The Research and Innovation Agenda for Africa …

… In the Agricultural and Life Sciences

Kwesi Atta-Krah. Ph.D.

International Institute of Tropical Agriculture

Outline

1. Background: Agriculture and Africa
2. Key Elements Research and Innovation
3. Partnership models: CGIAR, LEAP4FNSSA
4. Concluding Points:
   - Europe and Africa University collaboration

Agriculture and Africa

- Agriculture and Africa are inter-twinned:
  - Cultural heritage
  - Food security
  - Economic development
- Agriculture employs between 60 and 70 percent of the work force
- Major contributor to GDP in most countries
- Currently holds 60% of viable uncultivated land
- Productivity needs to increase by 100% heading towards 2025

Agriculture and Africa -

A needed transformation

Agriculture as a way of life - Development culture

- Associated with: Pain, Penury, Poverty
- Subsistence mindset

Agriculture as a business and investment sector

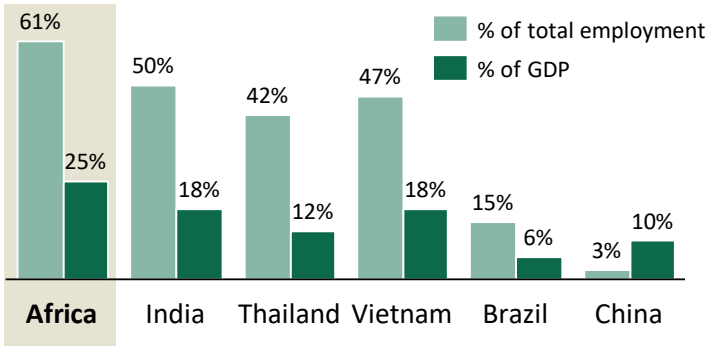
- Associated with: – Efficiency, Productivity, Wealth, Jobs
- Business mindset

➔ **Research and Innovation as key ingredient!!**

Africa's Agriculture Today

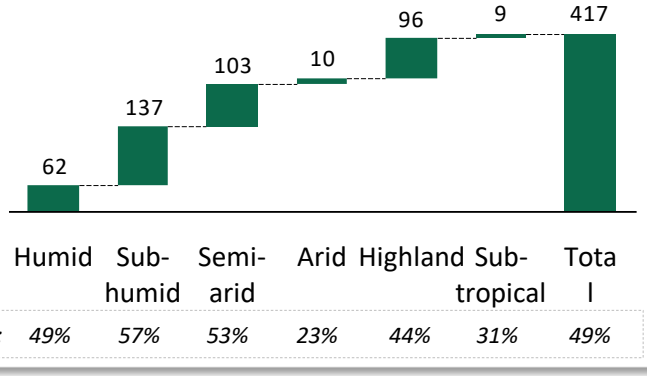
Gap between employment and income...

Agriculture as a share of employment and GDP; % 2014



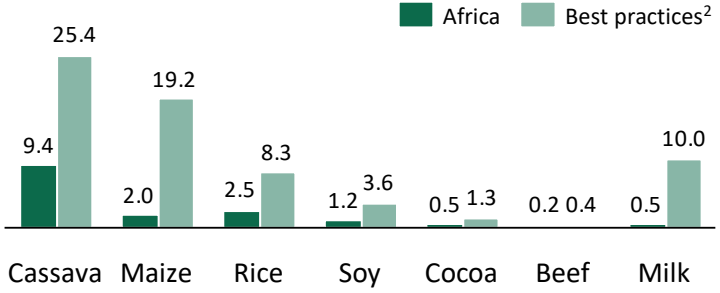
...resulting in widespread poverty.

