Smart, Balanced and Effective: Public-Private Cooperation to Restore Africa's Soils

Marco Ferroni

Syngenta Foundation for Sustainable Agriculture

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Overview

- **The soils imperative: restoration and wise use**
- **The farmer‘s business case for nutrients**
- **The need for**
  - **Relevant products**
  - **Effective farm support**
  - **Efficient fertilizer markets**
  - **Conducive public-private cooperation**
- **The Syngenta Foundation: how we engage**

Soils are like a bank account

Put in before you take out

- raise yields sustainably
- restore and maintain soil health
- enable farmers to make money
- optimize nutrient balances and footprint

Inputs and outputs	Nutrient balances by region (kg ha $^{-1}$ year $^{-1}$)					
	Western Kenya		North China		Midwest U.S.A	
	N	P	N	P	N	P
Fertilizer	7	8	588	92	93	14
Biological N fixation					62	
Total agronomic inputs	7	8	588	92	155	14
Removal in grain and/or beans	23	4	361	39	145	23
Removal in other harvested products	36	3				
Total agronomic outputs	59	7	361	39	145	23
Agronomic inputs minus harvest removals	-52	+1	+227	+53	+10	–9

Source: Vitousek et al., 2009

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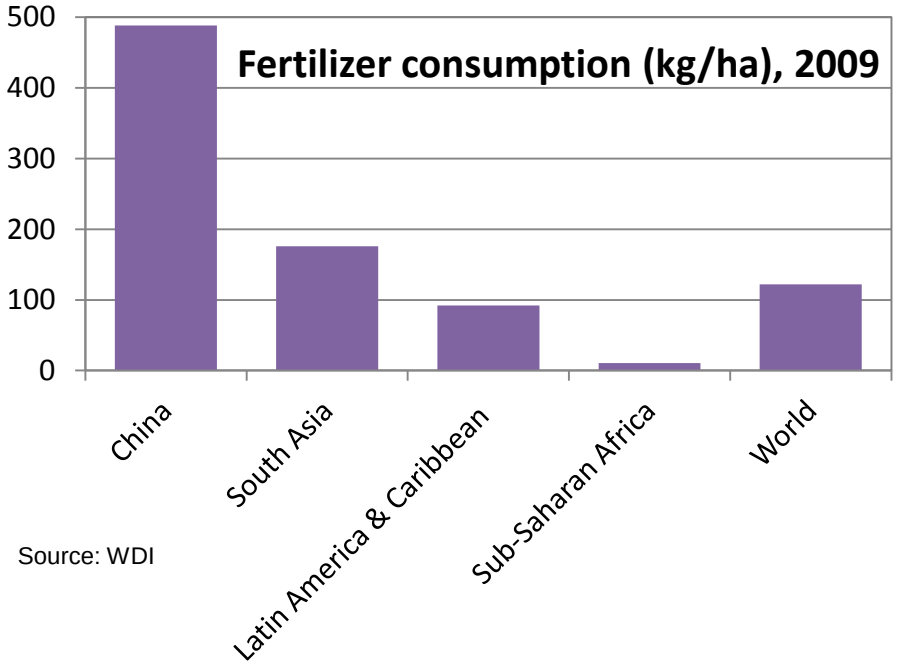
Balance negative: soil health in crisis

'In most agro-ecosystems, declining crop yield is exponentially related to loss of soil quality' M A Stocking (2003)



Source: WDI

Soil restoration:

- Mgt of biomass
- Fertilizer
- Crop rotation
- Intercropping
- Agroforestry
- Erosion control

