Better Soil, Water, and Land Management – Essential for Sustainable Agricultural Growth

FAO –CIAT GSP meeting
March 25-27, 2013

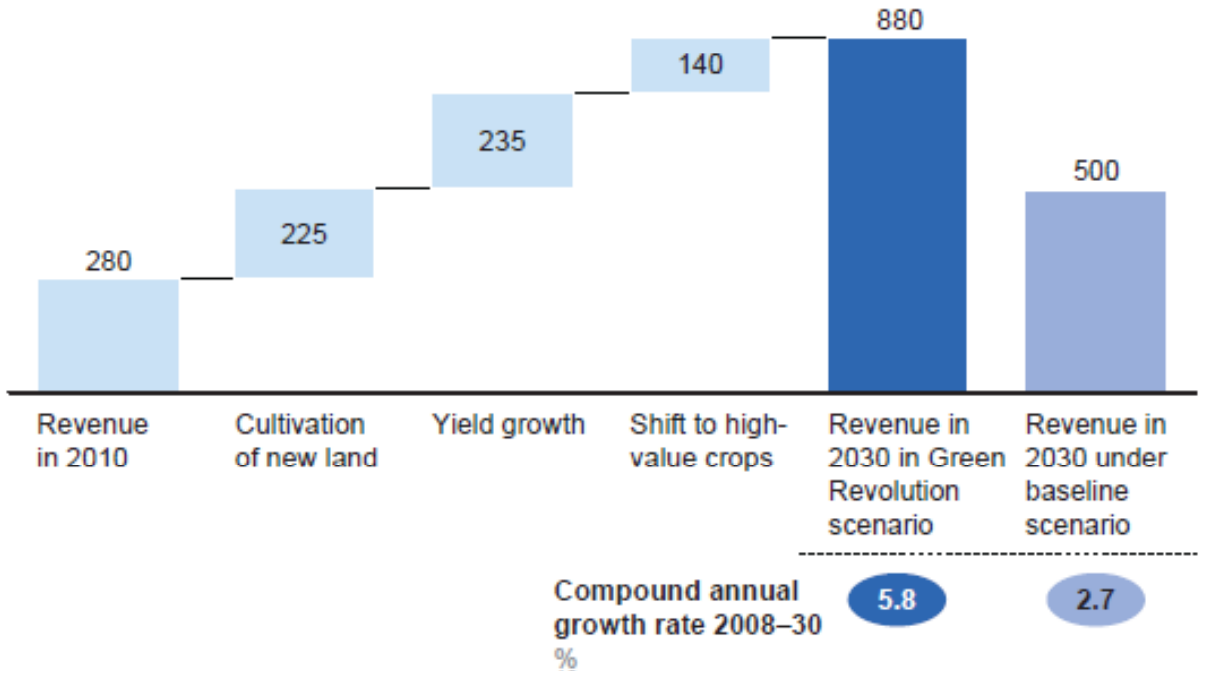
Dr. Saidou Koala
CIAT

Can we Realize a Bright Future for Africa's Agriculture?

Exhibit 34

An African "green revolution" could raise agricultural production to $880 billion per annum by 2030

Africa agricultural production revenue
$ billion



Source: Food and Agriculture Organization; McKinsey Global Institute analysis

McKinsey & Company, 2010

Challenges in Farming in SSA…

LACK OF PRODUCTION FACTORS

→ High input prices

(1 kg of NPK in East DR Congo costs 1.7 USD)

→ Recycling of organic residues, mainly manure

(but very limited availability)