Millions of Africans living on less than $1.25/day; 2014



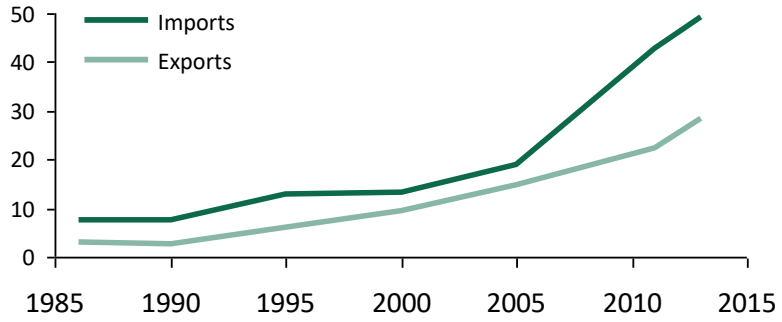
Relatively low productivity...

Average yields across Africa versus best practice[2]; mT/(hectares or animals), 2013



...and rapidly rising imports.

Imports vs exports[3]; billion USD



Part 2: Research and Innovation

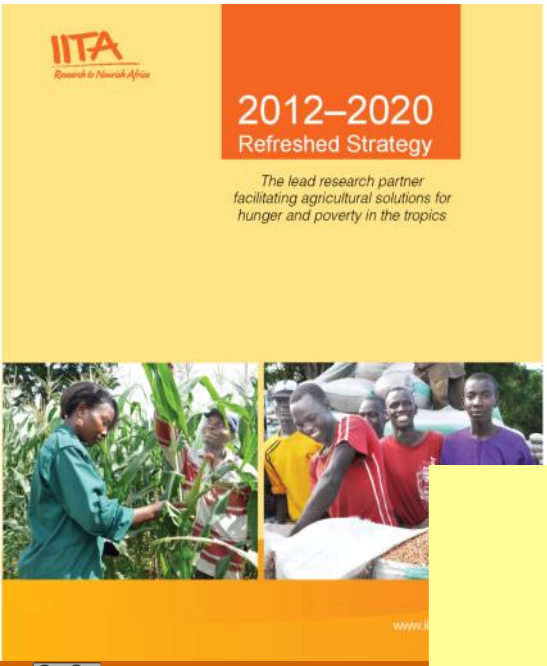
Some key Areas for Research and Innovation in African Agriculture (crops)

- International Institute of Tropical Agriculture (IITA) as Case Point

Vision of success

- A CGIAR Centre; established in 1967
- The largest agriculture research institution on the continent, with Hubs in West, East, Central and Southern Africa.

- Raise over 11 million Africans out of poverty
- Redirect 7. 5 million hectares of degraded lands to sustainable use
- Increase yield of mandate staples by 60%



Measuring progress against KPIs
- Poverty reduction – Social science team
- Sustainable Land Use – NRM team

