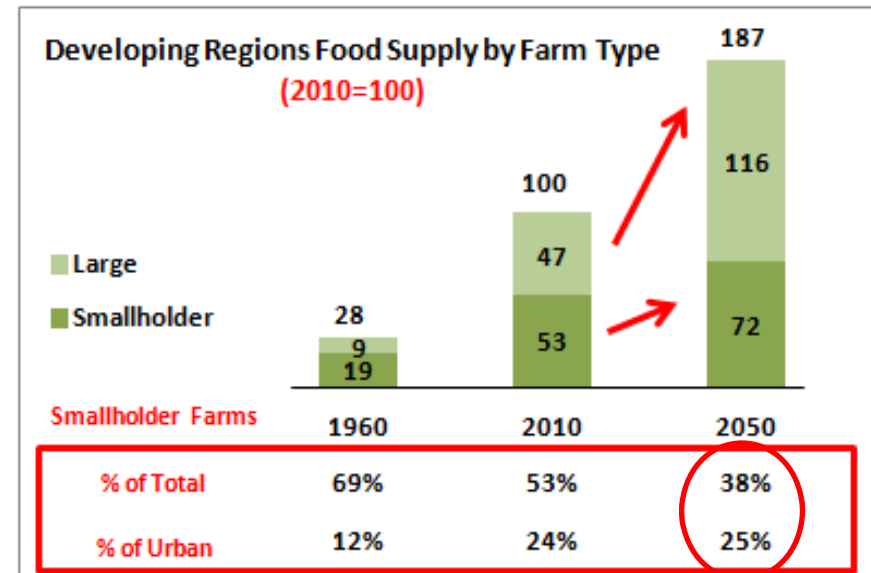
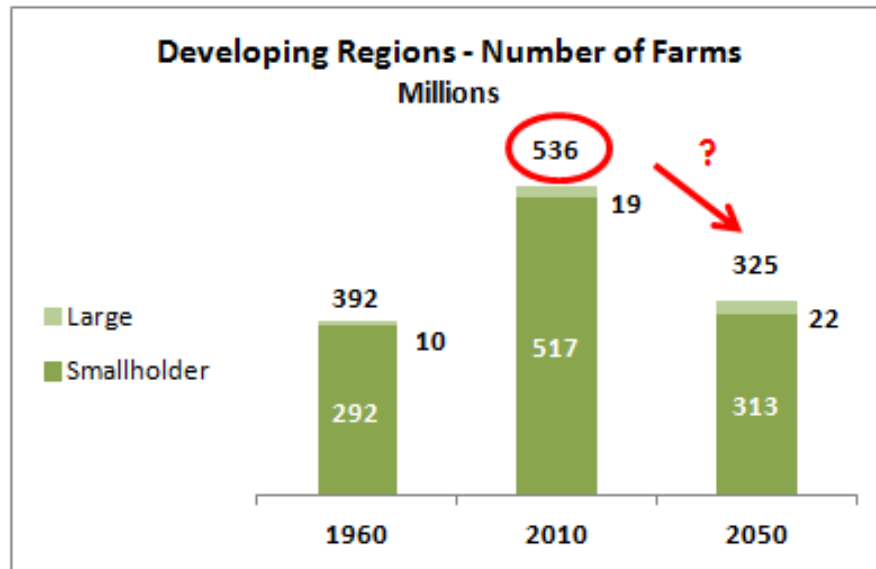
Demand increase - urban growth in developing regions



Implications:

- Near doubling of food output under tougher conditions – land, water, climate
- Absolute increase greater than achieved with ‘Green Revolution’
- Large infrastructure expansion to move 1.5x more food to urban markets