→ Limited labor availability

→ Relatively small farms on relatively old soils

LACK OF AN ENABLING ENVIRONMENT

→ Lack of infrastructure, market organization

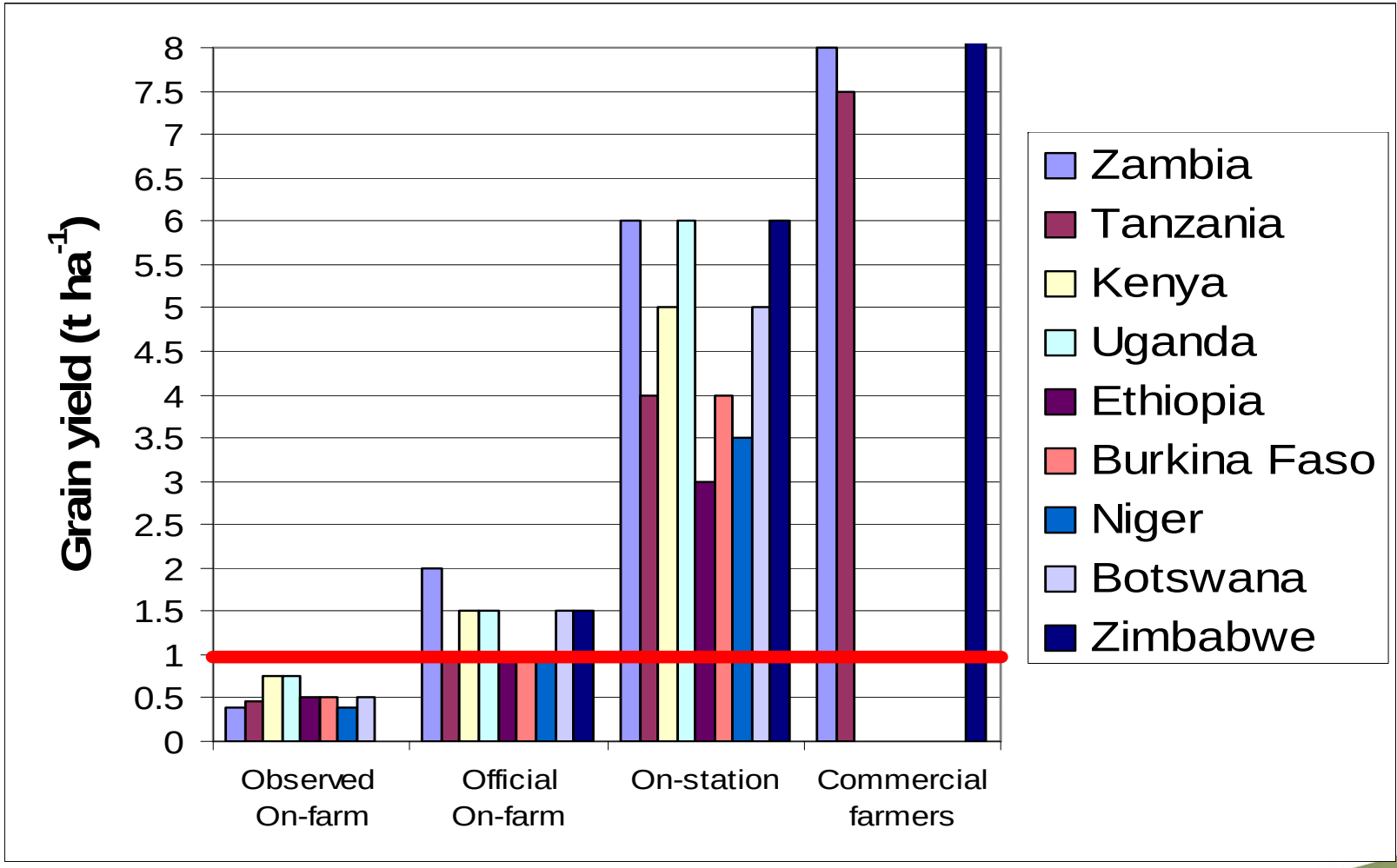
→ Civil strife

→ Climate change, etc, etc,…

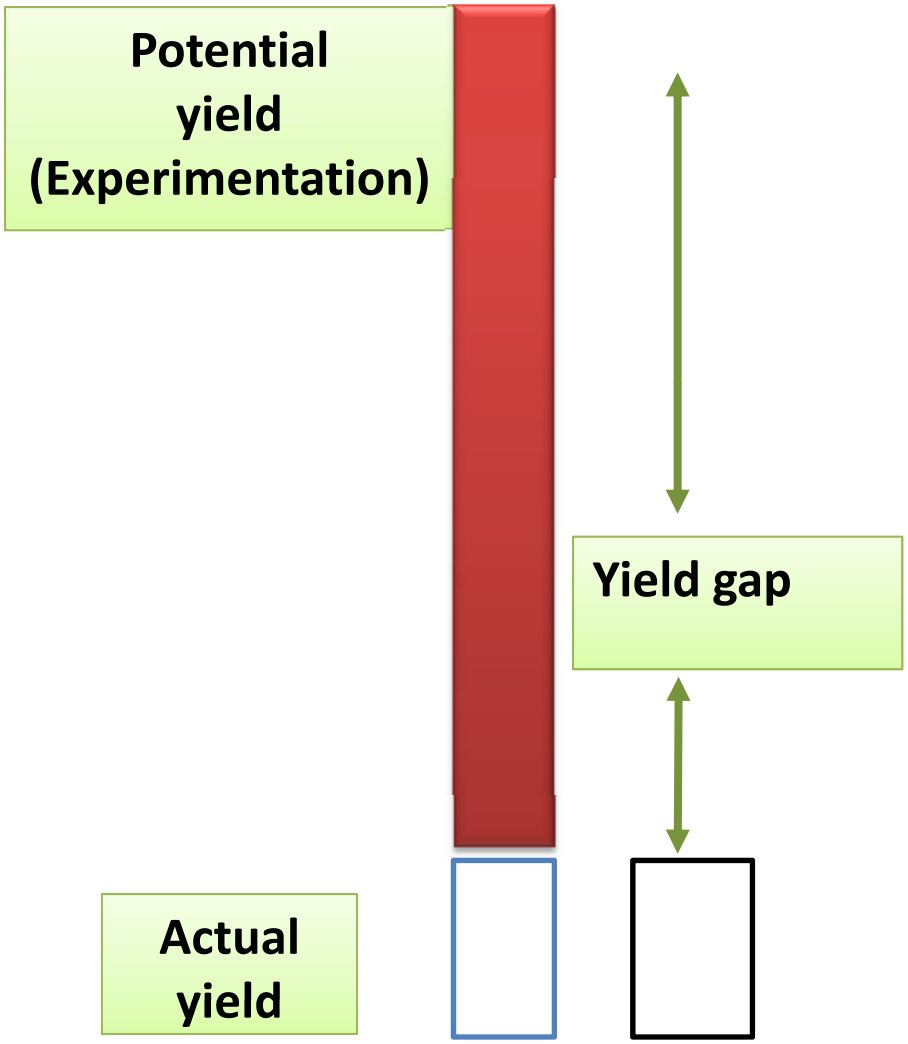
Sub Sahara Africa - Facts

- Average fertilizer use 8 kg/ha (mainly cash crops)
- Agronomic efficiency low: 10 kg grain / kg fertilizer
- Fertilizer demand SSA: 1.3 million MT nutrients
- >10% of global population, <0.8% fertilizer use
- Annual Food imports: 50 million MT
- Enormous potential

The Yield Gap in sub-Saharan Africa



Causes of Yield Gaps



Biophysical limitations
- **Low soil fertility**
- **Water scarcity**
- **Unimproved varieties**

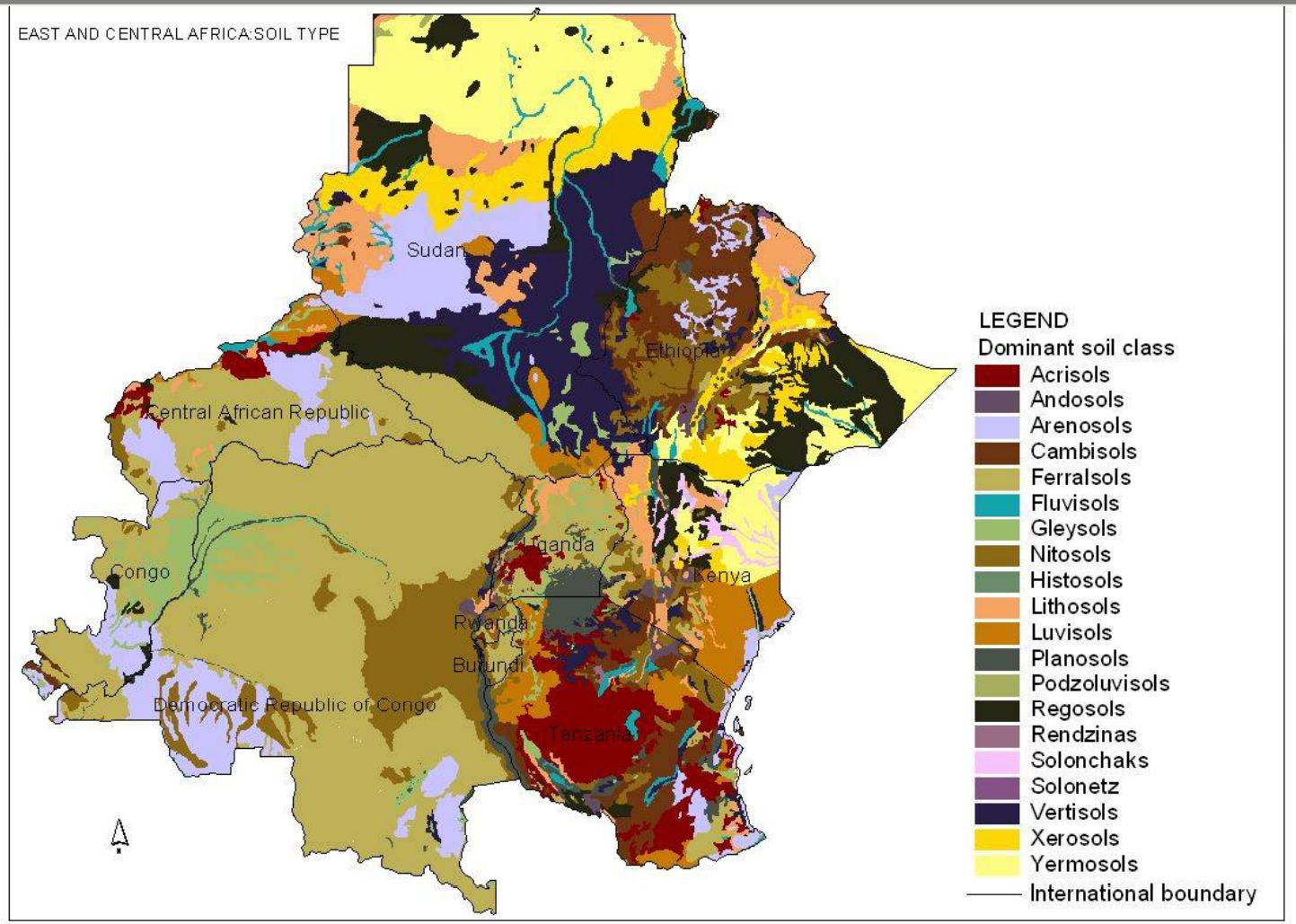
Which inputs are lacking?