IITA mandate crops

Cowpea

Soybean

Maize

Banana

Plantain

Yam

Cassava

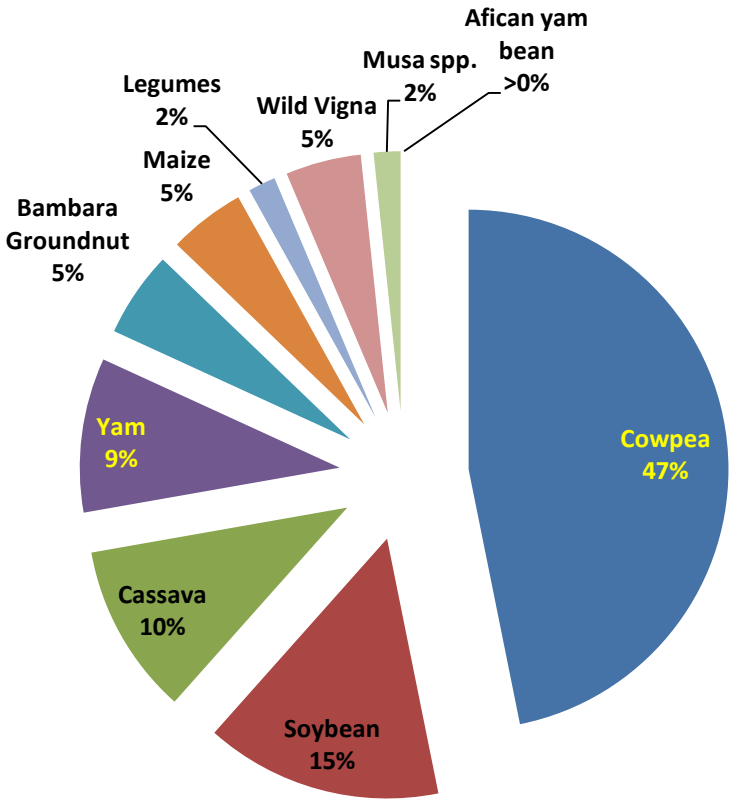
Thematic areas

- Crop improvement – Breeding and biotech
- Plant production and plant health
- Natural resource management
- Social science and agribusiness
- Nutrition and food technology

IITA's Genetic Resources Center

International collections of major food crops in Africa:

Crops	Number of accessions
Cowpea (*Vigna unguiculata* L.)	15379
Soybean (*Glycine max* L. Merr)	4841
Cassava (*Manihot esculenta* Crantz)	3499
Yam (*Dioscorea* spp.)	3170
Bambara groundnut (*Vigna subterranea* L. Verdc)	1752
Maize (*Zea mays* L.)	1565
Miscellaneous legumes	558
Wild Vigna (*Vigna* species L.)	1543
Banana/plantain (*Musa* spp.)	546
African yam bean [*Sphenostylis stenocarpa* (Hochst.) Harms]	456



IITA Genebank

http://genebank.iita.org/

IITA'S Genetic Resources Center

Seed Bank (seed crops)

Clonally propagated crops

Field Bank

In vitro Bank

Cryo Bank

DNA Bank

Seed Systems

- Development and delivery of seed and planting materials of improved varieties
  - Seed crops
  - Clonally propagated
- Most challenging for vegetative-propagated crops (e.g. cassava; yam; plantain)
- Disease free planting material
- Rapid multiplication and effective distribution
- Private sector roles and collaboration

Semi-Autotrophic Hydroponics (SAH)

- A rapid multiplication technology for clonal crops
- Developed in Argentina; initiated at IITA-Ibadan in July 2016
- Propagation of tissue culture (*in vitro*) plantlets under semi-hydroponic and semi-controlled environmental conditions
- Offers 'rooted plants' transferable to screen house or field.

Production of SAH™ derived stems

Meristem culture

Thermotherapy

Virus-free tissue culture plantlets

Virus-free SAH plantlets

100 boxes of SAH™ plantlets produces 1600 boxes within two months

12 months!

High quality SAH™ derived stems

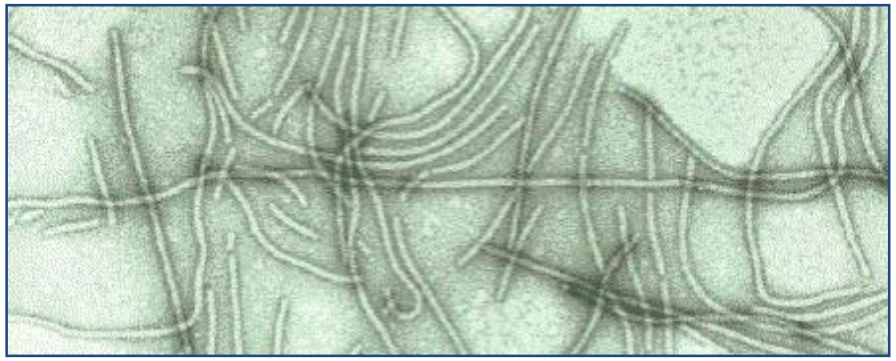
Uniform seed field of SAH™ plants

Clean seed systems to control virus diseases

- Cassava mosaic and cassava brown streak diseases spread through vegetative propagation
- Virus-free plants are produced using tissue culture methods (in vitro)

