



The African Center for Crop Improvement (ACCI) in 2023

A scientific meeting hosted by the University of Zambia
in collaboration with the Kirkhouse Trust

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Smallholder farmers – mostly women – produce most of Africa's food today, with minimal inputs



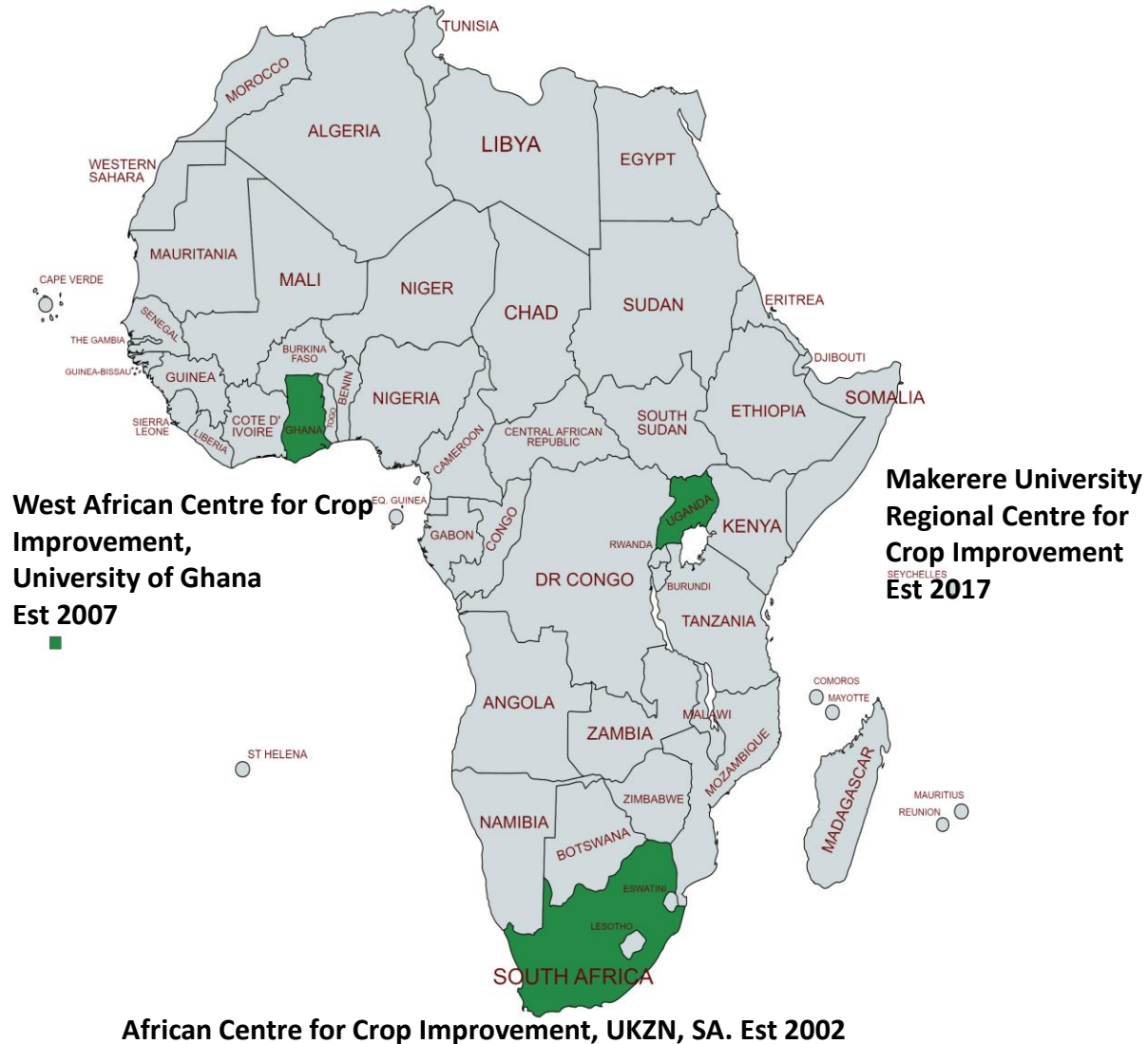
The Need for Plant Breeders in Africa

- **> 20 major food crops:** 7 cereals, 7 legumes, 5 roots/tubers + banana
- Diverse agro-ecological zones
- Low input and small-scale production – **> 50% of yield gap**
- Farmers still use **landraces**
- Rapid change to rainfall, temperatures, pests, diseases
- Need to breed new crop varieties faster than changes in climate
- Estimated **shortage** of active Plant Breeders = **440 across Africa**
- First generation of ACCI Plant Breeders: promoted, retired, deceased