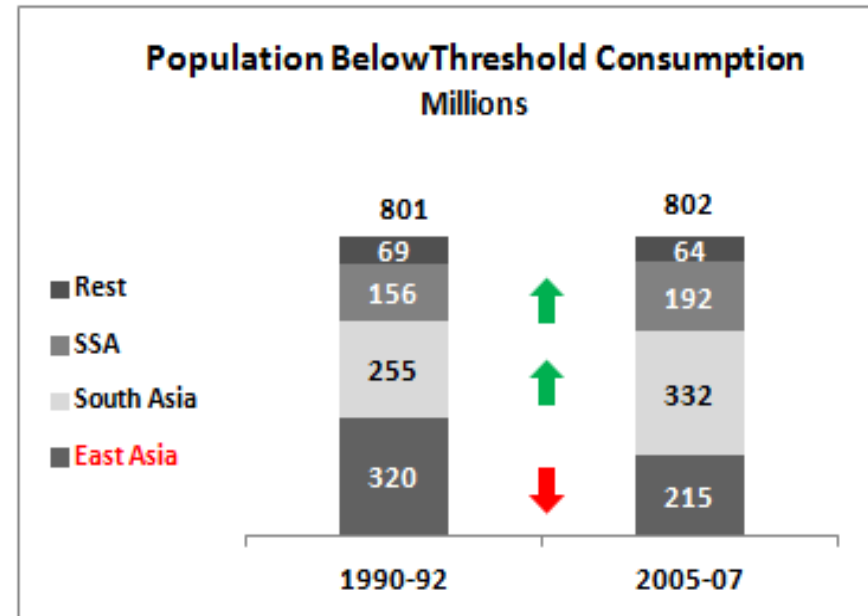
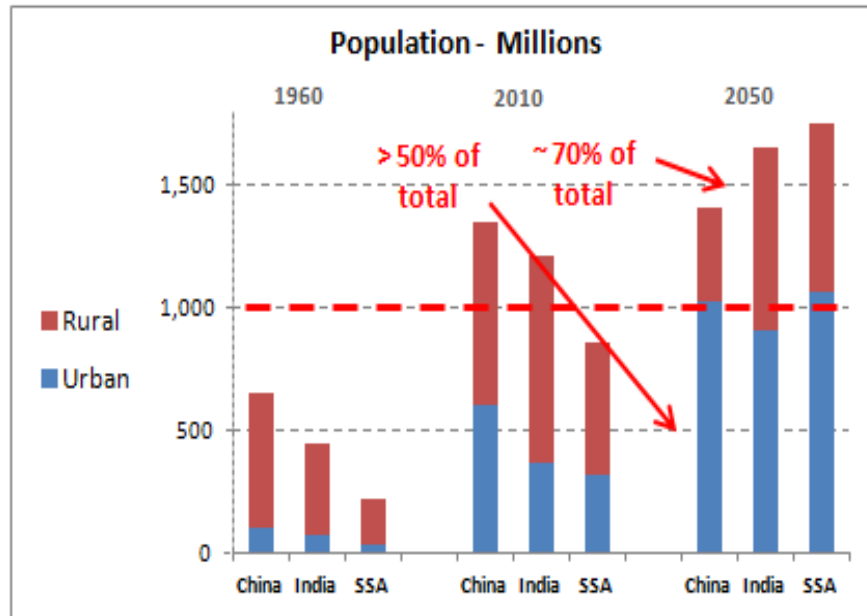
Supply - fewer farms, smallholder farms remain key



Implications:

- Land use policies must maintain agricultural acreage despite fewer farms
- Must increase smallholder farm productivity and output for urban supply
- Infrastructure needed for reliable, affordable access to agri-inputs, markets