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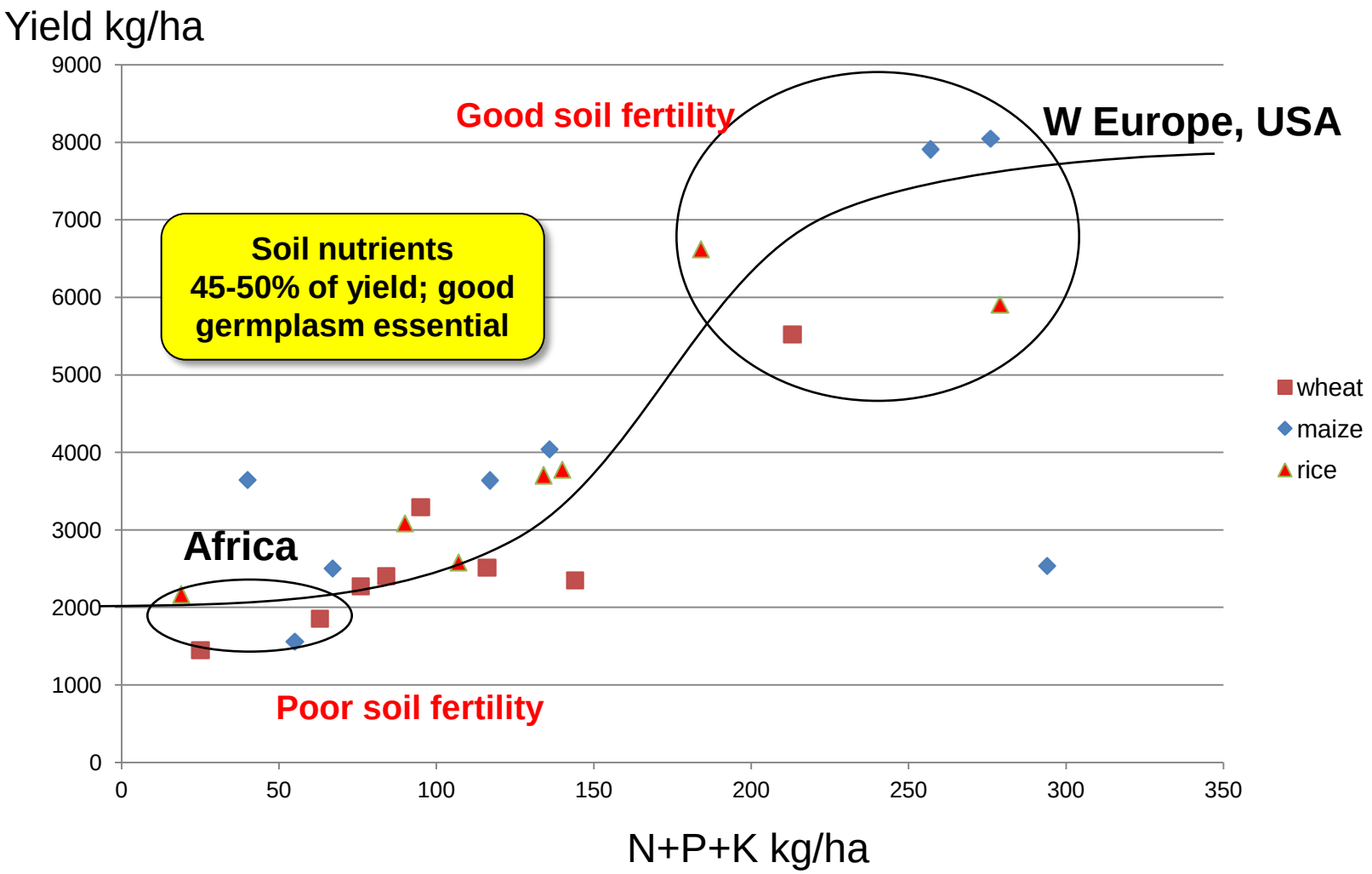
Conservation and fertility solutions key ...

