ARI Regional Strategies and Priorities for Breeding and Capacity Development

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The Second Leadership Consultation Meeting

NARES – CGIAR – AIDE Memoire
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Threats to the Progress of Regional Food Security

- Population increase
  - 2.5 billion people by 2050
- Low productivity in farmers’ fields
- Food import bill
  - US$ 110 billion by 2030
- Climate change
- Covid-19 and other Pandemics
- Conflicts in Africa & Russia-Ukraine war
Human Resource Capacity in SSA

- SSA lacks the critical mass of scientist and engineers to develop the continent
- Government investments in higher education in SSA generally <0.3% of GDP
- Returns on investments in higher education in Africa estimated at 21% (highest in the world)

Availability of Scientists and Engineers, Ranking, 2017

1 - 20 20 - 40 40 - 59 59 - 79 79 - 98 98 - 118 118 - 137 No Data
Higher Education in sub-Saharan Africa


1970s  mid 1990s

Brain Drain

- Poor Infrastructure
- Inadequate Funding for R & D
- Low Staff Morale
- Weak Post Graduate Programmes


- Brain Drain
Commitments to Accelerated Agricultural Growth and Transformation

- **Comprehensive Africa Agriculture Development Programme (CAADP), 2003**
  - Achieving an annual agricultural growth rate of at least 6%.
  - Allocating at least 10% of national budgets to agriculture.

- **Malabo Declaration, 2014**
  - Doubling agricultural productivity.
  - Reducing post-harvest losses to half of current levels.
  - At least 30% of farm, pastoral, and fisher households being resilient to climate and weather-related risks by 2025.

- **CAADP Biennial Review, 2017, 2019, and 2021**
  - Tracks performance in key areas such as investment in agriculture, ending hunger, and halving poverty by 2025.
World Bank Africa Higher Education Centres of Excellence (ACEs)

- HEIs in STEM, Environment, Agriculture, applied Social Science/Education and Health
- $580 million disbursed in three phases of the ACE projects & US$72 M from AFD
- 70 ACEs hosted in 50 Universities across 20 countries
- 33,435 students enrolled (3,357 PhD; 9,631 MSc; 20,447 professional short courses)
- 3,103 articles published & 283 programmes accredited
World Bank Africa Higher Education Centres of Excellence (ACEs)

- **Senegal**
  - ICT; Env. & Health; Food Security & Nutrition; Maternal Health

- **Nigeria**
  - Agriculture (3); ICT (3); Oil fields (1); Material Science (1); Health (8); Power – Energy (1); Renewable Energy (1); STEM Education (2)

- **Burkina Faso**
  - Water; Pharma. Sci.; BioTech - Vector Borne Diseases; Social risk Coll. of Engineering

- **Guinea**
  - Communicable Diseases; *Mining

- **Côte d’Ivoire**
  - Climate change; Statistics; Mining Environ; Valorization of Waste

- **Côte d’Ivoire**
  - *Engineering

- **Ghana**
  - Crop Improvement; Water & Sanitation; Infectious Diseases; Genetic medicine; Coastal Resilience; Transport; Water & Irrigation; Renewable Energy Coll. of Engineering

- **Togo**
  - Poultry Science; Power (energy); Urban Design

- **Benin**
  - Math & Stats.; Water & Sanitation; Coll. of Engineering

- **Mozambique**
  - Oil & Gas

- **Uganda**
  - Crop Improvement; Material Science; Pharm-Biotech; Agro-ecology

- **Rwanda**
  - ICT; Energy; Math & Sci. Education; Data Sciences/Statistics

- **Ethiopia**
  - Climate Smart Agric.; Water Mgt; Railways Engineering; Drug Development

- **Kenya**
  - Sustainable Agriculture; Sustainable use of Insects; Renewable Energy

- **Tanzania**
  - Infectious Diseases (humans/animals); Rodent Mgmt & Biosensor Tech; Water Infrast. & Sustainable Energy; Agric Research & Advancement

