

Fertilizers in sub-Saharan Africa Challenges and Opportunities

Prem Warrior



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The Bill & Melinda Gates foundation WHAT WE DO...

▲ Global Health Program

HIV/AIDS
Malaria
Vaccine-Preventable Diseases
Other Infectious Diseases
Tuberculosis
Maternal, Newborn, and Child Health
Delivery and Access Strategies
Acute Lower Respiratory Infections
Global Health Technologies
Reproductive Health
Advocacy
Nutrition
Diarrhea

▲ United States Program

Education
• Increasing High School Graduation
and College Readiness Rates
• Scholarships and College Access
• Early Learning in Washington State
At-risk Families and Children in the Pacific
Northwest

U.S. Libraries

Special Initiatives
Advocacy

▲ Global Development Program

Agricultural Productivity

Financial Services for the Poor

Advocacy

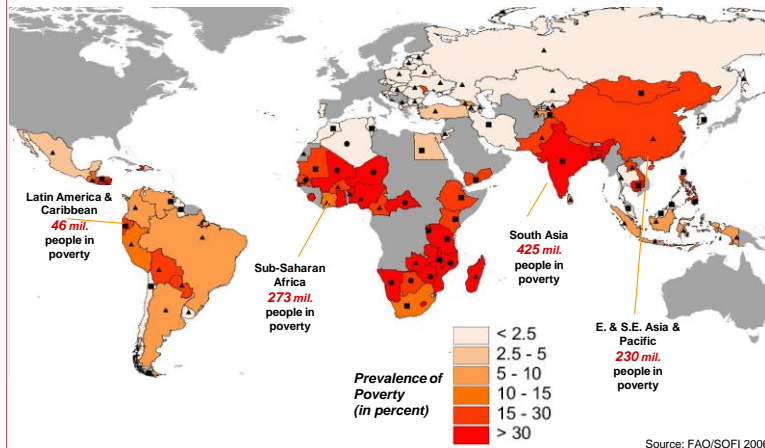
Global Libraries

Special Initiatives, e.g., Water, Sanitation, and
Hygiene

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AGRICULTURE IS THE ROUTE OUT OF POVERTY FOR MOST OF THE POOR

Current poverty status: <\$1/day 75% of the poor are rural, 65% in agriculture



Agricultural Problem in Sub-Saharan Africa is Complex

Low investment in research

Agricultural research expenditures, 2000
\$ Billions, percent

100% = \$36 billion per year

Developed countries	62
Developing countries	38

Of the \$-36 billion spent on agricultural research in 2000, only \$-1.5 billion (~4%) was spent on SSA

SSA	\$13.8 billion
ME and N. Africa	1.5
LATAM	2.6
Asia-Pacific	8.2

Very limited access to markets

Road access
Metres road/capita

Nigeria*	1.4
India	3.0
USA	21.4

* Nigeria has some of the best infrastructure in SSA so other nations are even worse off

The problem:

- There are 636 million people with low incomes and insufficient food – 229m in SSA – 407m in SA
- Many live in areas where agriculture is the primary means of income
- Although these regions have abundant potential (e.g., sunlight, labor, water, knowledge) productivity is low, which represents both a huge need and opportunity

Low input usage and yield levels

Fertilizer use kg/ha arable land, 2002

SSA	9
World	101

Average cereal yields by region, 1960-2003 m/ha

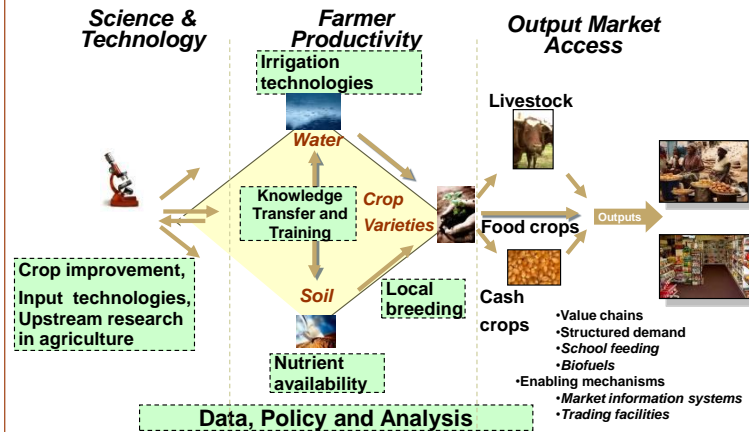
ROW (Rest of World) shows a steady increase in yields, while SSA remains significantly lower.