Cassava Brown Streak Disease

<u>Emerging virus</u>
Cassava brown streak virus
Potyviridae: *Ipomovirus*

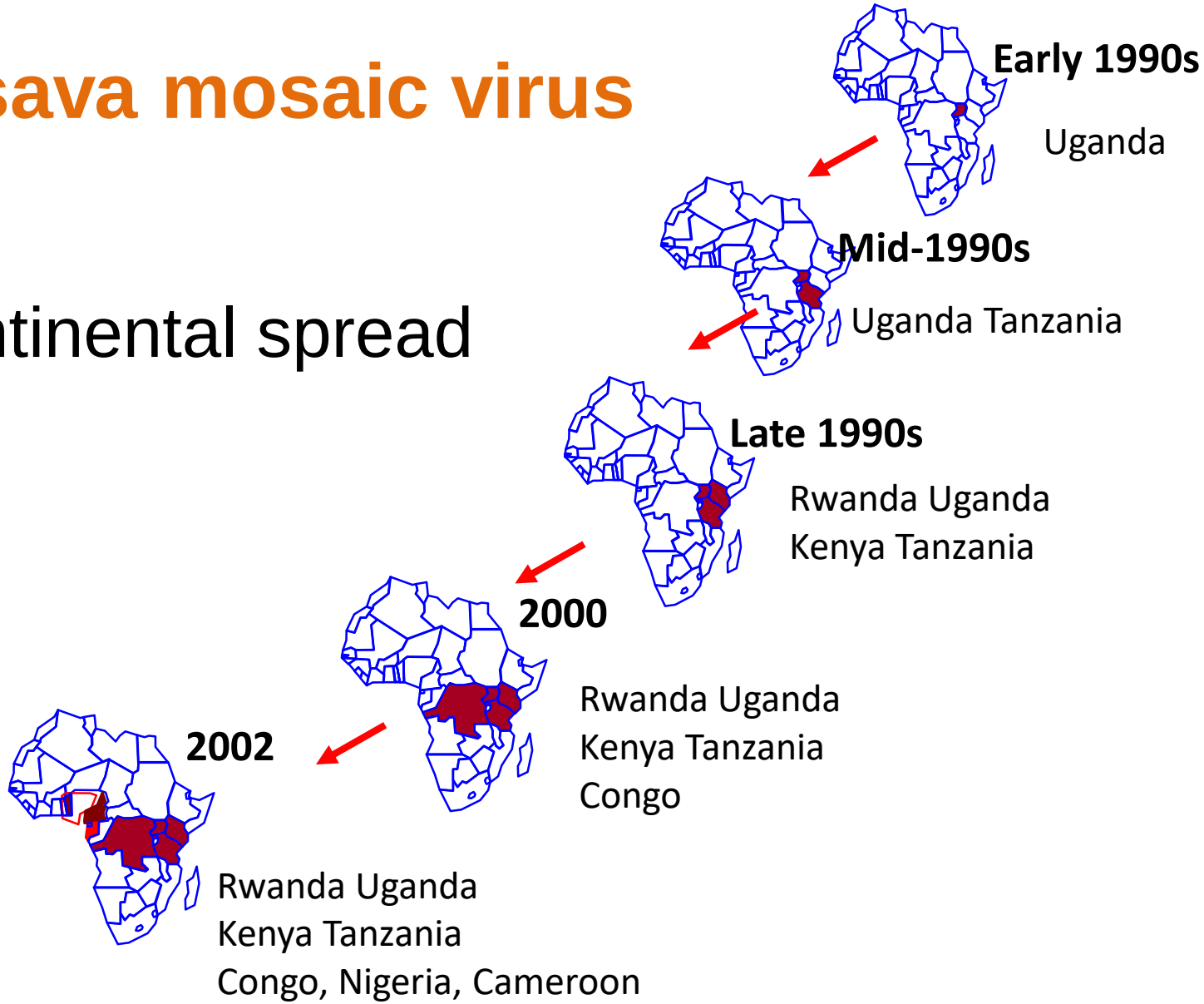


- Affecting 1.6 million people in Eastern Africa (Kenya, Uganda, Tanzania, Malawi and Mozambique
- Massive yield loss and economic loss

