

The Business of Plant Breeding

Sustainable Approaches to meet Variety Demand Africa

[www.demandledbreeding.org](http://www.demandledbreeding.org)

**Theme: Building crops to feed 2.5 billion Africans by 2050**  
**May 25, 2022**

[www.demandledbreeding.org](http://www.demandledbreeding.org)

# Content

- The power of modern plant breeding for food security and livelihoods in Africa
- Demand-led breeding (DLB) - a business model for plant breeders
- DLB enablers – modern education, variety design and policy support
- DLB curricula
- Product profiles
- Impact - case examples
- Resources
- Summary and perspectives

# The Power of Plant Breeding

- Plant breeding delivers farmer- and market-preferred high yielding plant varieties suited to the diverse agro-ecological conditions
- Played a key role in the successful green revolution in Asia and South America during the 1960s (e.g. yield gains > 400%), impacting food and nutrition security and livelihoods
- The Alliance for a Green Revolution in Africa (AGRA) - initiative on breeding, seed systems and inputs for a food-secure and prosperous future for millions Africans through productivity, access to markets and finance
- It brings a significant return on investment
- Plant breeding has an economic, social and environmental impact



# Plant Breeding in Africa

- Modern crop varieties and suitable production inputs would narrow the present yield gap (>50%) and contribute to food security, and enhanced livelihoods in Africa
- The new varieties must be adopted by smallholder farmers and serve local and regional markets = impacts of breeding and genetic innovations
- However, adoption of new and modern crop varieties in Africa is still low (<35%)

# The Business of Plant Breeding in Africa

- Plant breeding must be responsive to farmers & market requirements, using demand-led approaches
- Demand-led plant breeding: combines education, variety design & product development, & policy support tools
- DLB is about clients, stakeholders, the value chain, & technical & non-technical experts – considering the needs of all parties
- New generation plant breeders: must understand the science and business domains to transform public and private sector plant breeding and seed systems in Africa



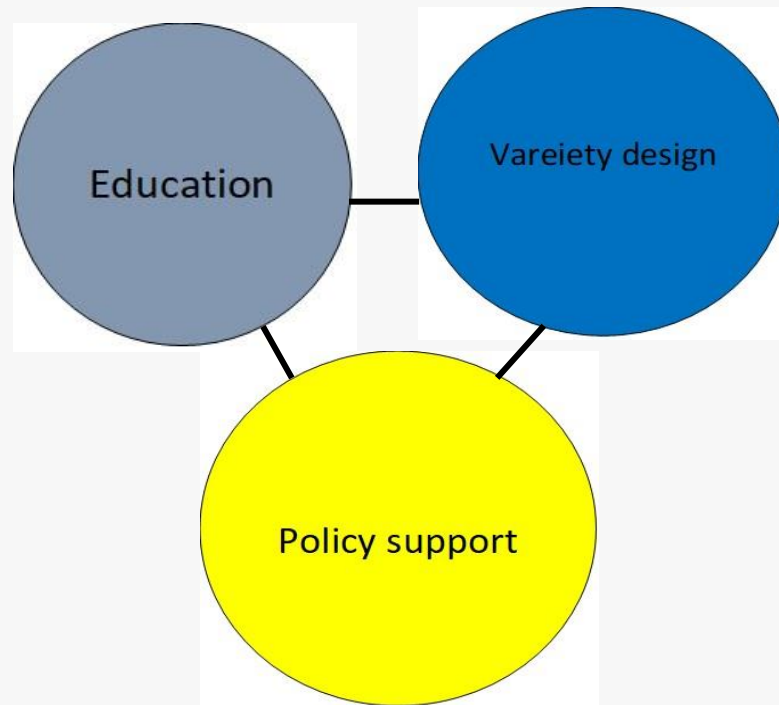
# Demand-led plant breeding

- Is there a business school for plant breeders?
- Demand-led breeding is a business approach
- Swiss-Australian-African partners

How can modern crop varieties contribute to food security, local and regional markets in Africa?



# DLB – enablers



- Postgraduate education and professional development
- Knowledge, methodologies and tools
- Policy support and investments

# DLB – educational curriculum

- Designed curriculum – by African educators
  - ✓ **Core principles of DLB** - participatory plant breeding, benefits, risks
  - ✓ **Visioning and foresight** - setting breeding goals
  - ✓ **Clients' needs and value chains** - markets and market segments
  - ✓ **Variety design and product profiles** - breeding objectives, trait prioritization, external standards, market demand, differentiation
  - ✓ **Variety development strategy and planning** - stage plan, timelines and critical path analysis, registration
  - ✓ **Breeding investment** - making the cases, decisions
  - ✓ **Monitoring, evaluation and learning** - key performance indicators, adoption and performance tracking, communication