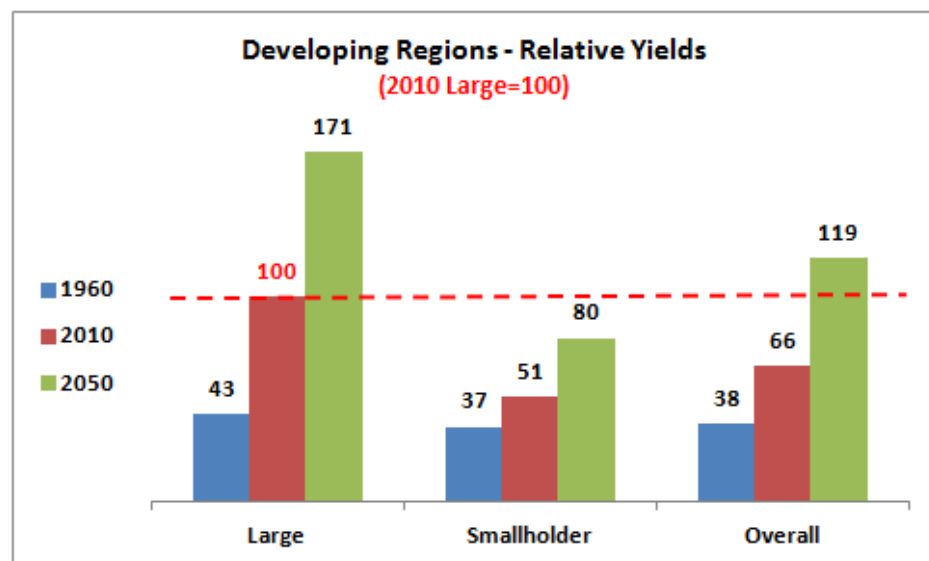
‘Billion plus Club’ – key to developing regions



Different challenges:

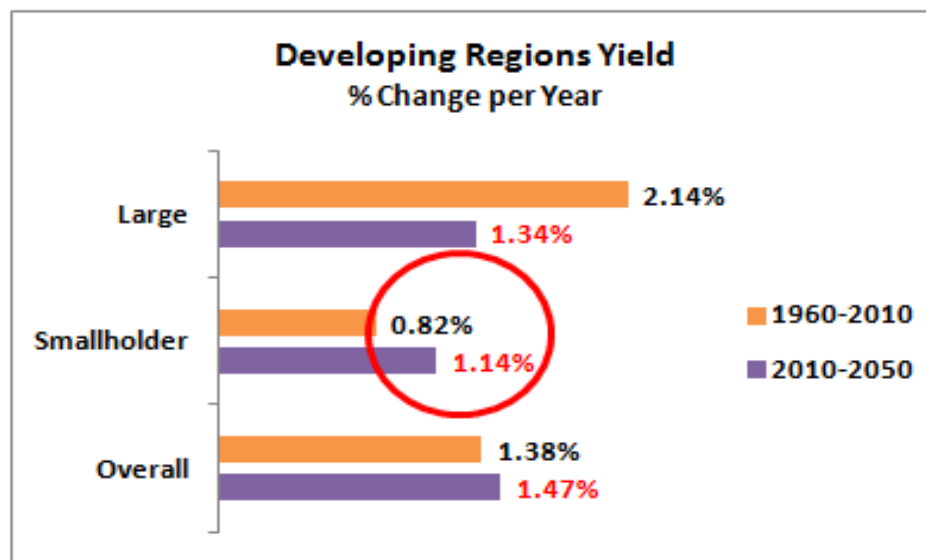
- China – Rapid urbanization, already high urban/rural population
- India, Sub-Saharan Africa - large urban shift, large marginal population