- **Malawi**
  - Fisheries; Public Health

- **Cameroon**
  - *Transport-Logistics/ICT; Coll. of Engineering

- **Djibouti**
  - ICT

- **Benin**

- **Mozambique**
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*refers to Emerging Centers
Designing New Crop Varieties for Africa

**Genomics**
- Genetic diversity studies
- QTL mapping (Linkage analysis, GWAS)
- Genome wide selection
- Meta-QTL analysis and QTL validation

**Epigenomics**
- DNA methylation & histone modification

**Genetic Engineering & Gene Editing**
- CRISPR – Cas9

**Phenomics, Robotics, Speed Breeding**
- High-throughput image analyzer
- Ground Robots
- Speed breeding in growth chamber and glasshouses

**Hybrid & Doubled Haploid Technologies**

**Transcriptomics, Metabolomics & Proteomics**
- Fast-SNP markers
- Mass spectrometry

**Artificial Intelligence & Machine Learning**

**Genetic basis of complex traits**

**Informed breeding and selection decision**

**Genetic improvement**

**Modern platforms for trait discovery and varietal development**
The “NextGen” African Plant Breeders

Focus on Developing Quality Crops
Open to Modern Trends
Practical
Demand Driven
Looking Ahead

Africa Academy of Leadership in Agricultural Sciences

US$ 150 million Endowment

ACCI
MaRCCI
WACCI

CGIAR, APBA & Other advanced institutions
Conclusion

We possess vast lands capable of feeding the globe, yet many of us remain impoverished and hungry. A self-sufficient Africa, free from hunger and poverty, is within reach by 2030. However, this vision requires visionary leadership that leverages the power of science, technology, and innovation. I urge our global development partners to re-evaluate their approach to collaboration in the agricultural sector. The potential benefits, measured in trillions of foreign exchange, highlight the importance of fostering strategic partnerships. Together, we can shape the future of agriculture in Africa, and by extension, the world.

– Eric Danquah, 2023 (Africa Food Prize Laureate, 2022)
Thank You
Established in June 2007 as a semi-autonomous unit in the defunct College of Agriculture and Consumer Sciences to train Plant Breeders for West Africa (Seed grant of US$ 5 m from AGRA)

Became a unit of the College of Basic and Applied Sciences in 2014 and a World Bank Africa Centres of Excellence in 2015
Outputs and Outcomes of the WACCI Project

Africa Centre of Excellence for Agricultural Innovation and Entrepreneurship: Developing talent in Africa for the future of Africa’s Agriculture

- Investments to date: US$ 40+ million
- Publications (students & faculty) >259
- Enrolment from 20 African Countries
  - 160 PhDs
  - 90 MPhils
- Graduates from 15 African Countries
  - 105 PhD (36 F)
  - 40 MPhil (18 F)
- Total Grants Attracted by Alumni > US$ 62 million
- 279 varieties released from 10 African countries
- 3 viable PPPs for scaling up seeds (Soybean, Tomato, Maize)
- Training and Outreach: > 5,474 farmers, 400 AEAs, 67 FFS, 53 Entrepreneurs
African Centre for Crop Improvement (ACCI), UKZN

150 plant breeders trained since 2002

Publications (students & faculty) >400

Alumni constitutes 40-50% of active NARS breeders with 100% retention in Africa

>200 varieties released accross 20 countries

Enhanced public-private partnerships
- Climate-smart cultivars for a water-scarce future
- Pan Africa Demand led Breeding initiative
- Partnerships with NARES in 20 African countries

Established in 2002 at UKZN
MaRCCI selected outcomes

Figure 3: The four core areas of research (Sorghum, cowpea, horticulture and seed science and technology;
Looking Ahead

- Urgent need for a revitalized higher education in agriculture: Entrenched in the trinity of Research, Development & Outreach
- Strategic partnerships: Public-private partnerships for genetic innovations, development of seed systems and commodity value chains
- Strengthen Extension Services: Equip farmers with the knowledge and skills needed to optimize yields in their fields
- Harmonization of policies critical to development: Secure farmers rights, provision of access to credit and support seed innovations
- Political will to deliver an Africa free from poverty and hunger by 2030: This should be backed by regional collaboration