Poor policy and regulatory environments

Overview of weaknesses in the policy environment in SSA

Agricultural Solution Development

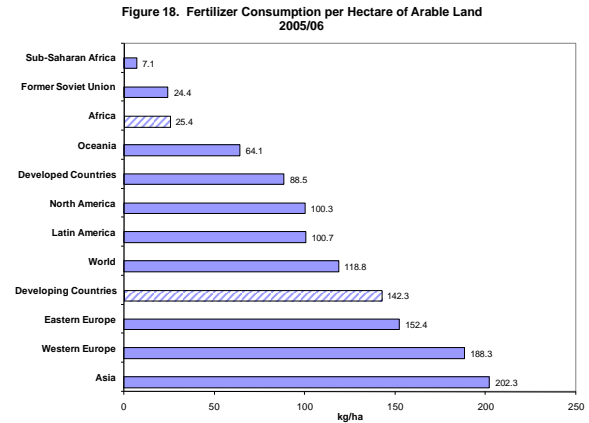
We search for solutions that have impact, scale and are sustainable.



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The Fertilizer Problem – stating the obvious

The actual consumption is less than 5 Kg/ha, leading to low crop productivity and steadily declining Soil fertility



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The Fertilizer Problem – stating the obvious

Comparison between Asia and SSA production increases over time by yield per hectare and by total hectares in production

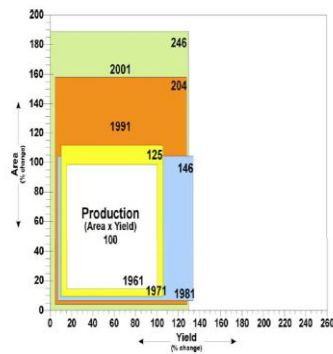


Figure 1. Changes in Cereal Production in Sub-Saharan Africa Due to Changes in Area and Yield (1961 = 100)

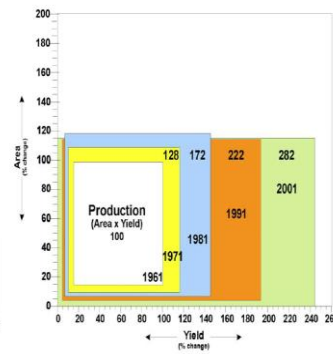


Figure 2. Change in Cereal Production in Asia Due to Changes in Area and Yield (1961 = 100)

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The Solution – recognizing the need for a multi-pronged approach

1. **Demand Creation** – Improve Farm-level knowledge on use and value to integrate fertilizer compositions with agronomic practices, soil/precipitation information, Value:Cost ratio
- Create markets, Generate pull
2. **Increase Supply** - Provide “customized” fertilizer mixtures
- Secure affordable prices at factory gate (energy)
- Affordability at port (insurance, tariffs, transport)
3. **Improve Distribution** - Reduce cost at farm gate
- Infrastructure to reach Small-Holder Farmer
4. **Policy** – Enabling and Sustainable (TBD)
5. **Financing mechanisms** – Innovative solutions needed
- Reduce “risks”
- Reduce financing costs

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Leveraging Technologies

1. Manufacturing/Supply (limited options for technology intervention)
 - Global sourcing/procurement may be an option
 - Local manufacturing – pros and cons
 - Cost reduction is key, but extremely difficult, and dependent on improving efficiency of manufacturing (Catalytic technologies)
2. Improve efficiency of fertilizer applied
 - Crop improvement technology (NUE maize etc.)
 - Application technology
 - Diagnostic kits e.g. Sensor technology for monitoring and release of N (W. Raun, Oklahoma state university)
 - Controlled/Sustained/Timed-release products – innovations
3. Biological options
 - Biological Nitrogen Fixation – proposal in development
 - Other biological options (bio-synthetic approach such as Phosphate solubilization)

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Formulations and Delivery technologies

Innovative, affordable options using Controlled/Sustained/Timed-release technologies for formulations and packaging

1. 4iNNO Open Innovation Approach (\$ 2.4 MM)
 - Working with legal and 4iNNO to develop proposal
 - Provide complete literature search
 - Complete IP, FTO search
 - Identify key areas to invest
2. Meridian Technologies (\$ 1.0 MM)
 - Innovation platform to define areas of intervention
 - Create soil technology and product development pipeline
 - Develop business plans

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OUR SOIL HEALTH STRATEGY IS SEEKING TECHNOLOGY OPPORTUNITIES WHICH COMPLEMENT AGRA'S PROGRAM

Areas of potential technologies:

Soil Fertility Information

- High Resolution Soil Map
- Soil Test Kits
- Fertilizer and plant diagnostics

Soil Fertility Information: GRANT Approved

"African Soil Information Service"
 4 years, ~\$18.0 MM
 TSBF-CIAT, Earth Institute, ICRAF, NARs

GOAL: High resolution map of African soil function for better policy, technology design and extension and large area decision support system

- Long-term sentinel sites for soil change and technology testing.
- Expert systems for soil management recommendations.
- Partial support of the 'Global Digital Soil Map Consortium.'