Yield – challenging increase for smallholder farms



Large farms will continue to drive overall yield in developing regions

Smallholder farms must also contribute to overall yield increase

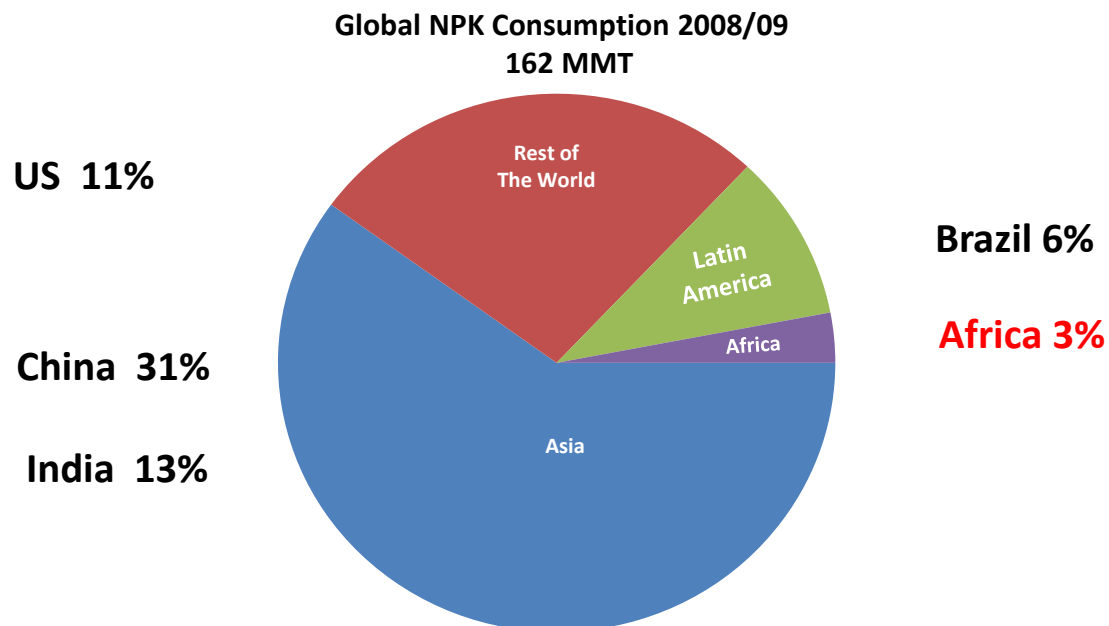


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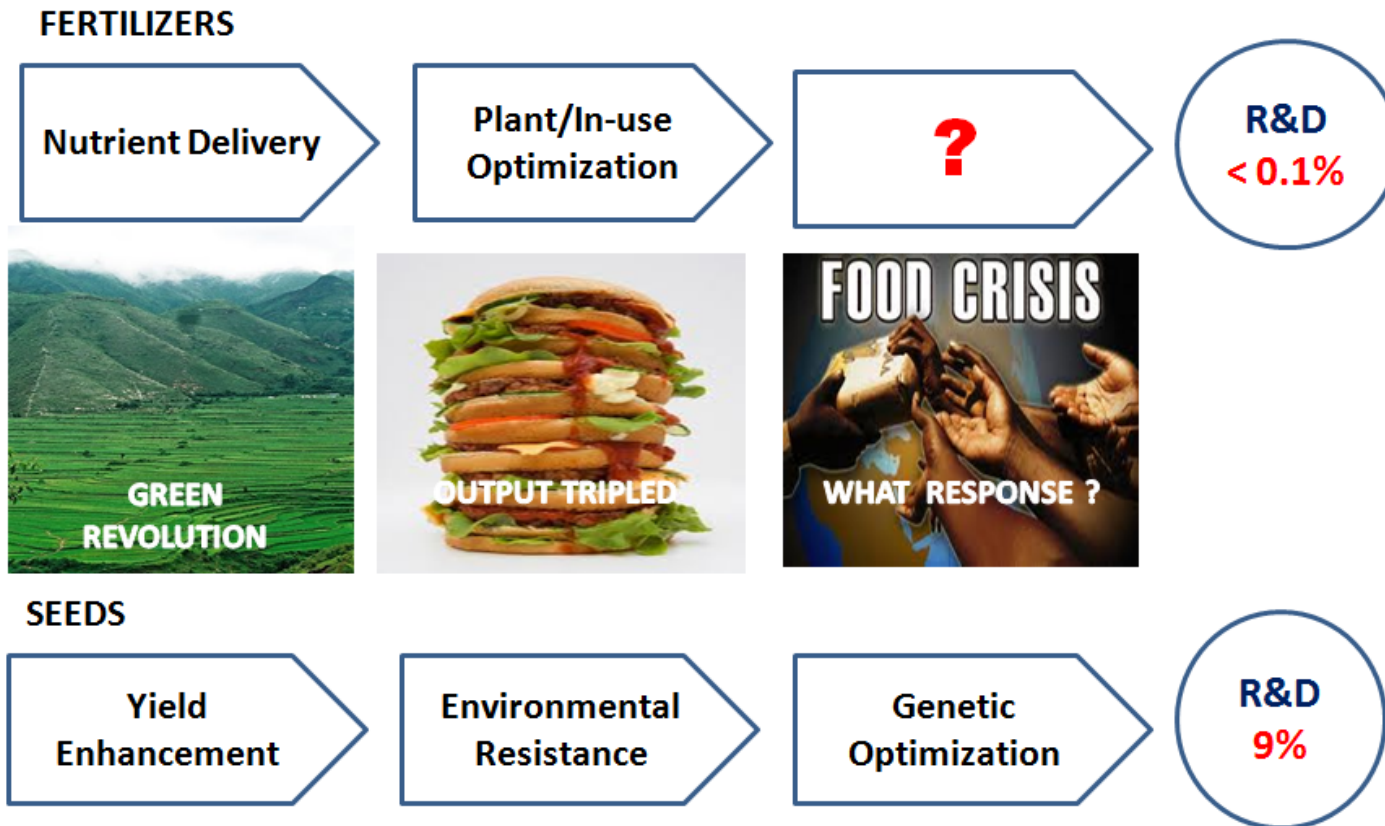
Developing regions - majority of global fertilizer usage