Socioeconomic conditions and policies that limit access to:
- **Knowledge**
- **Credit**
- **Inputs**

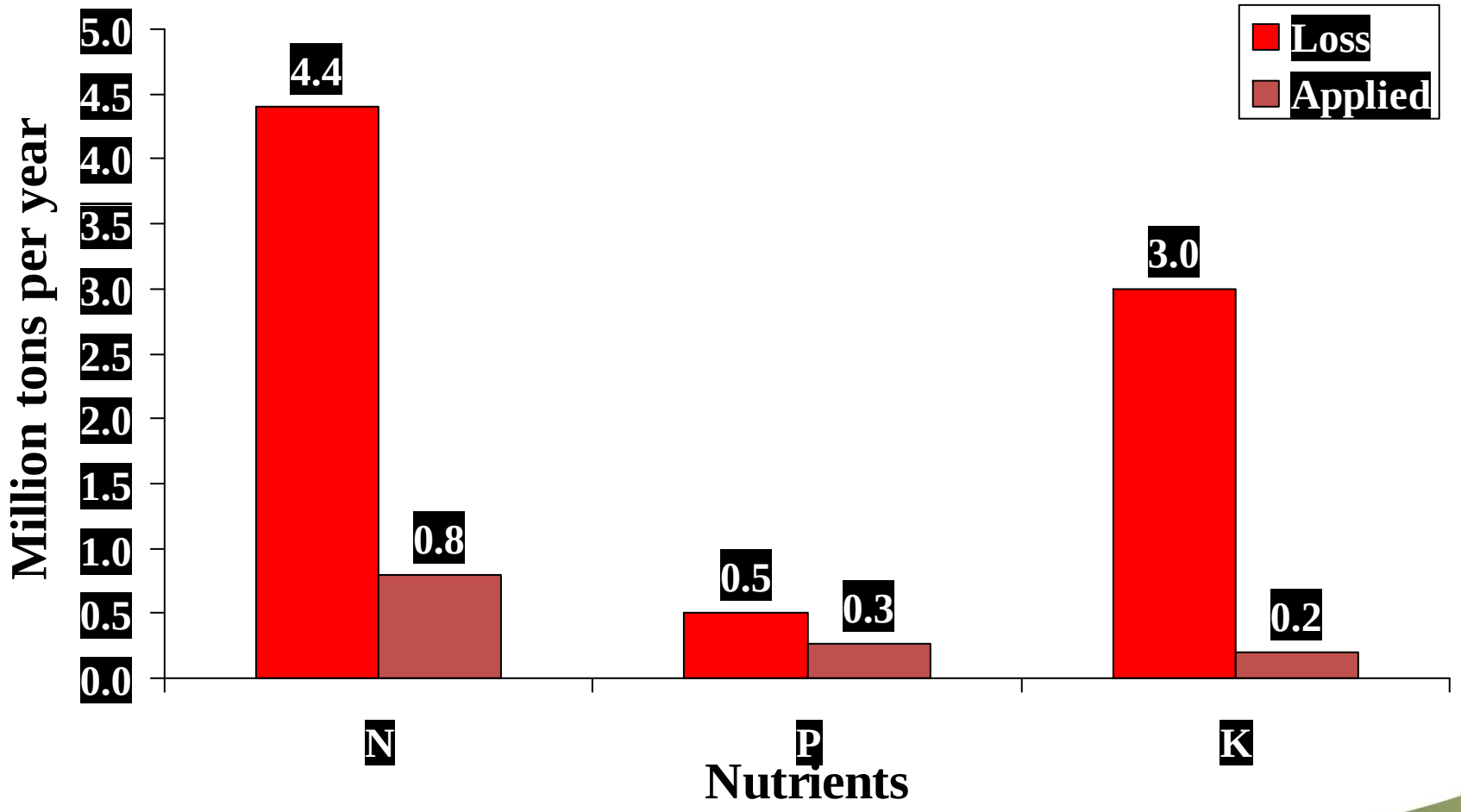
Why inputs are not used?

