Scientific Achievements for Ag Development in SSA

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Summary

• Scientific achievements
  - CGIAR
    • NERICAs
    • Cassava mealybug
    • QPM
  - Beyond
    • Push & pull
    • Strigaway

• IAASTD findings
  - Observations/lessons learned
Multi-institutional cooperation of scientific and technological communities ....

The NERICA success
Rice cultivation in Africa

The challenges
Water control
Pests and diseases
Weeds
Soil fertility
Input availability
Market access
HIV/AIDS
The African Rice *Oryza glaberrima*

- Domesticated 3,500 years ago
- Hardy & drought resistant
- Prone to lodging and shattering
- Low yield
The Asian rice *Oryza Sativa*

- High yield
- Low resistance to African pest & diseases
- Low weed competitiveness
The New Rice for Africa Traits

From *sativa* parents
- Non-shattering grains
- Secondary branches giving higher yield
- Responsiveness to mineral fertilizer

From *glaberrima* parents
- Weed competitiveness
- Drought tolerance
- Resistance to African gall midge, rice yellow motile virus, blast disease
- Taste and aroma

NERICA has higher protein content than its parents
NERICAs

- NERICAs combine the high quality productivity traits of Asian rice and the ruggedness of native Africa rice varieties.
- Labor saving for women farmers.
- Higher yielding (between 25-250%).
- Increased tolerance to droughts, pests and weeds.
Cassava mealybug
Classical Biological Control

Cassava mealybug *Phenacoccus manihoti* Matile-Ferrero
(Hom.: Pseudococcidae)

World distribution of *P. manihoti*
Classical Biological Control

Cassava mealybug *Phenacoccus manihoti* Matile-Ferrero
(Hom.: Pseudococcidae)

*CM* damage symptoms on cassava
Classical Biological Control

Cassava mealybug *Phenacoccus manihoti* Matile-Ferrero
(Hom.: Pseudococcidae)

*Apoanagyrus lopezi* de Santis (Hym.: Encyrtidae), parasitoid of CM
Classical Biological Control

Cassava mealybug *Phenacoccus manihoti* Matile-Ferrero
(Hom.: Pseudococcidae)

*Apoanagyrus diversicornis* Howard attacking CM
Classical Biological Control

Cassava mealybug *Phenacoccus manihoti* Matile-Ferrero (Hom.: Pseudococcidae)

*CM rearing unit in Benin*
Classical Biological Control

Cassava mealybug *Phenacoccus manihoti* Matile-Ferrero
(Hom.: Pseudococcidae)

Cassava trees for mass production of CM parasitoids
Classical Biological Control

Cassava mealybug *Phenacoccus manihoti* Matile-Ferrero
(Hom.: Pseudococcidae)

Population dynamics of CM following the release of exotic parasitoids (arrow) in Ibadan (top) and Abeokuta (below), both Nigeria; after Neuenschwander (2003).
QPM

- QPM planted on over 600,000 hectares in 25 countries, boosting food, nutrition, health and income security
- Has twice the amount of lysine, tryptophan — essential amino acids
- In Ghana, record yields of 7 tons per hectare achieved
Unique technique for (i) control of lepidopterous stem borers, (ii) the parasitic weed Striga and (iii) to improve soil fertility & increase maize yields.

Chemical Ecology - (ii) Push & Pull
Chemical Ecology - (ii) Push & Pull

Stemborers are the no. 1 field pest of maize in sub-Saharan Africa (SSA)

Parasitic weed Striga is rendering maize production impossible in many regions of SSA
Push & Pull encompasses intercropping maize with the legume Desmodium and a border row of Napier grass around the plot.
Chemical Ecology - (ii) Push & Pull

'Pull'
Volatile chemicals from Napier border attract moths to lay eggs

'Push'
Volatile chemicals from Desmodium intercrop repel moths

Napier grass  Maize  Desmodium  Maize  Desmodium  Maize  Napier grass
Different root exudates of Desmodium lead to (i) germination of Striga seeds and (ii) post-emergence kill of Striga plants.
Greatly reduce losses due to stemborer
Suppress Striga and clean soils from its seed
Increase yields (up to 3-fold)
Improve soil nutrients
Better water utilization
Provide fodder grasses & legumes
Thereby fuel animal husbandry
So far ~ 13,000 farmers adopted technology in the Lake Victoria region
Aim to boost to 25,000 farmers
Single Striga plant can produce up to 30,000 seeds that keep germinating for the next 10 years; intercropping with Desmodium basically cleans the soil by eliminating Striga seed bank in soil.
Strigaway -IR maize
IAASTD

Findings & Lessons Learned
IAASTD Goals

• Development and sustainability goals are the reduction of hunger and poverty, the improvement of rural livelihoods and human health, and equitable, socially, environmentally and economically sustainable development.
The SSA Context

• Per capita food availability increasing globally
• **Extreme hunger** increasing in SSA
• Livelihoods of the poor threatened by:
  - Rapid depletion of NR such as forests and capture fisheries
  - *genetic erosion* of indigenous germplasm of forage and livestock species
1. Characterization of AKST in SSA

- Farming systems **highly diversified**
- Ag highly dependent on rainfall
- **Land degradation** remains one of the key limiting factors
- Fertilizer input 9 kg/ha vs 206kg IC
- Ag & health closely linked
2. Characterization of AKST in SSA

- Most farmers operate in environment of high risk & uncertainty
- Situation for farmers is often exacerbated by weak institutions & policies
Individual successes

• Biological control, improved crop varieties & rinderpest

• Not translated into significant impacts on the assessment goals at the regional level.
Agricultural Policies

• Continue to emphasize production rather than whole commodity value chain & in particular access to markets

• AKST dev & tech-transfer still positions farmers at receiving end
1. Policy Responses to Dev & Sustainability Challenges

- Increasing **value addition** in Ag calls for **upgrading** existing Ag commodity value chains to enhance the linkages and elements of the chain.
- The relatively small nature of many African countries and their socio-cultural and agro-ecological similarities, suggests a **regional approach to value chain development** is most appropriate.
2. Policy Responses to Dev & Sustainability Challenges

- Well functioning input and output markets will enable the development, delivery and application of AKST
- To improve ag performance requires an improvement in the productivity of the 80% smallholder farmers in SSA.
3. Policy Responses to Dev & Sustainability Challenges

- There is scope to improve the enabling environment for farmers through improved institutions.
- Educating farmers increases farm productivity.
- The relevance of agriculture and agricultural products for women in SSA is changing.
4. Policy Responses to Dev & Sustainability Challenges

• Although more sustained funding is being called for, more effective use of existing funds is also required.
1. Particular Challenges & Responses

- Water resources under-exploited.
- Significant increases in the exploitation of both surface and groundwater required.
- Land degradation a key limitation for agriculture and increased applications of chemical fertilizers is limiting agriculture.
2. Particular Challenges & Responses

• **Constraints:**
  - Limited genetic potential of indigenous animal breeds
  - Loss of livestock diversity
  - Weak markets for livestock products
  - Reduced resilience of livestock owners

• Demand for fish products is increasing

• Fish production is declining.
3. Particular Challenges & Responses

- Agroforestry
  - Wealth-creating opportunities for households and communities exist
  - Reduced pressure on natural forests

- Primary ag productivity emphasised over micronutrient availability
Modern Biotechnology

- The ability of SSA to make informed decisions regarding modern biotechnology
  - Research & development
  - delivery & application
  - currently insufficient.
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