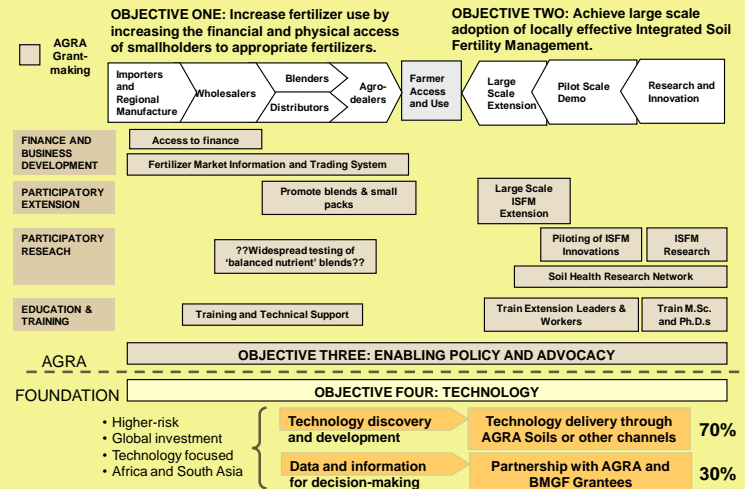
Soil Health Information Proposal – under consideration

"NUANCES DEED"
 4 years, ~\$8.0 MM
 Wageningen w/NARs, CRS, CIRAD

GOAL: Farm level nutrient management decision support system

- Analytic system development
- Best fit technologies
- Integration with field data and testing
- Scaling out with partners

AGRA'S SOIL PROGRAM ADDRESSES SUPPLY & DEMAND FOR KNOWLEDGE AND FERTILIZER BUT NOT PRODUCT DEVELOPMENT



Soil Health: Key Challenges to Pipeline Development

1. Technology prospecting and pipeline design
2. Supporting AGRA Soil Health Program
 - Market-driven & Place-based
3. End-user orientation to data and information grants
4. Improving soil health action across our portfolio
5. Future integration with water and extension

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Fertilizer Policy in sub-Saharan Africa

Past experiences and future priorities

Ellen McCullough



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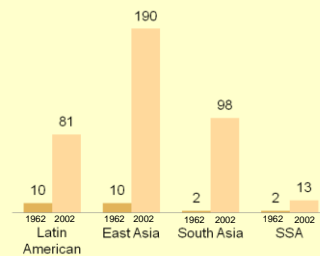
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Fertilizer has an important role to play in raising productivity in Sub-Saharan Africa

- Fertilizer use and crop yields are lowest in sub-Saharan Africa
- Increased fertilizer use is associated with increased production
- However, many past attempts to encourage fertilizer use in SSA have failed to raise productivity and have harmed the industry's growth

Fertilizer use

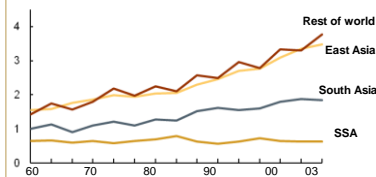
(kg of nutrients/ha of arable and permanent cropland)



Source: FAOStat; IFDC; World Bank

Average cereal yields by region

(mt/ha)



Source: WDR 2008, FAO "Food security and Agricultural development in SSA 2006" 14

Lessons learned from past efforts to promote fertilizer use in sub-Saharan Africa

What has been tried?

- Direct subsidies to reduce fertilizer prices paid by farmers
- Government-financed and –managed input credit programs
- Centralized control of fertilizer procurement and distribution
- Centralized control of key output markets (goal of stabilizing prices and linking input/output markets)

Why did these efforts fail?

- *Unsustainable* (high fiscal and administrative costs)
- *Ineffective* (government lacked the capacity to implement programs effectively)
- *Inappropriate* ("One size fits all" systems did not account for differences in production systems and farmer's needs)

Direct price subsidies have almost always had disappointing results due to *high cost* and *modest benefits* generated.