Variability! → Continental scale

Soils in East and Central Africa



Macronutrient application versus loss in Africa



The opportunity…

→ **Finally, fertilizer and inputs are back on the agenda!**
Statement in 1996 (Research Director, IITA):

'You can't include fertilizer in your work since farmers in SSA are not using fertilizer'

→ **The African Fertilizer Summit declaration:**

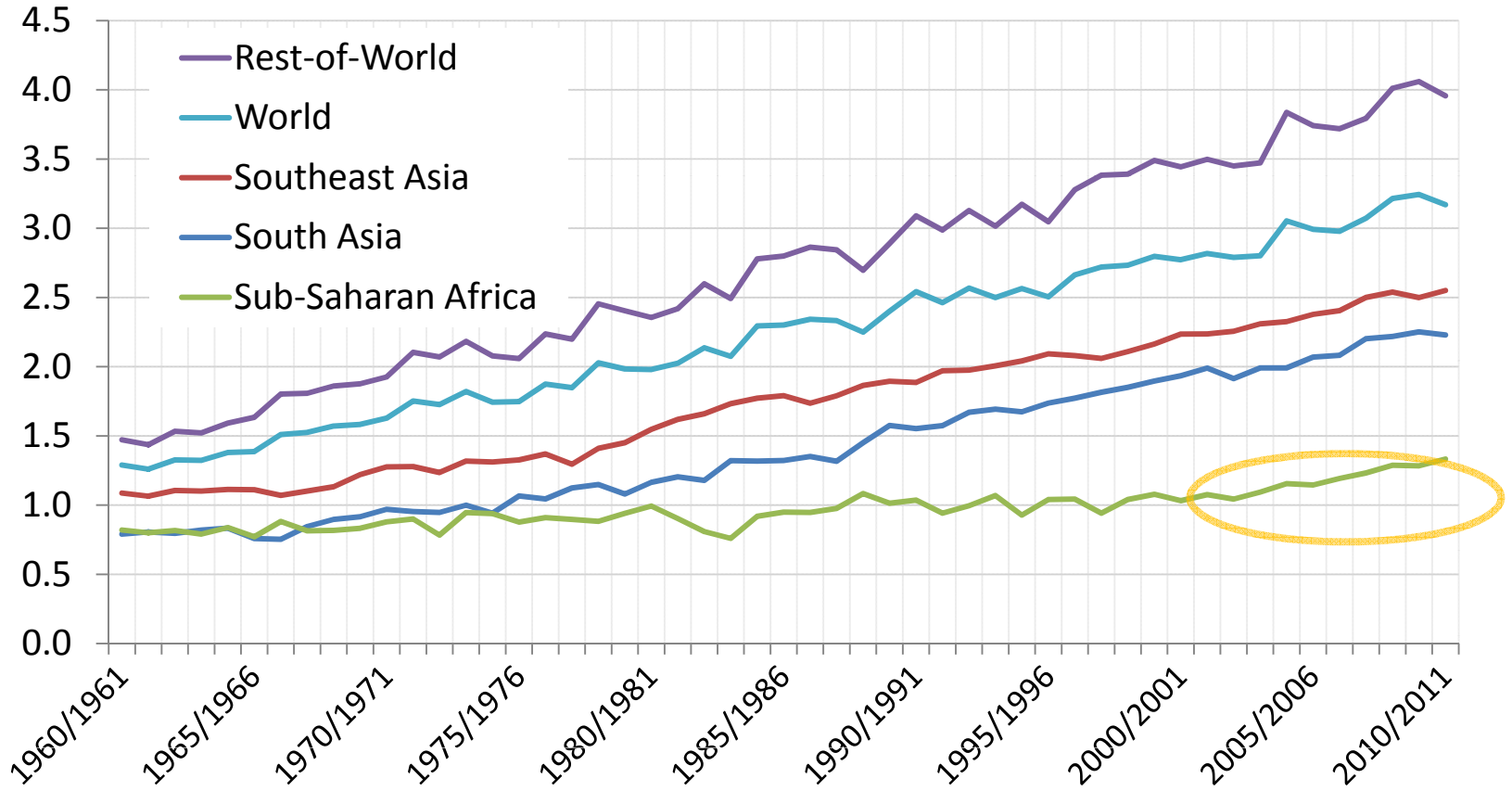
'By 2015, increase fertilizer use from 8 to 50 kg fertilizer nutrients/ha'

→ **The Alliance for a Green Revolution in Africa**

Uniquely African (K Annan): 'Recognizing its great diversity of landscapes, soils, climates, and cultures…'

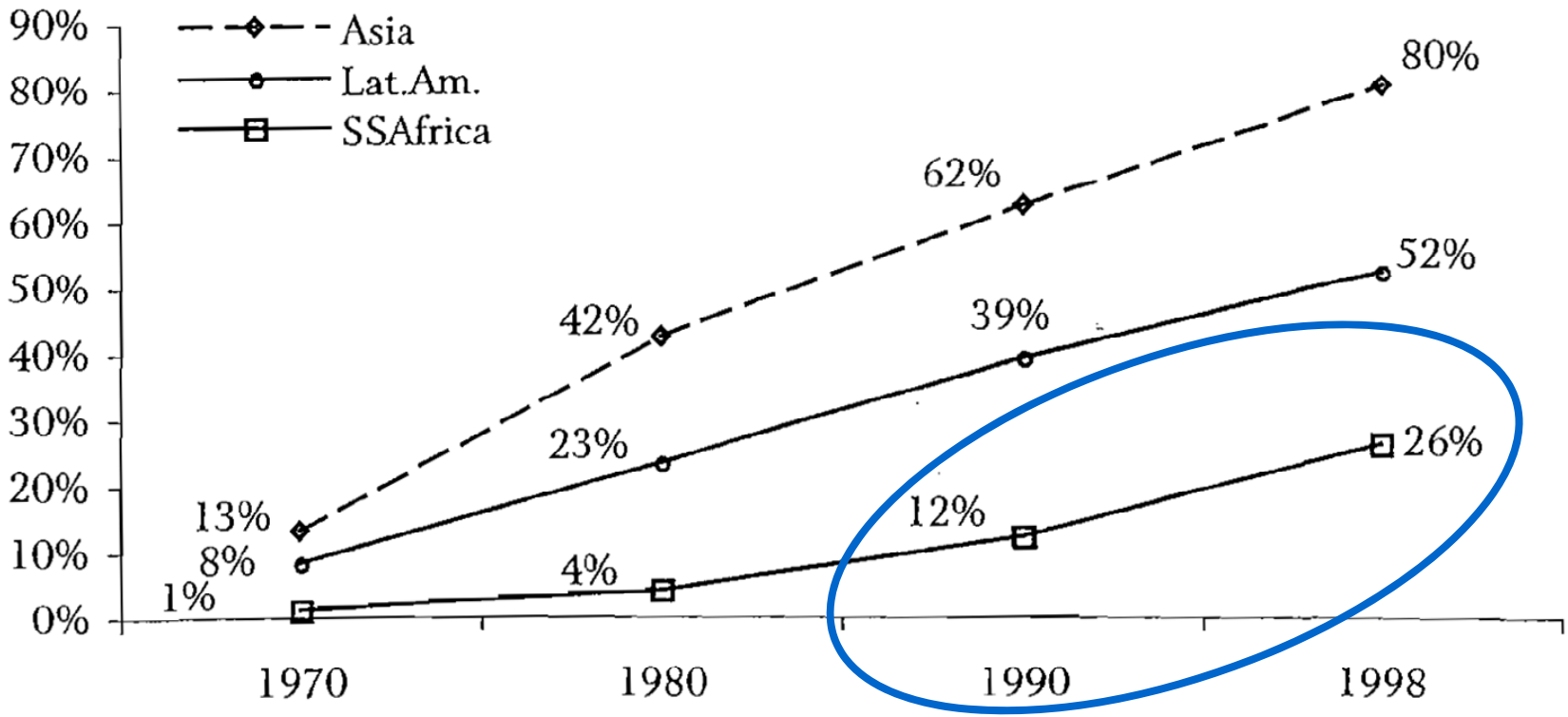
Africa Is Finally Moving Toward Higher Crop Yields