Fertilizer rates and yields for wheat, maize and rice



Source: SFSA
Data circa 2000

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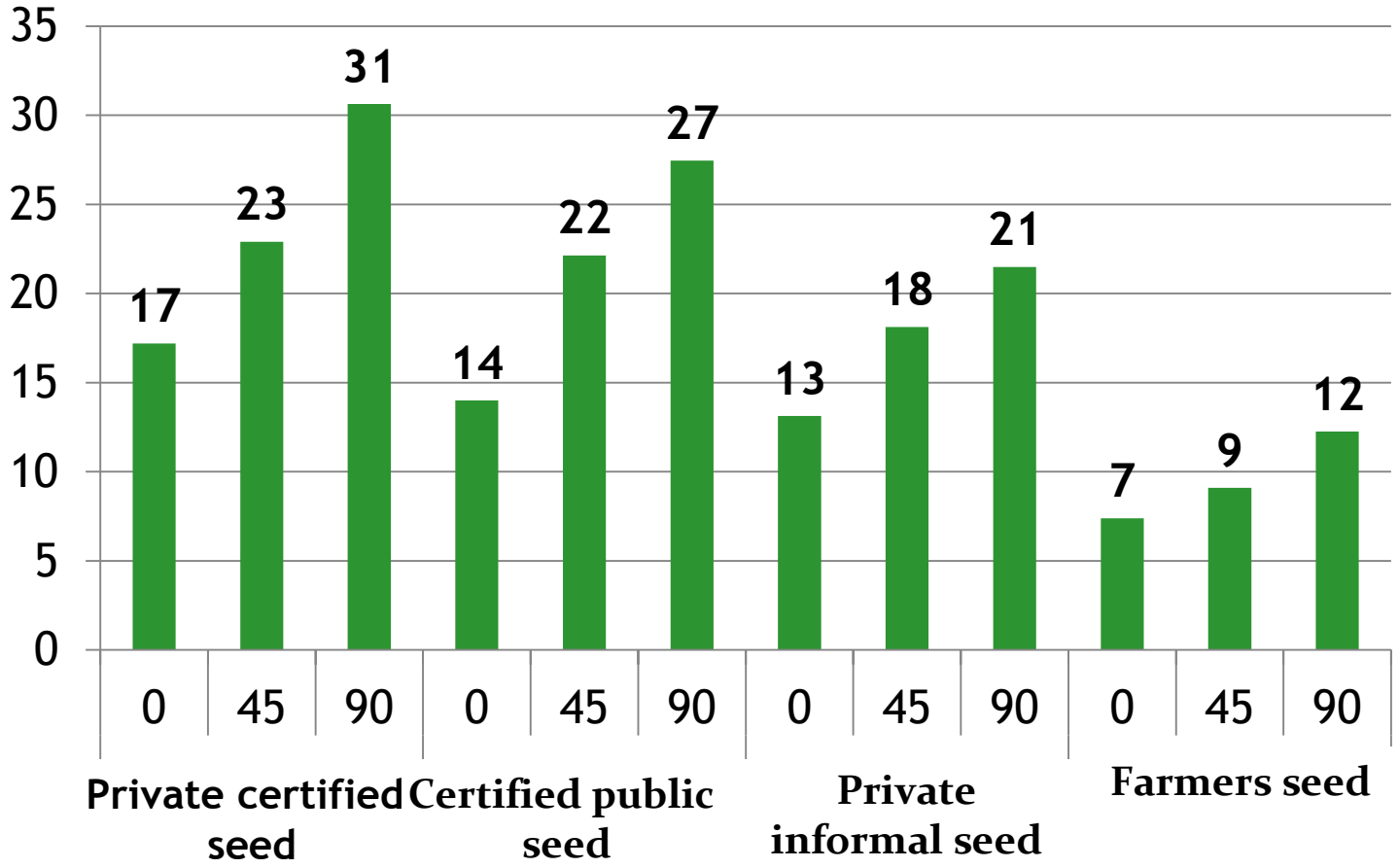
... to make input combinations pay

Effect of fertilizer (kg N in NPK) and seed quality on potato yields and returns, Kenya 2010

Seed source/ management	Cost per acre (KSh)	Income per acre (KSh)
Farm saved/ave	18,890	36,930
Certified plus	52,930	153,330



X-axis:
- kg of N

Y-axis:
- t/ha

Source:
Barker & Schulte-Geldermann, CIP

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Nutrient use efficiency fundamental in all dimensions …

Need all tools that work technically, financially

Prioritize according to ROI

Array of options

Fix:
- Legumes
- Symbionts
- Synthetic

Apply:
- Precision
- Fertigation
- Recycling
- Organic amendments

Use:
- Earliness
- Yield
- NUE
- Solubility

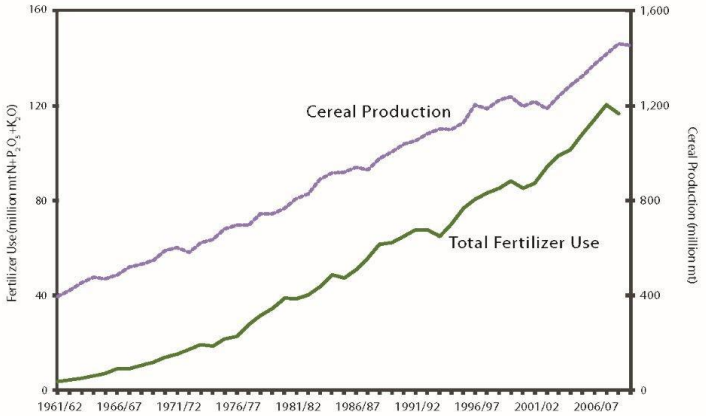
Extend:
- Inhibitors
- Slow release
- Split application