Training Plant Breeders in Africa

- African universities teach Plant Breeding mainly in undergraduate level
- There is a lack of **postgraduate** training
- Need to create regional centres with a critical mass of experienced Plant Breeders
- **ACCI, WACCI & MaRCCI** in South, West and East Africa, respectively

Regional Plant Breeding Training Centers



The Need for Plant Breeders in Africa

- **Funders:** RF, BMGF (via AGRA), World Bank, CG Centers
- **Common Educational Model:** research in Africa, on local crops, at local research stations, in local agro-ecological zone – very successful
- **>500 PhD's + MSc's** trained since 2002, from 25 countries, hundreds of new cultivars released, hundreds of research papers and conference presentations, 100% retention of graduates in Africa
- **Challenge:** each of the 3 centres needs to train 10 PhD's p.a. to replace retiring scientists, still leaves a deficit of >400 Plant Breeders

ACCI in 2023



- **Training African Plant Breeders, in Africa, on Africa Food Crops Since 2002**
- Multiple student-specific funders:
 - NARS, CGs, IAEA, OWSD, TWAS, KT etc.
- **Students:** 25 PhD students + 15 MSc students
- **Academic Staff:** 5 Plant Breeding staff at UKZN and ACCI
- **Resources:** farm, greenhouses, labs, genomics, proteomics, electron microscopy, biometricians, soil scientists, etc.
- **Rapid phenotyping:** drought, frost, NIR for quality traits, pest & disease
- **Institutional Support** from UKZN
- **Primary Challenge:** Need to scale up activities to meet Africa's need for Plant Breeders with continued funding

Impact - case examples

Beans: Iron and zinc enriched climate smart varieties: MOORE 88002, RWR 2154, RWR 2245 (bush type), MAC 44 and Nyiramuhondo (climber type) varieties

- First releases in Uganda (2017)
- High yield gains (20 to 49%)
- Extended time of harvest and bean consumption
- Increased marketability
- RWR2245 is highly adopted in Rwanda and enhanced nutrition and incomes of smallholder farmers



Developed and released by:

The Pan-Africa Bean Research Alliance (PABRA)

The National Agricultural Research Organization (NARO)/Uganda

HarvestPlus, International Center for Tropical Agriculture (CIAT),

United States Agency for International Development (USAID)-

Feed the Future and Tropical Legumes III (TL III)

Cowpea:

Drought tolerant grain cowpea varieties (ShR3P4, BrR4P11, NkR1P3, ShR4P1, BrR11P2, ShR10P10 and NkR8P9) released in Namibia in 2017