USDA estimates of average cereal grain yields (mt/ha), 1960-2010



Source: Calculated from USDA , PS&D data (www.fas.usda.gov/psdonline), downloaded 7 Nov 2010. Results shown are each region's total production per harvested area in barley, corn, millet, mixed grains, oats, rice, rye, sorghum and wheat.

Africa's Recent Gains Reflect Uptake of Modern Seeds



Source: Calculated from data in R. E. Evenson and D. Gollin, *Crop Variety Improvement and its Effect on Productivity*, (Cambridge, MA: CABI, 2003).

Figure 16. Adoption of new varieties (percentage of cropped area).

Source: Reprinted from W.A. Masters, "Paying for Prosperity: How and Why to Invest in Agricultural Research and Development in Africa" (2005), *Journal of International Affairs*

CIAT: A Collective Will and Way to Succeed in Africa

Integrated soil fertility management – livelihood perspective

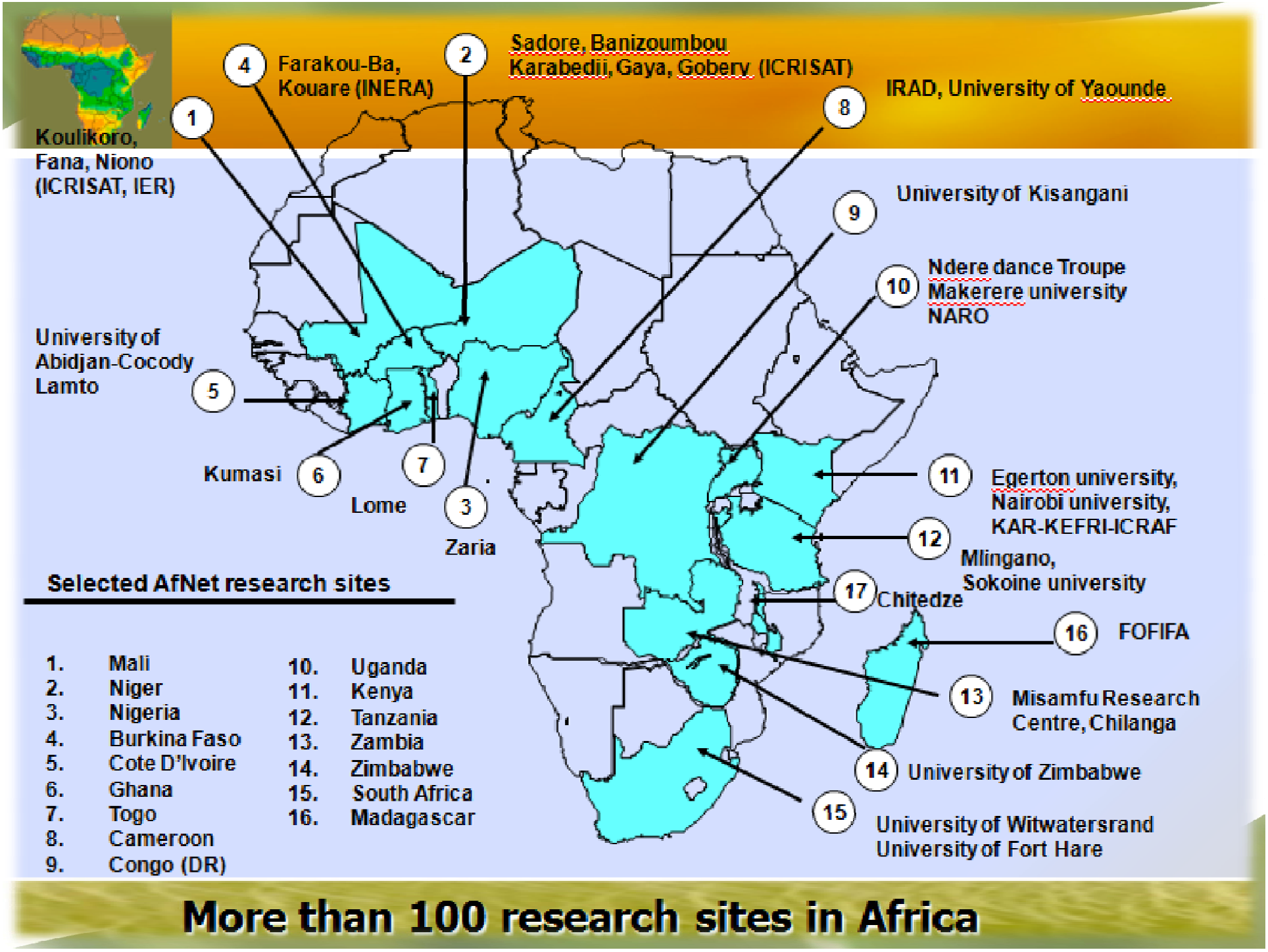
Sustainable land management – landscape perspective

- African Network for Soil Biology and Fertility (*AfNet*)
- Consortium for Improving Agricultural-based Livelihoods in Central Africa (CIALCA)
- Africa Soil Information Service (AfSIS)
- N2Africa Putting nitrogen fixation to work for smallholder farmers in Africa

Building the Capacity of various development stakeholders is a key component

AfNet – Strengthening Stakeholder Capacity in Soil Fertility Management

- Involves a range of public and private partners and extension specialists, including 140 from NARIs and 110 from universities
- Network trials implemented in over 100 sites across SSA & spread across three impact zones
    - Management of mineral and organic inputs
    - Integration of legumes in cropping systems
    - Biological nitrogen fixation
    - Below-ground biodiversity
    - Conservation agriculture
    - Soil and water conservation