Fertilizers
45-50% of yield



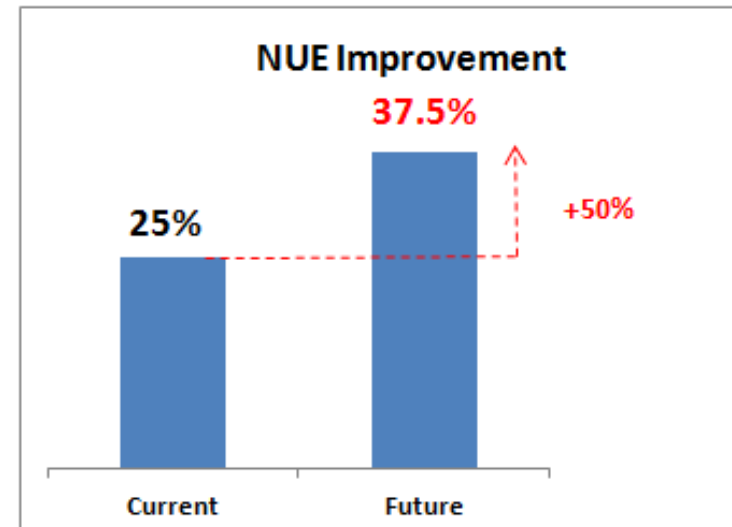
	Millions MT 2009		\$ Billions
	Nutrient	Fertilizer	FOB 2010
Nitrogen	105	263	144
Phosphorous	38	95	62
Potassium	21	36	18
Total NPK	164	393	224

Industry's technology focus - optimization



Fertilizers essentially unchanged since early 1980s

NUE opportunity example – Urea in developing regions



Improved Yield	Investment Productivity	Environmental sensitivity
+15%*	\$7-8 billion per year**	\$1.5 billion/yr carbon tax offset***