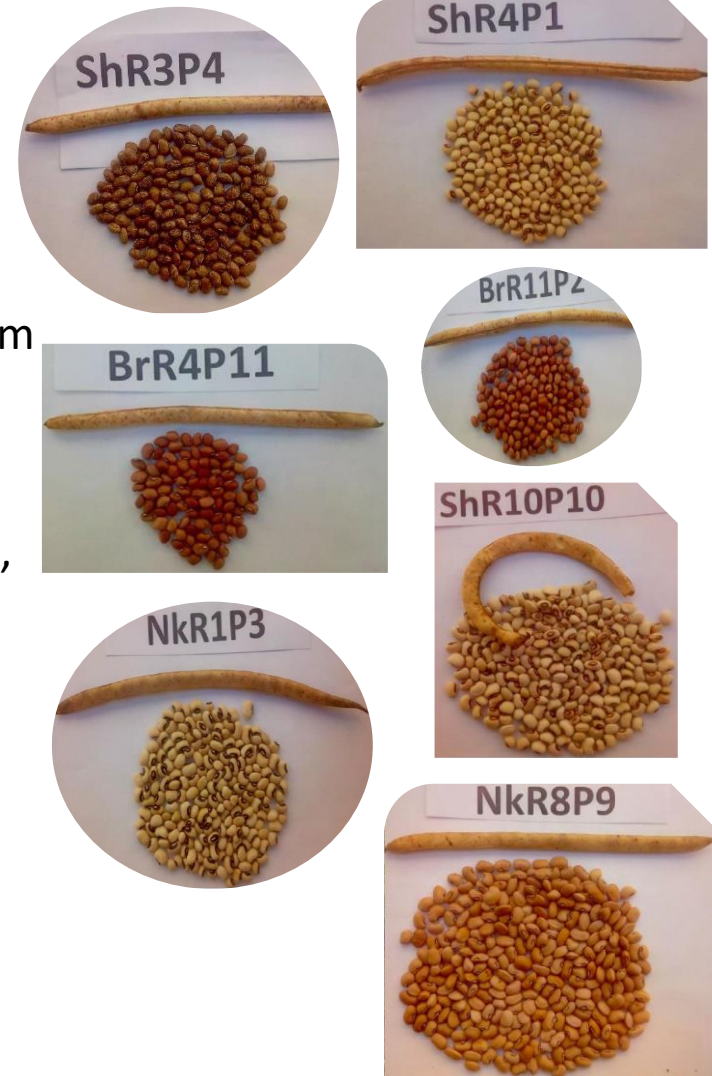
Attributes:

- Pod Shape: straight, coiled (ShR10P10)
- Seed color: speckled (ShR3P4), brown (BrR4P11, BrR11P2), white (NkR1P3, ShR4P1, ShR10P10), cream (NkR8P9)
- Maturity days: 70
- Yield: 1.2 t/ha (NkR8P9), 1.6 t/ha (BrR4P11, ShR4P1, NkR1P3, BrR11P2, ShR10P10), 2 t/ha (ShR3P4)

Developed and released by:

Ministry of Agriculture, Water and Land Reform/Namibia (Dr Lidya Horn), The African Centre for Crop Improvement (ACCI)/South Africa

Funded by: IAEA



Pigeonpea:

Three varieties released in Malawi in 2021

Mthawajuni wofiira

Seed colour: brown
Maturity days: 130 to 150
Seed size: 20-24 g/100 seed
Resistant to insect pests
Good flavour and shorter cooking time
Yield: 2 t/ha



Mthawajuni wamawanga

Seed colour: Cream mottled and speckled
Maturity: days 130-150
Seed size: 20-24g
Tolerant to pod borers
Yield: 2 t/ha



Mthawajuni woyera

Seed colour: cream (grey - white)
Maturity days: 150 -180
Seed size: 18-24 g
Tolerant to pod borers
Yield: 2.5 t/ha

Developed and released by:

Department of Agricultural Research Services, Malawi (Dr Esnart Nyirenda Yohane), ACCI

Funders: AGRA, ACCI and Sustainable Agricultural Productivity Program (SAAP) , an International Fund for Agricultural Development (IFAD)

Sorghum: *Striga*-resistant varieties (TARISOR1 and TARISOR2) in Tanzania, 2018

- First released in Tanzania
- *Striga*-resistant
- High-yielding (3 to 4 tonnes/ha)
- Amenable to a biocontrol agent, FOS

Developed and released by:

Tanzania Agricultural Research Institute –
Tumbi Centre (Dr Emmanuel Mrema)

The African Centre for Crop Improvement (ACCI)



Sorghum:

Drought tolerant grain sorghum varieties (NAMSO series: NAMSO-01 to 05) released in Namibia in 2022

Attributes:

- Use: porridge and brewing
- Plant height: 140-180 cm (NAMSO-01, NAMSO-04, NAMSO-05), 120-160 cm (NAMSO-02), 150-190 cm (NAMSO-03),
- Seed color: White, Red (NAMSO-02)
- Maturity days: 120-140 (NAMSO-01, NAMSO-04), 100-120 (NAMSO-02), 110-130 (NAMSO-03, NAMSO-05)
- Yield: 1.5 - 3 t/ha (NAMSO-01, NAMSO-04), 2 - 4 t/ha (NAMSO-02), 2 - 3 t/ha (NAMSO-03), 1.5 - 2.5 t/ha (NAMSO-05)

Developed and released by:

Ministry of Agriculture, Water and Land Reform/Namibia (Mr Wanga Athon Maliata), The African Centre for Crop Improvement (ACCI)/South Africa
Funded by: IAEA



Potato:

Processing quality (variety Cyerekezo) and short dormancy (var. Ndamira) developed and released in Rwanda in 2020

Processing quality var.

Cyerekezo:

Use: French fries and chips

Maturity days: 90-110

Dormancy: 90 days

Yield: 30 t/ha)



Short dormancy var. Ndamira:

Use: boiled/table

Maturity days: 90 -100

Dormancy: < 30 days

Yield: 30-40 t/ha



Developed and released by:

- Rwanda Agriculture and Animal Resources Development Board (RAB) [Drs Placide Rukundo, Jean Baptiste Muhinyuza]
- The African Centre for Crop Improvement (ACCI) – South Africa
- Funded by AGRA, RAB

Sweetpotato:

High dry matter orange fleshed varieties: Ukr/Eju-10 (Alamura) and Ukr/Eju-13 (Dilla) in Ethiopia, 2019

- First releases developed via crossing in Ethiopia
- High dry matter (31-32.5%) and high beta-carotene (pro-vitamin A) content (9-12.4 mg 100 g⁻¹ on dry weight basis)
- High-yielding (23-28 tonnes/ha)
- Moderately resistant/tolerant to sweetpotato virus diseases
- Preferred by farmers among 12 elite genotypes



Developed and released by:

South Agricultural Research Institute – Hawassa Research Centre
(Dr Fekadu Gurmu)

The African Centre for Crop Improvement (ACCI) – South Africa,
Funded by AGRA



Sweetpotato:

Dual-purpose varieties (RW11-17; RW11-1860; RW11-2419; RW11-2560; RW11-2910 and RW11-4923) developed and released in Rwanda

RW11-2560 and RW11-2910:

- First releases as dual-purpose varieties
- Orange-fleshed, rich in β -carotene, precursor of Vitamin A



Preferred traits:

Use: Dual-purpose

Optimum production: mid-altitude

Maturity days: 120-150

Yield: 25-30 t/ha

Other characteristics:

Moderately resistant to SPVD

Resistant to *Alternaria spp.*

Moderately resistant to weevils

Wide adaptation

Developed and released by:

Rwanda Agriculture and Animal Resources Development Board (RAB) (Dr Damien Shumbusha), the ACCI
Funded by AGRA

Brachiaria brizantha:

Two varieties (KS1 and BS1) in Kenya in 2021

KS1 and BS1

- Use: livestock feed: fresh, feedblock, hay or silage
- Other uses: biogas, ecology service
- Maturity days: 5-6 months
- Tolerant to drought and spider mite
- Nutritive values: high contents of crude protein (14-16%), amino acids (methionine and lysine), highly palatable
- Yield: 45 t/ha (KS1) and 40 t/ha (BS1)
- Tolerance to overgrazing
- Seed dormancy duration: 30 days

Developed and released by:

Kenya Agricultural and Livestock Research Organization [KALRO] (Ms Ann Indetie/Kenya). Funded by KALRO and IAEA



Youth entrepreneurship in feed formulation and packaging:
Ground *Brachiaria*, *Dolichos lablab* seed and minerals



Summary and Perspectives

- ACCI's educational model works
- There is a need for investment in training centres, breeding programmes and crop improvement enterprises, through public-private partnerships
- Partnerships are drivers of innovation, access to resources, facilities, germplasm, expertise, and links to full value chain
- There is need for expanded partnerships between Universities, NAREs and CGIAR for research, training and supervision
- Entrepreneurial approach and business enterprises can transform the public and private sector plant breeding and seed systems