Impact ($/ha/year)

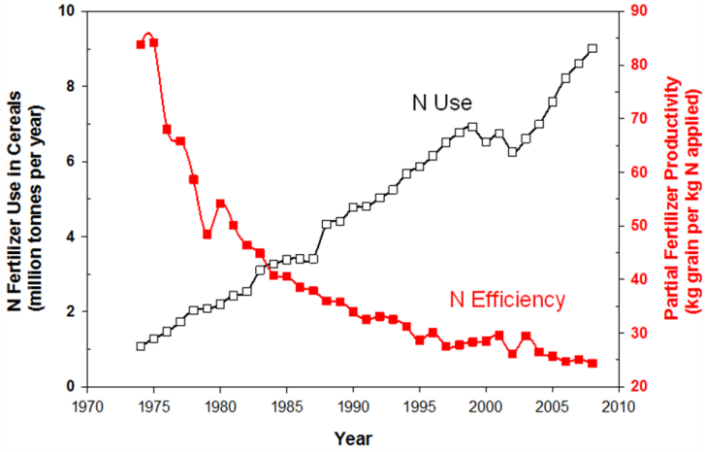
… including fertilization that is *smart, balanced,* and *effective*

India 1960-2007:

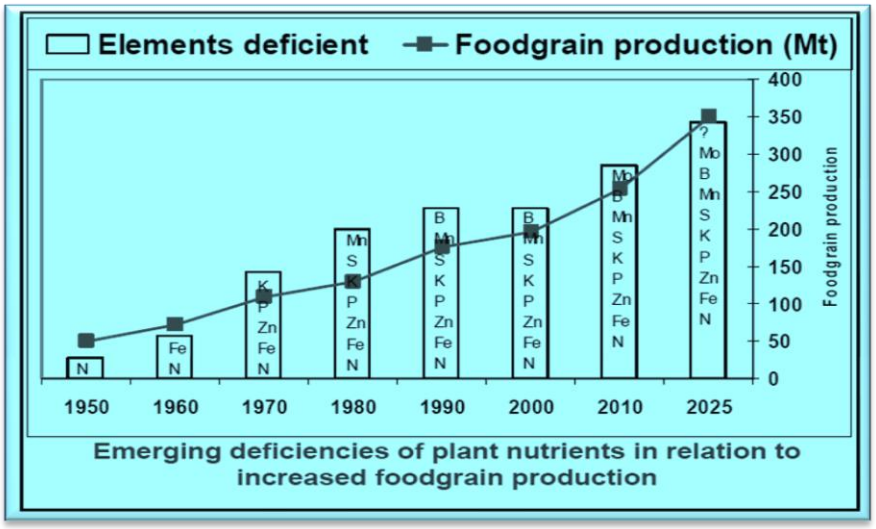
Increased fertilizer use and output ...



Declining fertilizer efficiency ...



Growing nutrient deficiencies



Nutrient based fertilizer subsidy scheme introduced in April 2010

Source: IFDC

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How to take inputs and NUE to the farmer?

- **Relevant products**
  - **Soil testing, digital mapping, right products and package size, precision agriculture services, breeding/GM for NUE**
- **Effective farm support**
  - **Services for farmers in line with incentives, farmer rationality, private benefit: *skills, organization, inputs, access to markets***
- **Efficient fertilizer markets**
  - **Measures to increase accessibility and affordability, infrastructure, pricing and marketing arrangements, tendering**
- **In all of the above: public-private cooperation**
  - **Bring out complementary strengths of private, public and voluntary sector**

Relevant products

Example 1: smart precision fertilization

- **Novel NUE mechanisms**
  - N control, P availability
  - Sub-surface placement, bio-organisms
- **Improved micronutrient delivery**
  - Ready access
  - Application convenience
- **‘Greener‘ local sourcing**
  - Waste stream recycling
  - Alternative feedstocks
- **Increased application accuracy, better timing**
  - Rapid soil and nutrient quality analysis
  - Affordable application equipment

Example 2: breeding and GM technology for NUE

Ways to increase NUE include:

Improve uptake efficiency
Optimize root length density
Reduce N requirement
Reduce N stored in stem and pod walls
Increase yield
Increase remobilization or late N uptake

With oilseed rape, for example:

Each additional tonne of yield requires extra 30 kg N/ha
Increasing root length density can raise soil N recovery by 26%

Source: P. Berry/ADAS

Example 3: soil testing and follow-through

Field: Isaac [redacted] Top Soil

To maintain the correct history ensure that the next sample sent from this Field is labelled: Isaac [redacted]

History (Last 4 Analysis)

Parameter	Unit	Result	Guide Low	Guide High	Low	Optimum	High	Symbol	Current
pH		5.35	6.00	7.00				pH	5.35
Phosphorus	ppm	13	30	100				P	13
Potassium	ppm	456	548	1096				K	456
Calcium	ppm	2315	3371	4214				Ca	2315
Magnesium	ppm	435	337	607				Mg	435
Manganese	ppm	112	80	300				Mn	112
Sulphur	ppm	13	15	100				S	13
Copper	ppm	0.62	1.00	10.00				Cu	0.62
Boron	ppm	0.32	1.00	2.00				B	0.32
Zinc	ppm	1.73	2.00	10.00				Zn	1.73
Sodium	ppm	40		< 323				Na	40
Iron	ppm	86	80	250				Fe	86
C.E.C	meq/100g	28.09	15.00	30.00				C.E.C	28.09
Aluminium	ppm	1320		< 1200				Al	1320
EC (Salts)	uS/cm	125		< 800				EC(S)	125
Organic Matter	%	5.51	3.00	8.00				OM	5.51
PERCENTAGES AND RATIOS									
Calcium %	%	41.2	60	75				Ca%	41.2
Magnesium %	%	12.91	10	18				Mg%	12.91
Potassium %	%	4.16	5	10				K%	4.16
Sodium % (ESP)	%	0.62	0	5				Na%	0.62
Other Bases %	%	6.69	3	10				OB%	6.69
Hydrogen %	%	34.41	10	15				H%	34.41
Tot al	%	100.00							
Ca:Mg Ratio	%	3.19	4	7				Ca:Mg	3.19

COMMENTS

Very low pH can cause deficiencies of calcium, magnesium and molybdenum and result in toxicity of manganese and aluminium. > Low potassium severely reduces flowering, flower setting and yield. > Very low Ca levels result in low oxygen levels and poor microbial activity and nutrient availability. > Low Zn levels may cause yellowing which develops into a bronze or brown color. The leaves may have a rusty appearance. Plants may become deformed and dwarfed and may die. Pod formation may be hampered and the plants are slow to mature. > Very low B levels may cause brittle stems and hard leaves and reduce flowering and increase flower abortion. > Low S levels may cause growth to stop and golden yellow leaves which fail to expand. > Very low P may results in stunted plants with thin shortened stems; upper leaves are small and dark green. Few flowers and pods are produced.

SOIL FERTILITY CORRECTION PROGRAM

PRODUCT	RATE (Kg/Ha)	COMMENTS
AGRICULTURAL LIME	5400	Apply before planting, mix well into the top soil. Ensure that it is agricultural lime (high calcium, no magnesium) by testing before application. Do not apply more than 3,000 kg/Ha per season.
DOLOMITE LIME	3000	Apply before planting, mix well into the top soil. Ensure that it is dolomitic lime (> 10% magnesium) by testing before application. Do not apply more than 3,000 kg/Ha per season.
GYPSUM	300	Apply at planting.
ROCK PHOSPHATE	440	Use in soils with pH < 6.0. Use in combination with TSP fertilizer.
TRIPLE SUPER PHOSPHATE (TSP)	160	Apply at planting to give quickly available supply of phosphorus to the plant.

ADDITIONAL RECOMMENDATIONS

> Apply lime as per recommendations. > Apply extra potassium nitrate at flowering and high K foliar feeds. > Apply lime to build calcium levels and balance soils. > Apply high zinc foliar feed. > Apply boron foliars (with calcium)pre flowering and early pod setting. > Apply extra P at planting. Apply high P foliar during early growth and at early flowering.