*IFDC UDP experience

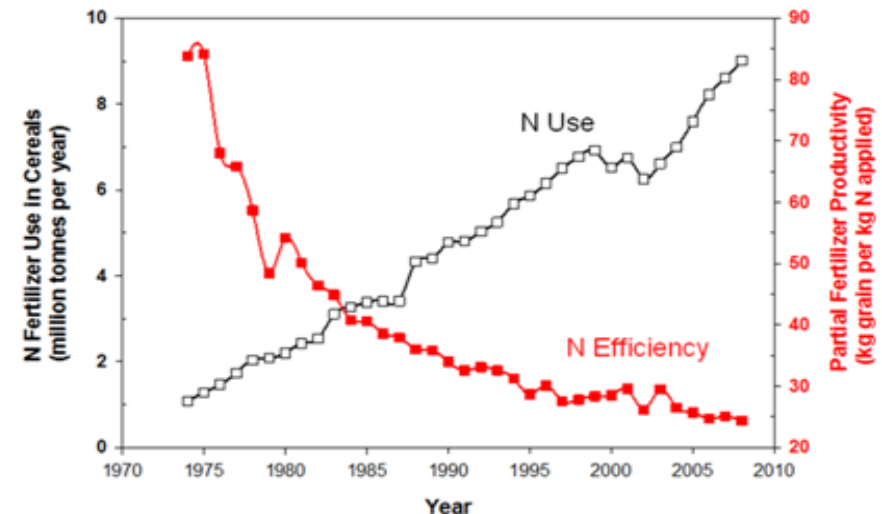
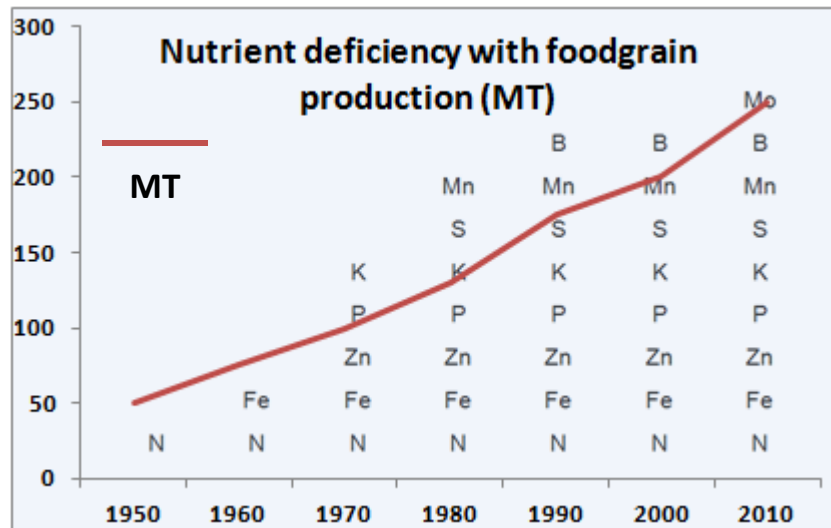
** @100 MMT urea per year currently

*** \$25/MMT CO₂ GHG equivalent

Micronutrients – health and yield opportunity



INDIA



- More assured availability in developing regions
- Greater application convenience, especially for smallholder farmers
- Supportive regulatory and subsidy policies

Opportunities in fertilizer sourcing

N fertilizers

- **Prevalent Haber-Bosch method** uses natural gas for H feedstock
 - Ties pricing to globally traded non-renewable fossil fuel
 - 'Forces' importation by gas-poor countries (e.g. India)
- **Complex capital-intensive facilities** disallow dispersed production points closer to markets

P fertilizers

- **Prevalent phosphoric acid method** uses high-grade phosphate rock
 - 50% nutrient recovery
 - Inefficiencies imbedded in fertilizer price
 - Large waste streams
- **Locally available phosphate rock** (e.g. In Africa) generally uneconomic with current technology

- **Greater self-reliance – local feedstock (hydrogen, phosphate rock)**
- **Improved economics – higher recovery efficiencies, lower capital intensity**
- **Smaller environmental footprint – lower waste streams**

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Adopt a focused 'technology agenda'

TARGET OUTCOME

Responsible, sustainable food security

- Higher, more assured yield at lower cost
- Improved human health
- Smaller environmental footprint
- Greater nutrient self-reliance

TECHNOLOGY PRIORITIES

Focus on N&P fertilizers for South Asia and Sub-Saharan Africa

- Improve NUE by 25-50% at affordable cost
- Reduce the risk of failed yields for smallholder farmers
- Increase the convenience and accuracy of delivering secondary and micro nutrients
- Reduce sourcing costs, increase self-reliance with alternatives and improvements to current production processes

TARGET OUTPUT

New 'intelligent' fertilizers

- Fail-safe
- Adaptive
- Eco-sensitive
- Economical

Virtual Fertilizer Research Center (VFRC)



- **Managed under IFDC**
- **Led by global Board of Advisors**
- **Supported by Advisory Committees**

VFRC VISION

The world's smallholder farmers have ready access to sustainable, affordable, efficient and environmentally friendly fertilizers.