Severely affected roots are unfit for any use

Cassava mosaic virus

Continental spread

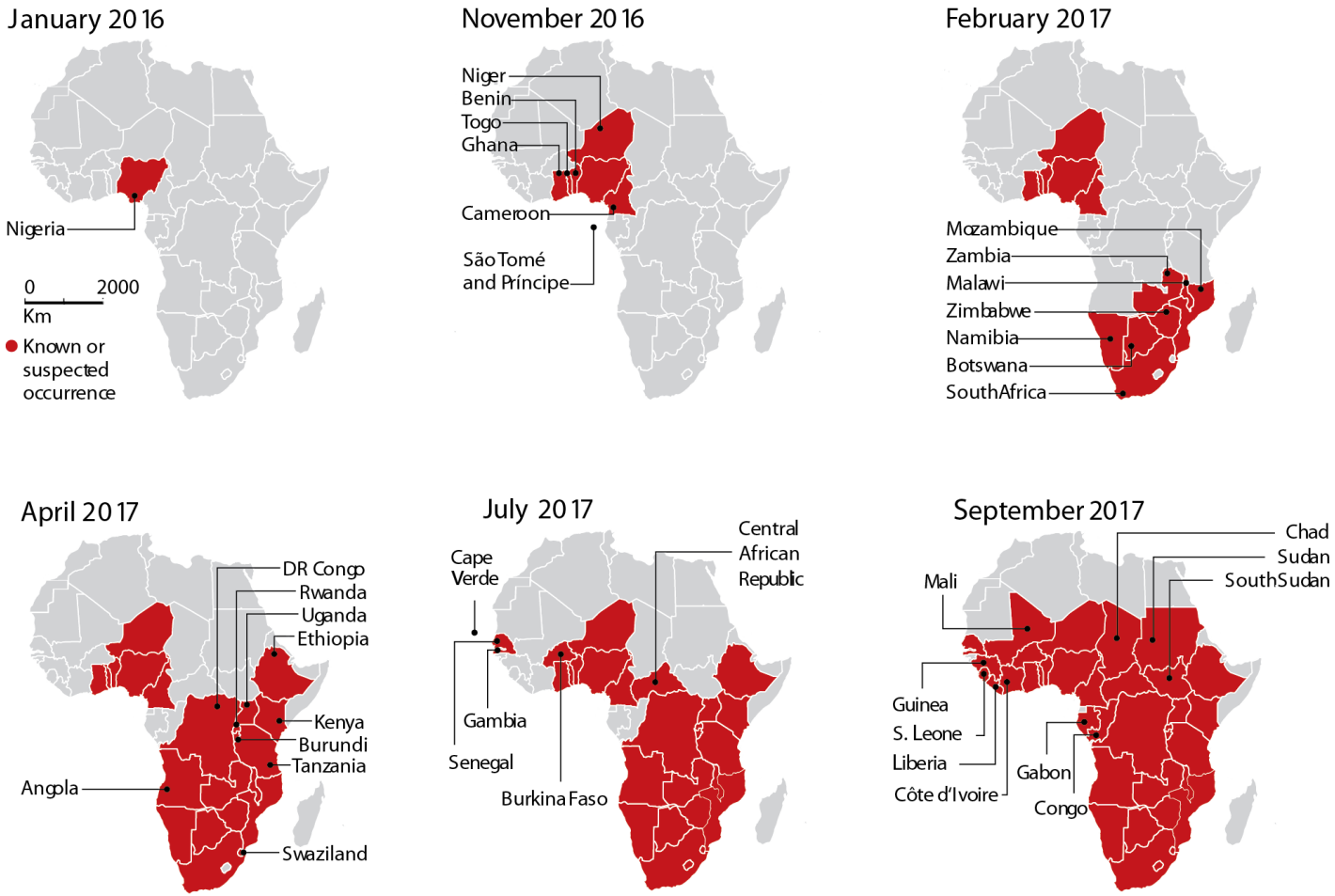


Fall armyworm *Spodoptera frugiperda* (J E Smith) (Lepidoptera: Noctuidae)

Goergen, G., Kumar, P. L., Sankung, S. B., Togola, A. & Tamò M., 2016. First report of outbreaks of the fall armyworm *Spodoptera frugiperda* (J E Smith) (Lepidoptera: Noctuidae), a new alien invasive pest in West and Central Africa. *PLoS ONE* 11(10): e0165632.