Project partners**:** KHE, SFSA, Family Bank, Min Agr (Kenya)

Objective: Timely application of inputs; organize and mentor farmers to respond to market opportunities

Soil fertility solution: Liming (among other aspects)

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Effective farm support

Basic principles …

What farmers want

Technology:
- Germplasm
- Soil fertility
- Crop protection
- Mechaniz'n

Inputs:
- Relevant products, accessible
- Infrastructure

Services:
- Extension
- Credit
- Insurance
- Organizat'n

Markets:
- Information
- Access
- Predictability
- Subsidies

Impact ($/ha/year)

Challenge and opportunity:
To push this in the context of ‚pull' from growing markets and the on-going economic transformation

... a model of mentoring ...

- Grower budget preparation
- Access to finance
- Managing incomes and re-investments

- Knowledge empowerment to the growers will lead to independence ensuring long term sustainability

- Maximise marketable yield
- Develop markets for reject and 2nd grade produce
- Ensure compliance and quality and efficiency of internal processes

- Market links, export and domestic
- Managing rejected produce
- Understanding of quality requirements
- Product differentation where appropriate

- Access to input suppliers and infrastructure development
- Optimum crop & product assortment
- Hands on training and guidance
- Risk management

- Development of an atmosphere of trust and loyalty between relevant stakeholders.
- Active and open communication
- Market intelligence

... and how to insure against weather risk

Enabler of demand for fertilizer

- **Kilimo Salama**: largest index insurance program in Africa (64K farmers and USD 2.6m ‚value at risk' insured in 2012 so far)
- Partnership between SFSA, UAP Insurance, Safaricom, KMD
- Covers farm inputs, expected value of harvest, and other combinations
- Products evolving, responding to farmers' needs
- First crop insurance product worldwide to register *and* compensate farmers via mobile phone

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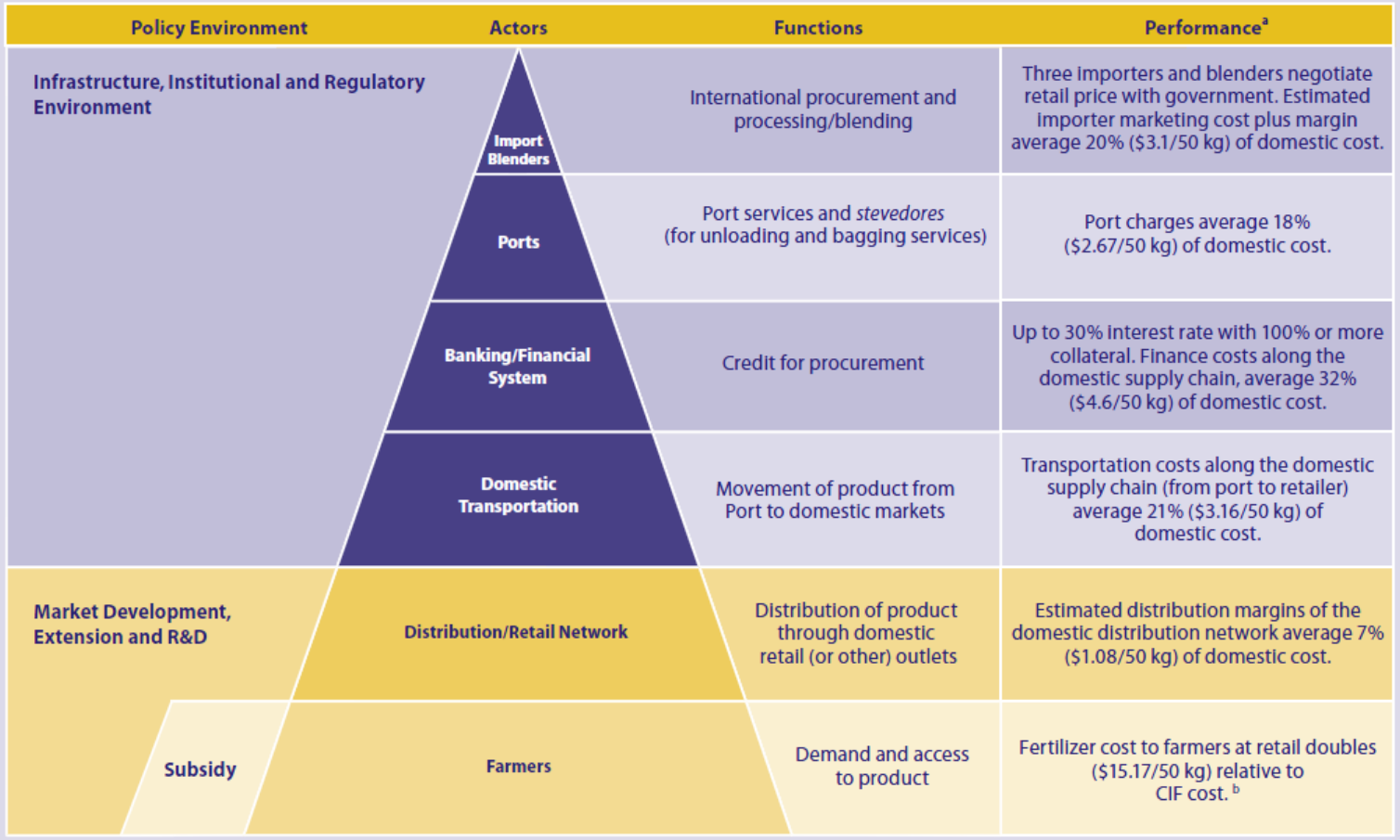
Efficient fertilizer markets