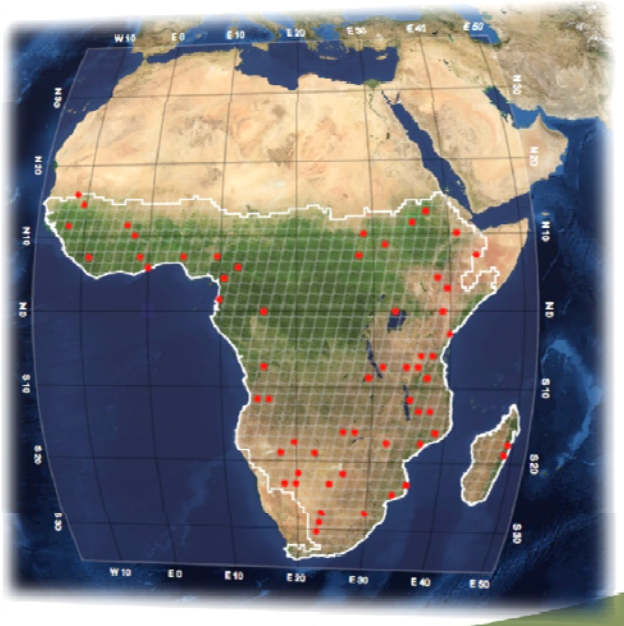

Koulikoro, Fana, Niono (ICRISAT, IER)
1
Farakou-Ba, Kouare (INERA)
4
Sadore, Banizoumbou Karabedji, Gaya, Gobery (ICRISAT)
2
IRAD, University of Yaounde
8
University of Kisangani
9
Ndere dance Troupe
Makerere university
NARO
10
University of Abidjan-Cocody Lamto
5
Kumasi
6
7
Lome
3
Zaria
11
Egerton university, Nairobi university, KAR-KEFRI-ICRAF
12
Mlingano, Sokoine university
17
Chitedze
16
FOFIFA
13
Misamfu Research Centre, Chilanga
14
University of Zimbabwe
15
University of Witwatersrand
University of Fort Hare
Selected AfNet research sites
1. Mali
2. Niger
3. Nigeria
4. Burkina Faso
5. Cote D'Ivoire
6. Ghana
7. Togo
8. Cameroon
9. Congo (DR)
10. Uganda
11. Kenya
12. Tanzania
13. Zambia
14. Zimbabwe
15. South Africa
16. Madagascar
More than 100 research sites in Africa

From Diagnoses of Soil Constraints to Evidence-Based, Site-Specific Soil Management Recommendations

Soil survey covering 18.1 sq km with 60 sentinel sites in 27 sub-African countries

A digital soil map for Africa

- AU Fertilizer Summit recommendation 8 to 50 kg/ha
- Land degradation surveillance
- Mitigation to climate change: Carbon sequestration



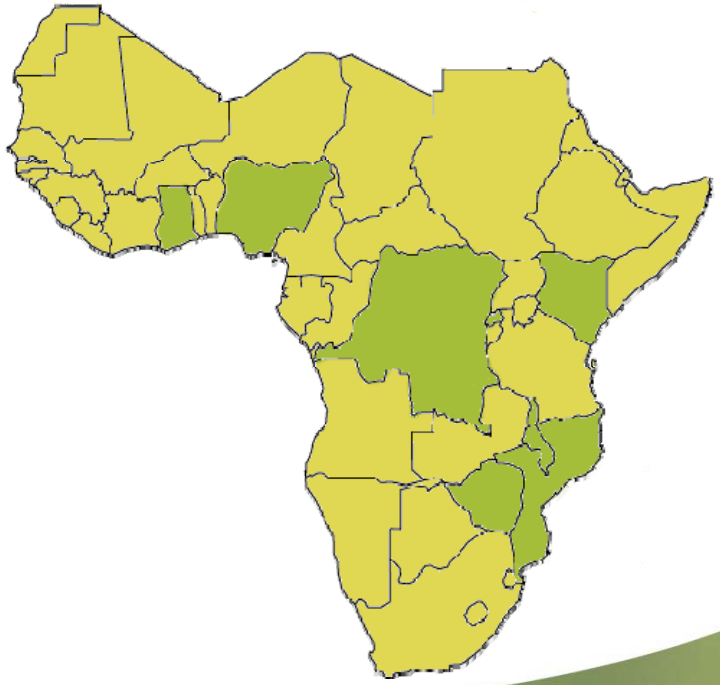
Towards Restoration of Non-responsive Fields

- Provide accurate and spatially explicit land and soil information to guide action and policy for 42 African countries
- Contribute to the reversal of soil degradation in Africa
- Provide soil and land recommendations to improve crop yield and improved livelihoods for approximately 1 to 2 million poor African households
- Contribute to the development of African institutions' capacity for soil mapping and fertility management

N2Africa – Putting Nitrogen Fixation to Work for Smallholder Farmers in Africa

Research on agronomy and rhizobiology for farmers in eight countries

- Main crops: soybean, groundnut, cowpea, and common bean and forage legumes
- Making best varieties, inoculants, and agronomic practices available to farmers



Potential Collaboration within the GSP
The Way Forward

- Scaling up of successful agronomic practices to improve nutrient-use efficiency and reduce the yield gap
- Targeted use of fertilizer for a two- to three fold increase in crop yield
- Strengthening the capacity of African researchers, extension specialists, NGOs, and other stakeholders to improve soil health
- Landscape analysis for policy decision
- Building a road map on GSP and a consortium of stakeholders to move it forward

Thank you

CIAT's Mission

To reduce ***hunger*** and ***poverty***, and improve human ***health*** in the tropics through ***research*** aimed at increasing the eco-efficiency of agriculture