Invasion of the African continent by FAW:

41 countries, >22 m km^2



Source: modified & updated from Science Magazine, 5 May 2017

Food Safety – Case of Aflatoxin

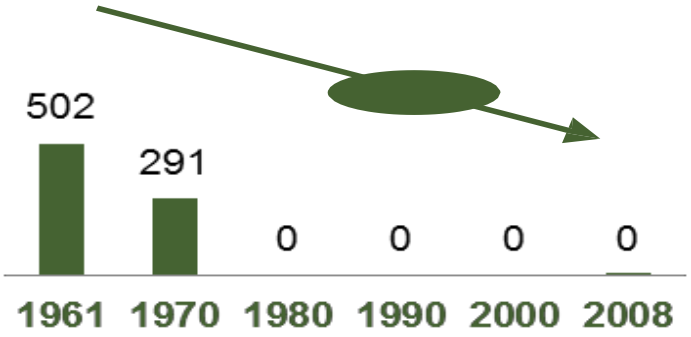
Aflatoxins in food and feed pervasive in Africa

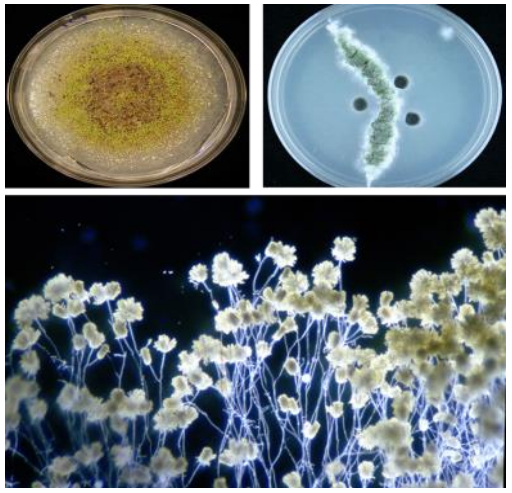
- Biological control in conjunction with other management practices can dramatically reduce aflatoxin contamination
- IITA has developed “Aflasafe” product that is capable of controlling Aflatoxin infestation
- Commercialization efforts underway in a number of countries

Africa-wide Initiative
on Aflatoxin biocontrol can improve health and income of African people

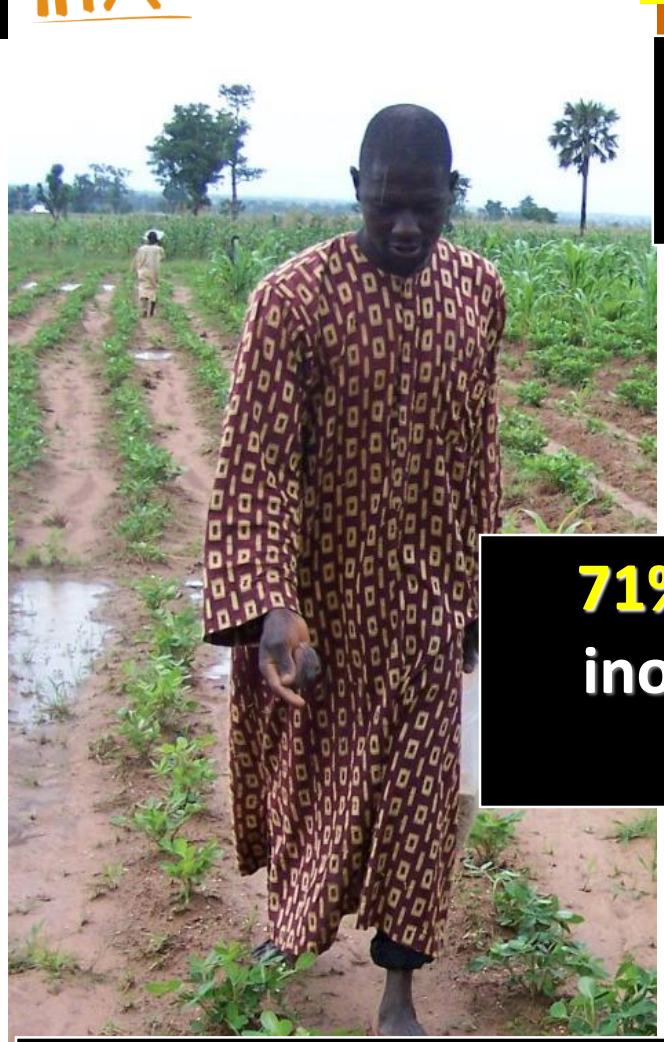
Extinct groundnut pyramids in Nigeria due to aflatoxin