Supply chain in Ghana: not yet particularly efficient

Figure 1—Performance of the fertilizer supply chain in Ghana

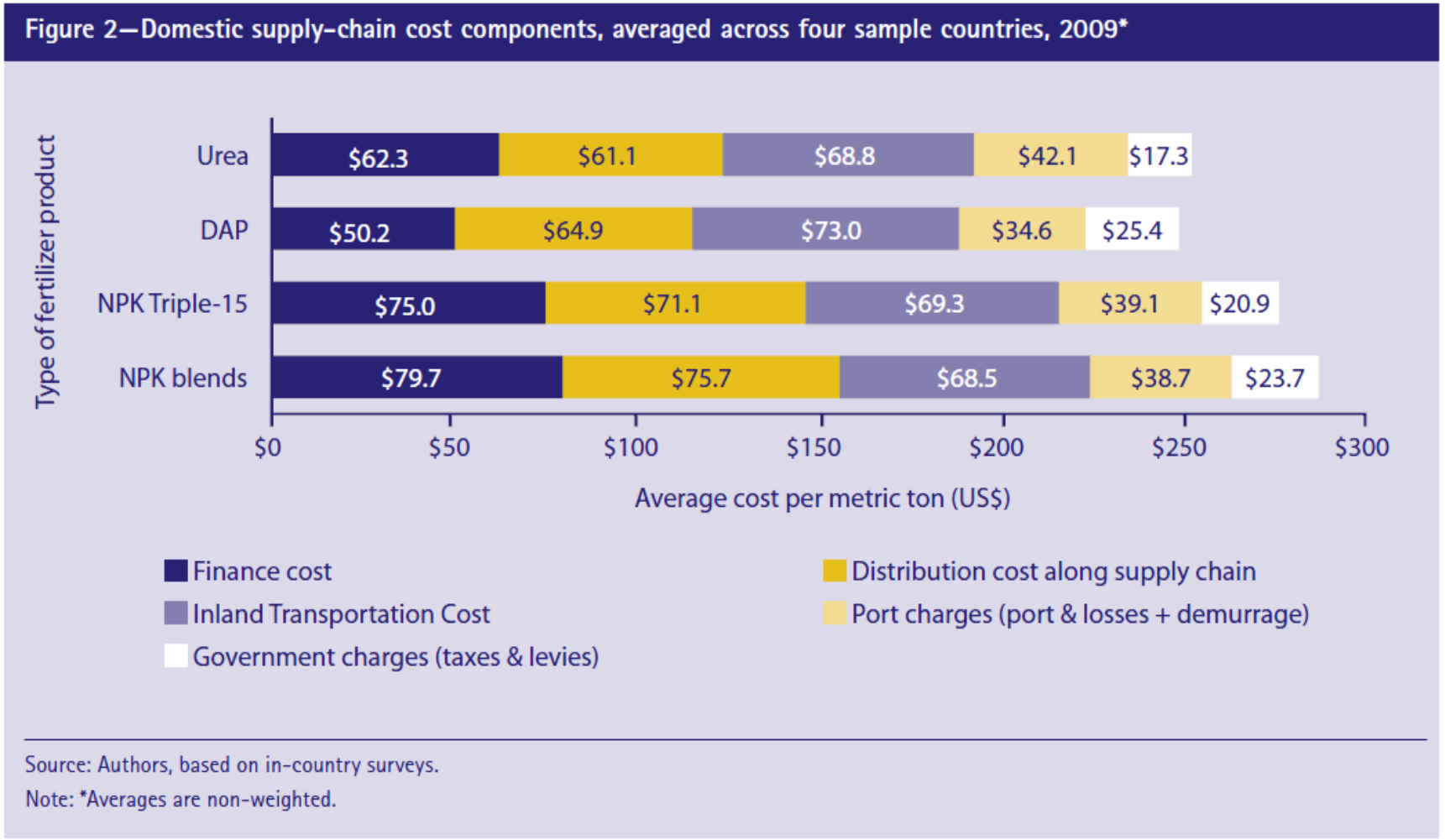


Source: Fuentes, Bumb, and Johnson forthcoming.

Notes: [a] Performance indicators are average percentages and monetary values across different products, for a 50-kilogram bag. [b] Government charges account for 3.8 percent ($0.62/50 kg) of domestic cost.

Source: IFPRI, 2012

Mark-ups (hence cost to farmer) remain high



Source: IFPRI, 2012

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Fertilizer subsidies?

- **Yes, if**
  - Fiscally affordable, at defensible opportunity cost
  - Part of a smallholder-focused agricultural development and soil restoration strategy
  - Properly targeted and implemented
  - Focusing on the right fertilizer products and nutrients
  - In conjunction with policies to make other essential inputs available (good seed)
  - Operates through private distribution channels, deepening input markets
  - Has an exit strategy

Rwanda crop intensification program

Innovative use of vouchers

- **10 bln RWF in 2011, fully funded by government**
- **Subsidy for transport; fertilizer provided at cost ex-Mombasa**
- **Private sector involvement**
  - Central auction gives successful bidders right to sell inputs (set areas & terms)
  - Successful bidders receive fertilizer on government credit
  - Training and distribution: 835 fertilizer dealers
- **Input import activities in 2011 (more or less as in 2009)**
  - 44K mt of fertilizer / 500 mt wheat seed / 1227 mt maize seed
- **Input support**
  - 167K vouchers distributed to farmers, enabling access to fertilizer subsidy
- **Recovery: 763,829,389 RwF for 2010/2011 = 8%**
  - Key threat to program sustainability. 1AF Rwanda, offering services alongside fertilizer loans, has 95% repayment – but other service providers find recovery very hard

Source: MinAgri interview May 2012

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Public-private cooperation

In all of the above, there is a need for more and better PPPs

- **Because of market and government failures in agriculture, neither the public nor the private commercial sector is able to solve the soil restoration problem alone; cooperation is needed**