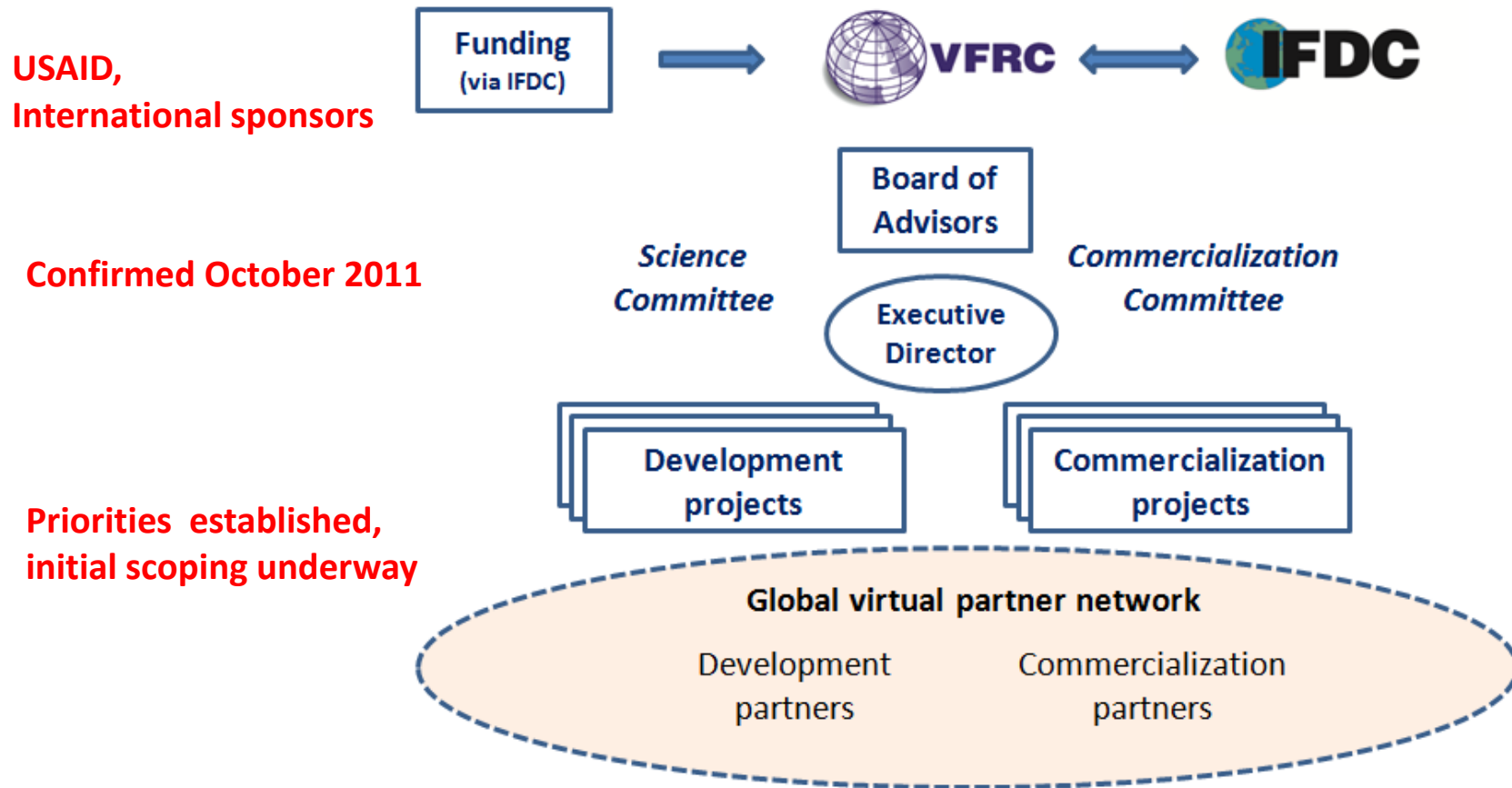
VFRC MISSION

Through collaborative research and development, the VFRC will help develop and introduce the next generation of the world's fertilizer products and technologies necessary to benefit smallholder farmers in the developing world.