Nigeria glory in global trade in 1961





Farmers treating maize and groundnut fields with AflaSafe



Aflatoxin reduction at corn harvest:

2009: 80% **2010: 89%**

71% and **52%** carry-over of inoculum 1 & 2 years after application

Aflatoxin reduction at peanut harvest:

2009: 96% **2010: 98%**

NRM – Agronomy and Weed Management

- Cassava weed management project
- Africa Cassava Agronomy Initiative (ACAI)
- Integrated agricultural systems research
  - Integrated Soil Fertility Management
  - Cropping systems
  - Mixed cropping
  - Relay cropping

3.0 Structural and Institutional Framework for Research and Innovation

Case Points

- **CGIAR:**
  - A portfolio of 15 IARCs; 12 CGIAR Research Programs (CRPs) + partners

- **LEAP4FNSSA:**
  - Long-term Europe Africa Partnership for Food and Nutrition Security and Sustainable Agriculture

A New Business Plan – 5 Global Challenges

Food – the way we grow, catch, transport, process, trade, and consume it – is central to the main challenges facing humanity.

FOOD SECURITY

Yield increases of staple crops have flatlined, struggling to keep pace with growing demand. **Agricultural output must increase in harmony with the natural environment** by improving access to quality inputs, extension services and innovations along the value chain

HEALTH

2016 saw this decade's first increase in the number of **chronically undernourished**, now more than 800 million people. Two billion people suffer from **micronutrient deficiencies,** an equal number are **overweight** or obese.

ENVIRONMENT

Water, land and forests are precious, yet finite, natural resources. **Agriculture accounts for about 70% of global water withdrawals and is the biggest cause of forest loss.** Additionally, a third of the world's **soil** is classified as degraded.

CLIMATE

Climate change and climate shocks put the most vulnerable people at risk. Heat, drought, flood, and unpredictable growing seasons harm farmers and production systems.

PROSPERITY

Many of the world's **poor rely on agriculture and natural resources** for food and livelihood. More than 85% of the world's 1.2 billion **youth l**ive in developing countries where meaningful **employment** and entrepreneurial opportunities are limited – contributing to **migration and political insecurity.**

Source: CGIAR Narrative document, 2018

4.0 Concluding Points. I

Research and Innovation in Agriculture and Life Sciences:

- Africa is open for business - lots of opportunities for research and innovation
  - Breeding and biotechnology (crops and livestock)
  - Crop and livestock production and seed systems
  - Value chain development, processing and markets
  - Plant health and food safety
  - Nutrition
  - Social science and Agribusiness
  - Youth in Agriculture and Agribusiness

- Strategic partnerships for ag transformation
  - Private sector
  - Universities
  - Development banks and investors
  - CGIAR; LEAP4FNSSA
  - Regional bodies: European Union, African Union (CAADP)

4.0 Concluding Points. II

Universities and collaboration

- Agriculture & Life Science universities should be a 'hotbed' for ARI in Africa.
- Partnerships need to be strengthened:
  - Between Europe and African Universities
  - Universities and research institutions in Africa.
- Strengthen engagement in translating research outcomes into strategies and evidence for policies.
- In the above regard, I propose a strong partnership between ICA Forum and RUFORUM
- A call for a model 3-point partnership involving European and African universities and African NARS with possible engagement of international research institutions.

Thank You