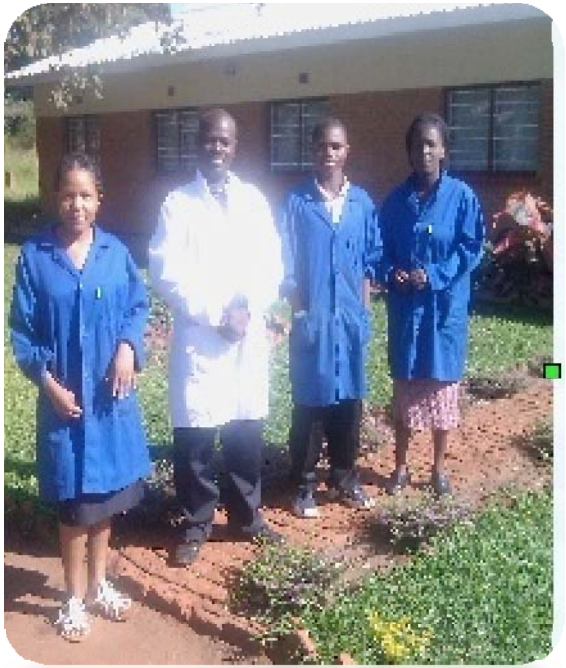
Science for Impact

CIAT: Science for Impact

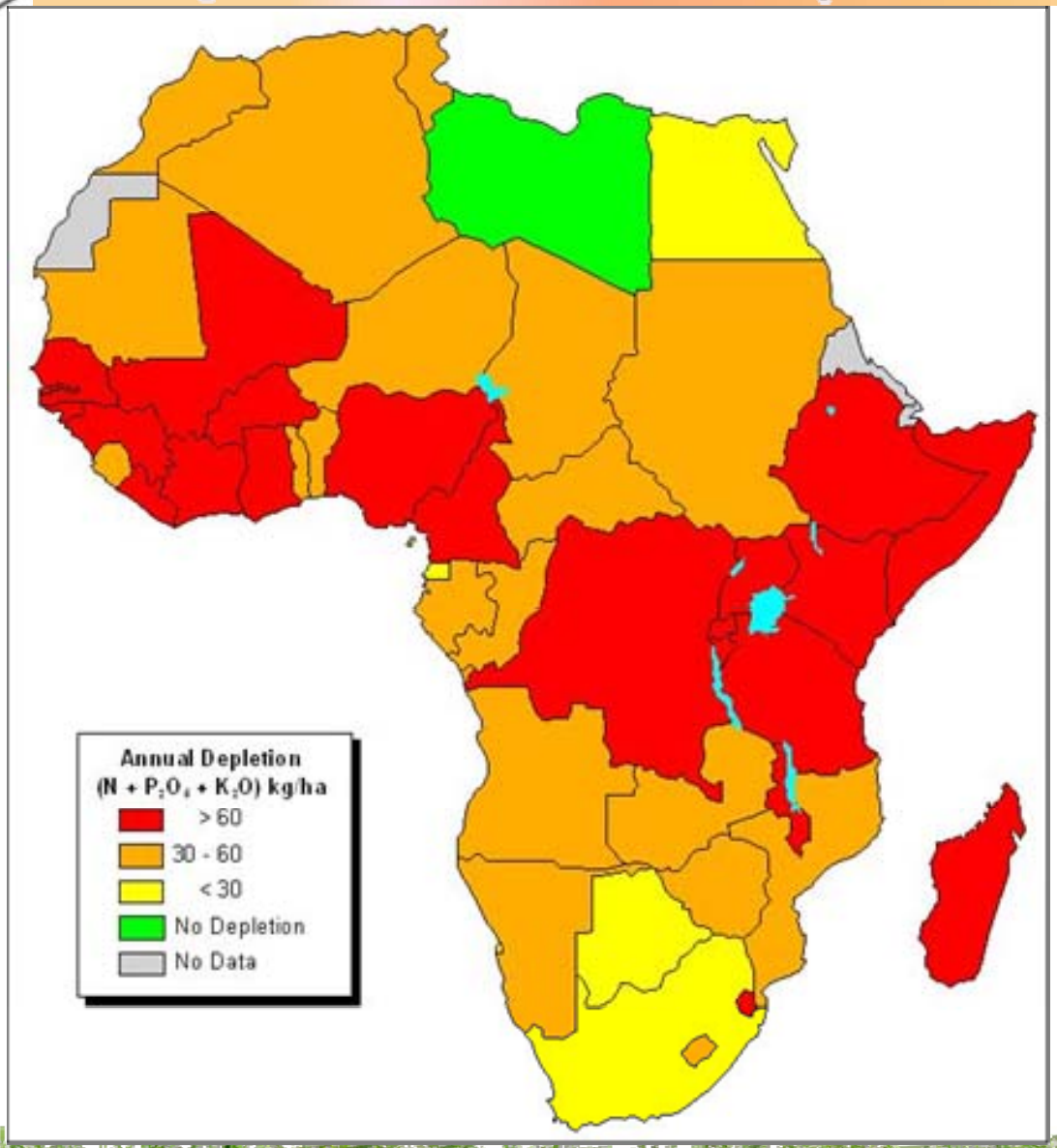
- **Results-**oriented
- Focus on **high-priority activities** that are key to research for development
- Generate **useful knowledge** for reducing hunger, poverty, and degradation of natural resources
- Align activities with the **CGIAR Research Programs (CRPs)**
- Work through networks and **long-term partnerships**

Investing in Africa's Human Capital for Science

CIAT-Soils
50 PhD, 150 MSc. candidates plus 500 other technicians and NGO staff improved skills in Natural Resource Management and Agronomy in the past 5 years