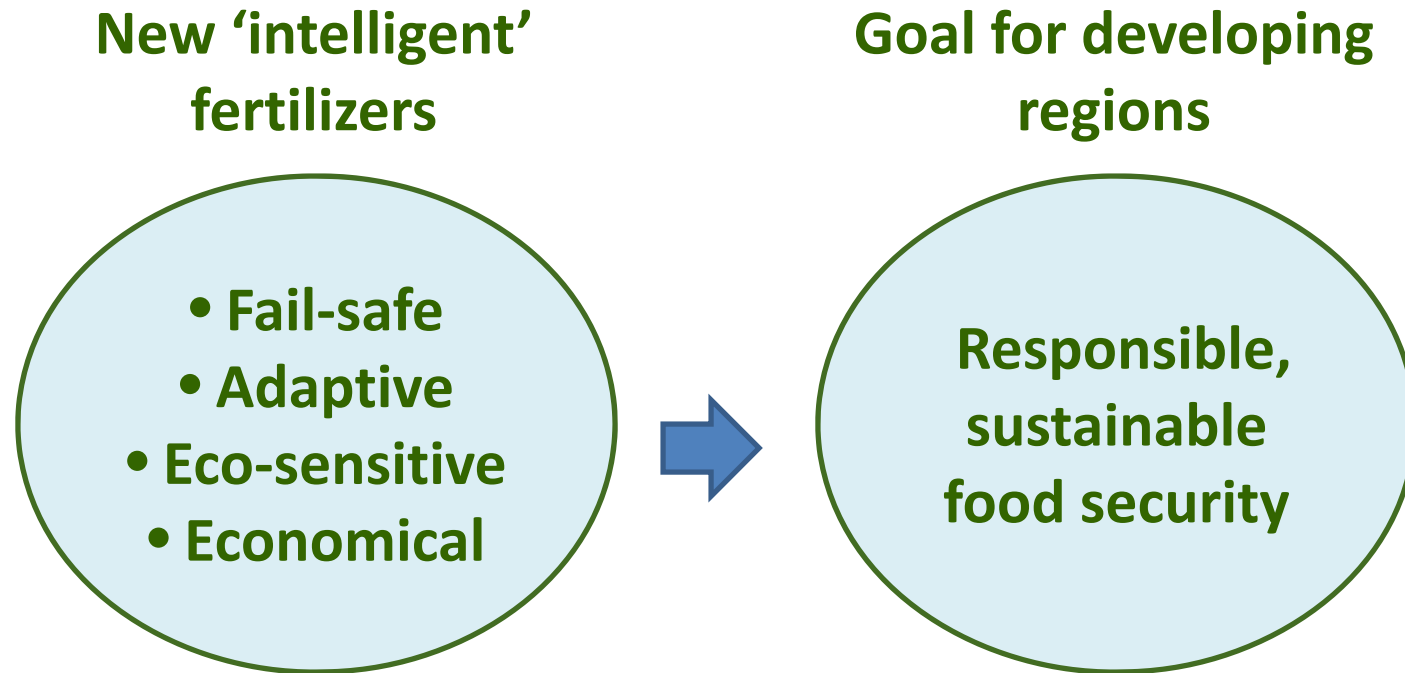
Facilitate a co-ordinated program

- **Multiple initiatives** over time supporting a common agenda
- **Multiple ‘partner teams’** in several locations
- **Differing timelines** for development and commercialization
- **Many distinct jurisdictions** for ‘review and approval’
- **Many financing sources** and approaches (funding, in-kind)

VFRC Organization



Fertilizers and the Food Challenge



Thank you!