Source: Morris et al. 2007

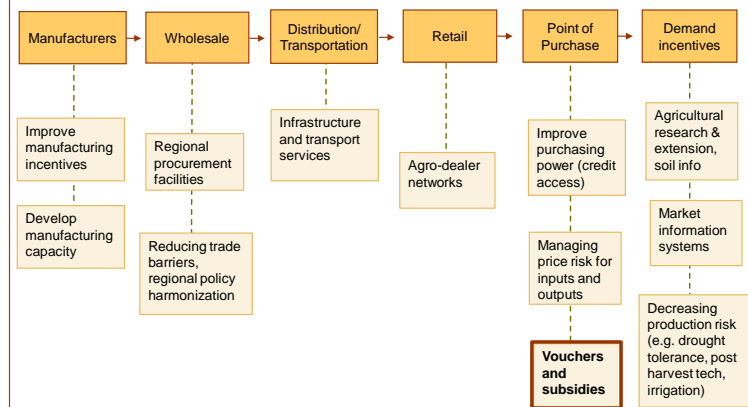
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Effective and sustainable fertilizer policies should:

- **Promote long-term industry health**
(could promote early growth in fertilizer use, but public sector must have exit strategy)
- **Encourage private sector investment across the value chain**
(agro-dealers, farmers, manufacturers, importers, etc)
- **Be cost effective**
(cannot displace critical public goods investments that also increase food production and farm incomes, like ag. R&D)
- **Be context specific**
(should be tailored to the specific place and objectives)
- **Be linked with improved farm productivity**
(cannot be successful without a holistic approach involving inputs, extension, and market access)

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Fertilizer policy entry points in Sub-Saharan Africa:



Source: Morris et al, 2007 and the Abuja Declaration, 2006 17

The role of fertilizer subsidies in promoting agricultural productivity growth and poverty reduction

Salzburg Consensus

A convening held by the Bill & Melinda Gates Foundation
April 29-30, 2008

Purpose:

- Assess the appropriateness of fertilizer subsidies for enhancing productivity and reducing poverty,
- Identify key principles for smart implementation of fertilizer subsidies,
- Evaluate long term costs and unintended consequences

Participants:

Prabhu Pingali Bill & Melinda Gates Foundation	Andrew Dorward University of London	Michael Morris The World Bank Group
Akin Adesina Alliance for a Green Revolution for Africa (AGRA)	Thom Jayne Michigan State University	Sheila Sisulu World Food Program
Sir Gordon Conway UK Department for International Development (DFID)	Lutz Goedde Bill & Melinda Gates Foundation	Roy Steiner Bill & Melinda Gates Foundation
Glenn Denning The Earth Institute at Columbia University	Suresh Kumar KaiZen Innovations	Peter Timmer Center for Global Development
	Ellen McCullough Bill & Melinda Gates Foundation	Gary Toenniessen Rockefeller Foundation

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Why provide fertilizer subsidies?

1. *Increase Agricultural Production*
 - Strategy: broad subsidy in geographies with a high production response (bread basket areas)
 - Impact: stabilizing food supply, lowering food prices
2. *Enable Pro-Poor Growth*
 - Strategy: targeted subsidies to poor farmers
 - Impact: increased productivity and rising farm incomes for smallholders, rural poverty reduction
3. *Provide Safety Nets for the Ultra Poor*
 - Strategy: targeted vouchers for the ultra poor
 - Impact: improve farm production and food security for targeted households
4. *Meet Market Supply after a Food Shortfall*
 - Strategy: short term intervention in affected areas
 - Impact: avoid production shortfall and price spike, promote liquidity and investment post crisis

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How effective are fertilizer subsidies in meeting their objectives?

1. *Increase Agricultural Production* – very high cost
 - Huge financial burden over time, high opportunity cost
 - Benefits decline as fertilizer use increases (they are captured by those already using fertilizer)
 - Exit is very difficult (see Asian experiences)
2. *Enable Pro-Poor Growth* – limited effectiveness
 - Implementation challenges
 - Targeting the poor is difficult and costly, danger of rent capture
 - FS are ineffective without complementary supporting investments
3. *Provide Safety Nets for the Ultra Poor* – not very effective
 - Fertilizer may not be what the ultra poor need most
 - Flexible voucher systems for inputs and food are more effective
 - Targeting the ultra poor is difficult and costly
4. *Meet Market Supply after a Food Shortfall* – can be effective in short run, but...
 - FS can disrupt private sector agro-dealers
 - When fertilizer supply is inadequate, FS can exacerbate high prices
 - Phase-out can be difficult

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Conclusions

- Improving fertilizer use is critical to achieving an African Green Revolution
- Policy enabling environment can promote long term health of the industry. Some short term interventions may be necessary to jump start the industry, though fertilizer subsidies are likely not the most cost efficient tool for doing so.
- Fertilizer subsidies have a very high opportunity cost (Malawi program in 2008 equal to 10 years of agricultural R&D budget). Targeting can help lower costs but there is little if any evidence of successful targeting.
- The Bill & Melinda Gates Foundation and AGRA can partner to support country level analysis identifying appropriate, cost effective and sustainable fertilizer policy strategies

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Thank you