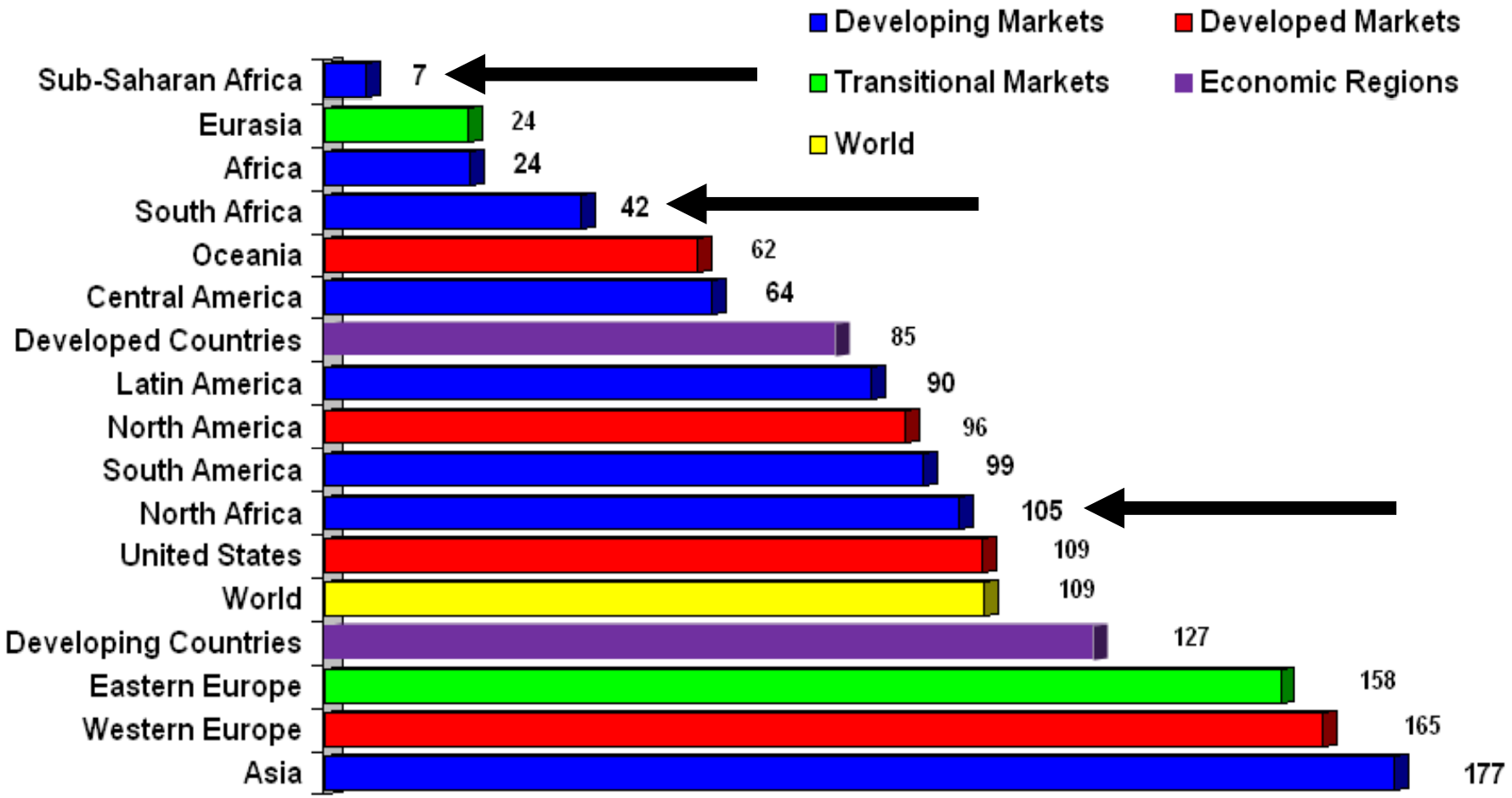


Average annual rates of nutrient (NPK) depletion in Africa (Years 1993-95)



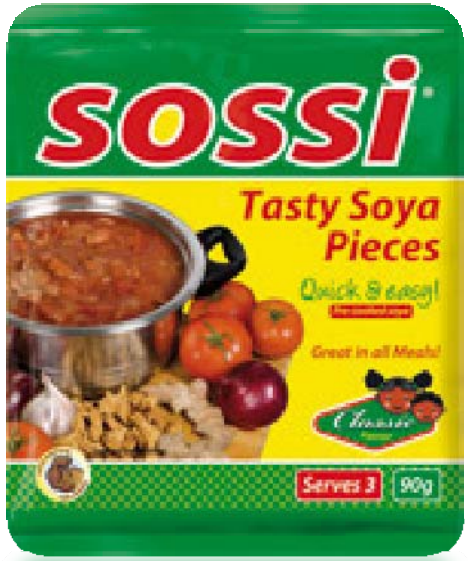
Source IFDC

Average fertilizer use (kg/ha)



Increased Use of Soybean and its Products for Better Nutrition and Economic Benefits

Kenya – PROMISADOR (South Africa) contracts for
4000 tonnes of smallholder soybean by 2012; partnership
TSBF – PROMISADOR – SMART LOGISTICS - SEEDCO



PROMASIDOR

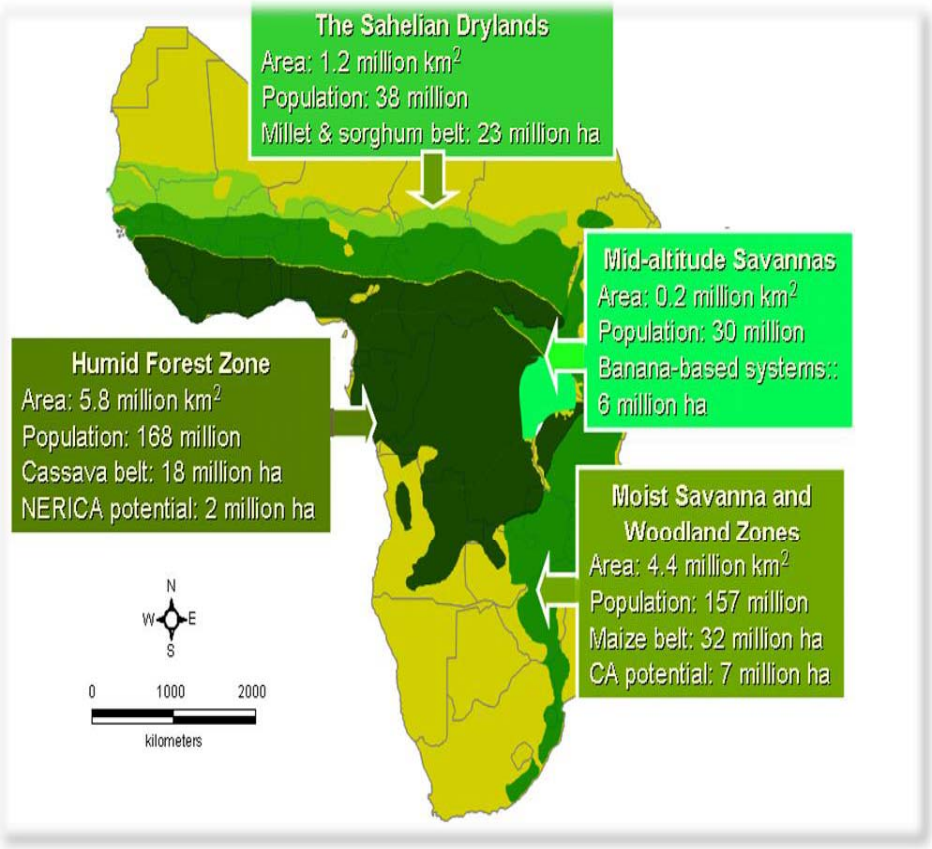
SEED-CO
The African Seed Company

CIALCA: Improving Farmers' Livelihoods in Central Africa

- New crop varieties selected, tested, and adopted by farmers – mainly banana, grain legumes (climbing bean and soybean), and maize
- Increasing use of organic inputs and fertilizers
- New agricultural practices developed
  - Intercropping (banana-beans, banana-coffee, cassava-legumes, beans-maize)
  - Integrated pest management, especially for bananas
  - Integrated soil fertility management
  - Erosion control
  - Macro-propagation techniques
- Optimal plant densities (e.g., in bananas) for different rainfall and soil fertility levels

Focus on Impact Zones and Emerging Partnerships

Production system platforms



Collaborative platforms

- ASARECA
- FARA learning sites
- USAID Feed the future
- AGRA & BMGF