# Product profiles

- **Product profile (PP)** - an innovative and structured approach to capture a new variety profile
- A PP - a technical specification of a new variety. Detail a set of technical attributes with quantitative measures and qualitative descriptions
- Includes - trait prioritization, external standards and validation
- Translates into clear breeding objectives
- The target profile of a new variety enables communications with a range of technical and non-technical stakeholders – sets a common goal

# Product profiles

- Technical and non-technical audience: design team, R&D management, variety development team, technology transfer, seed scaling organisations, value chain representatives, investors and donors
- The PP of a new variety includes - purposes, crop management systems and technical attributes
- PP capture template:
  1. Clients and markets
  2. Technical specification of the variety - variety design and technical specification

# Product profile capture

## I. Clients and markets

Design Team Lead/Champion

Descriptors

Target clients and use

Target crop producers and production system

## II. Technical specification of the variety (variety design and technical specification)

Client/customer

Driver of their choice

Trait category

Preference group

Trait demand classification

Trait description (quantitative and qualitative attributes)

Benchmark variety

Performance required compared to benchmark variety

Product profile - clients and markets		Please complete each green cell and type over the text		
PP Design Team Lead/Champion	Name	PP Design Team		
	Organisation	Person	Area of Expertise	Name of organisation
		<i>Name 1</i>	<i>Ag economist etc</i>	
Product profile descriptors		<i>Name 2</i>		
Product profile name	e.g. Higher yielding tomato	<i>Name 3</i>		
Crop		<i>Name 4</i>		
Country(s)		<i>Name 5</i>		
Geographic region(s)		<i>Name 6</i>		
Target market segment and positioning	<i>Market, positioning and differentiating features and benefits over existing varieties</i>			
Name of target variety(s) or landrace to be replaced	<b>Example NAROBEAN 1:</b> <b>Strength</b> ( <i>mod Fe &amp;Zn, high yield and early maturing</i> ) <b>Weakness</b> ( <i>long cooking time and lacks bruchid resistance</i> )			
Date PP created				
Target client and use				
Value chain primary clients/customers: farmers, processors, transporters, consumers etc				
Market scale: households, local, regional, national and international markets				
clothing etc				
Type of processing: none (fresh), dried, cooked, milled, canned, brewed, etc				
Market class: bean type, wheat quality etc				
Target crop producers and production system				
Number of farmers (min-max range)				
% ratio: male to female farmers (min-max range)				
Production system: open field (+/- irrigation), plastic tunnel, glasshouse, hydroponics				
Area of production system (ha)				
Growth habit: eg. beans, tomatoes, grapes (bush, climbing etc)				
Expected level of inputs: low, medium, high (fertilizer, crop protection chemicals)				
Typical yield range of target system (eg. 0.8-1.5 T/ha)				
Cropping system: continuous monocrop, rotated intercrop, intercrop mixed cropping etc				
Mechanisation: planting, maintenance and harvesting				
Agroecological zone(s)				
Potential seed or vegetative propagation material (tonnes/numbers)				