- **Role of the public sector**
  - Infrastructure, institutions, property rights, rule of law
  - Business climate, regulation, trade and subsidy policies
- **Role of the private sector**
  - Input and service delivery perceived to be relevant by farmers
  - Uptake of products on the output side
- **Public-private partnerships (including donors, governments, fertilizer industry and distributors)**
  - To increase certainty and get things started

Challenges as we craft PPPs

- **The soil testing/market-led extension project in Kenya, the Rwanda Crop Intensification Program, and the Kilimo Salama weather index insurance thrust referred to above are examples of PPPs**
- **PPPs are increasingly recognized as a key part of the way forward in many aspects of agriculture, including soil restoration**
- **Recurring challenges:**
  - How to create mutual benefit and trust?
  - How to share risk and deliver efficiently and with impact?
  - As partners, how to align to achieve strategic goals, as opposed to just seeking tactical advantage?

Ottawa conference by IDRC and SFSA (March 2012) underscored relevance and desire for more PPPs – and knowledge management, new resources, and an incubator platform: **http://www.syngentafoundation.org/index.cfm?pageID=719**

The Syngenta Foundation: a broker of PPPs

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Syngenta Foundation

Separate but aligned; has its own Board; can access company expertise

- **Scalable solutions for 'pre-commercial' small farmers**
- **Six work thrusts, mainly operating through PPPs**

R & D	**Market-led Extension**	**Policy Development**
Seed Systems	**Risk Management**	**Outreach**

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Recap: will we rise to the challenge?

- **Relevant products**
- **Effective farm support**
- **Efficient fertilizer markets**
- **Conducive PPPs**

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Contributions by Mike Robinson, Yuan Zhou, Paul Castle, Ian Barker, and Sanjib Choudhuri are acknowledged

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