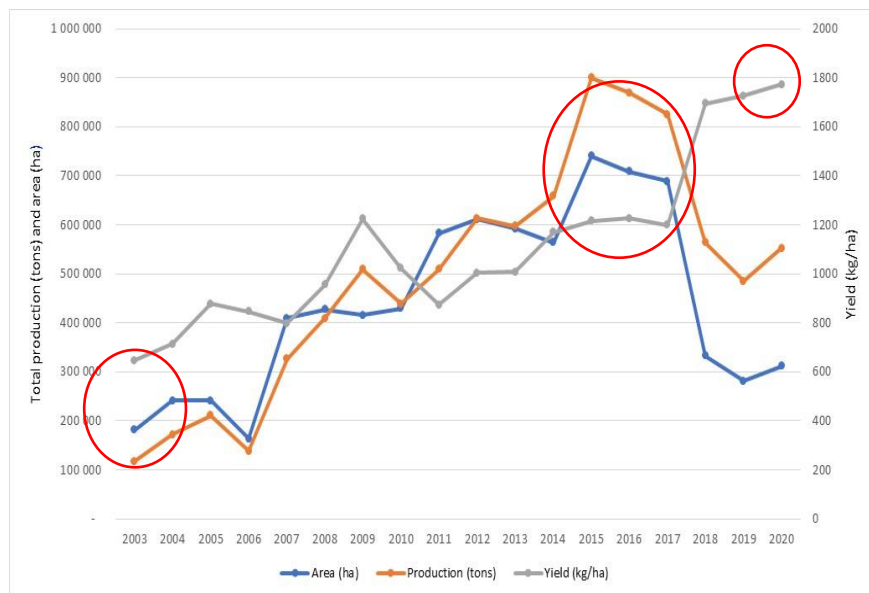
Product profile - variety design and technical specification					Please complete each green cell - type over the text			
			Preference group: Women (W) Men (M) Youth (Y) W+M+Y (All)	Trait demand classification: 1. Essential/"must have" 2. Niche opportunity 3. Added-value 4. Winning trait				Performance required compared to benchmark variety < , = , > etc
Client/customer	Driver	Trait category			Target traits	Trait description (Quantitative measures)	Name of benchmark variety	
Farmer	Productivity	Yield			e.g. economic yield e.g. fertiliser efficiency e.g. grain size eg. resistance or tolerance to key fungal, bacterial and virus diseases e.g. resistance or tolerance to insect pests etc e.g. resistance or tolerance to nematodes e.g. drought, heat, salinity, water submergence			
		Biotic stress resistance						
		Abiotic stress tolerance						
	Fodder/forage	Biomass			e.g. total dry biomass e.g. protein content e.g. level of odoriferous compounds e.g. methane production			
		Animal nutrition						
		Animal palatability						
		Animal digestibility						
	Crop management and harvesting	Plant architecture			e.g. branching pattern, crop height, regeneration, upright growth and pod clearance for mechanization i.e. bean, chickpea			
	Market value and price	Grain weight			e.g. seed density			
		Crop duration			e.g. Time to flowering, early or late maturation			
	storage	Storage-life			e.g. Potato sprouting dormancy e.g. mycotoxin production			
Transporter	Durability and cost	Container suitability			e.g. shape of aubergines for packing crates			
		Transportability and storage			e.g. mycotoxin production			
Processor	Raw material quality specification	Milling			e.g. grain milling efficiency e.g. protein, wet gluten and hagburg falling number e.g. protein content for malting barley eg. tomato brix value e.g common bean: hydration coefficient of soakability, degree of splitting, degree of clumping			
		Bread-making						
		Brewing						
		Paste eg. tomato						
		Canning						
Retailer	Sales and profit	Shelf-life			e.g. number of days without refrigeration			
Consumer	Satisfaction	Taste			e.g. organoleptic properties e.g. uniformity of shape of cucurbits e.g. number of days before fungal decay e.g. protein content, Fe, Zn etc e.g. gas production e.g. fast cooking time			
		Appearance						
		Shelf-life						
		Nutrition						
		Digestibility						
		Food preparation						
Seed/vegetative material producer	Scalability and cost	Seed numbers			e.g. number of bean seeds in pods eg. rice spikelet fertility eg. propagule storability			
		Reproductive fertility						
		Ease of vegetative propagation						
Seed distributor	Variety identification	Unique appearance of plants, grain and produce			e.g. phenotypic mark or identifiable feature			

# Impact - case examples

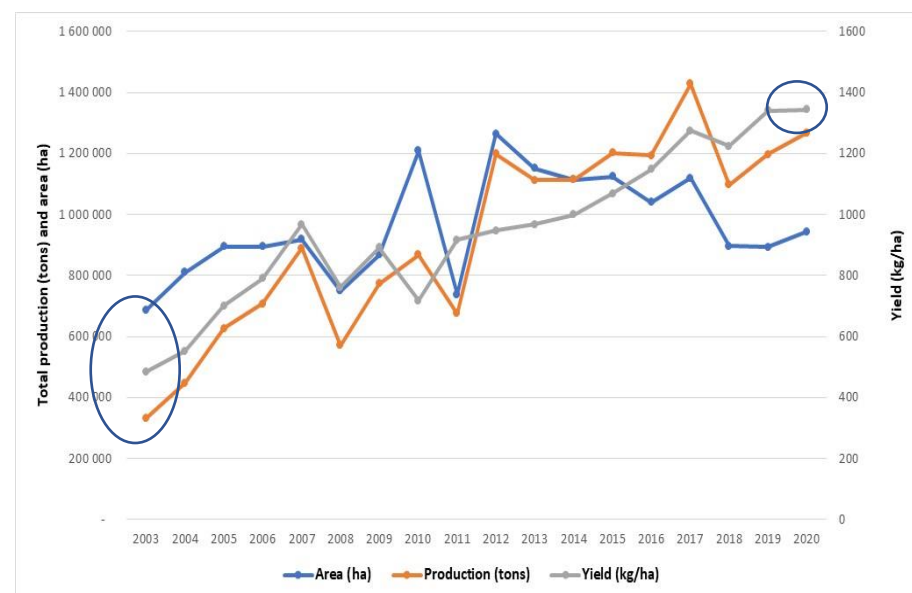
## I. White gold – common bean value chains and market corridors

- Ethiopia – new varieties of white common bean
- Cultivated by about 3.6 million smallholder farmers
- High commercial value, particularly for export
- Extended markets in the Middle East
- Annual export earnings from USD 8 m (2004) to 140 m pa (2018)
- Led to development of large numbers of small scale enterprises

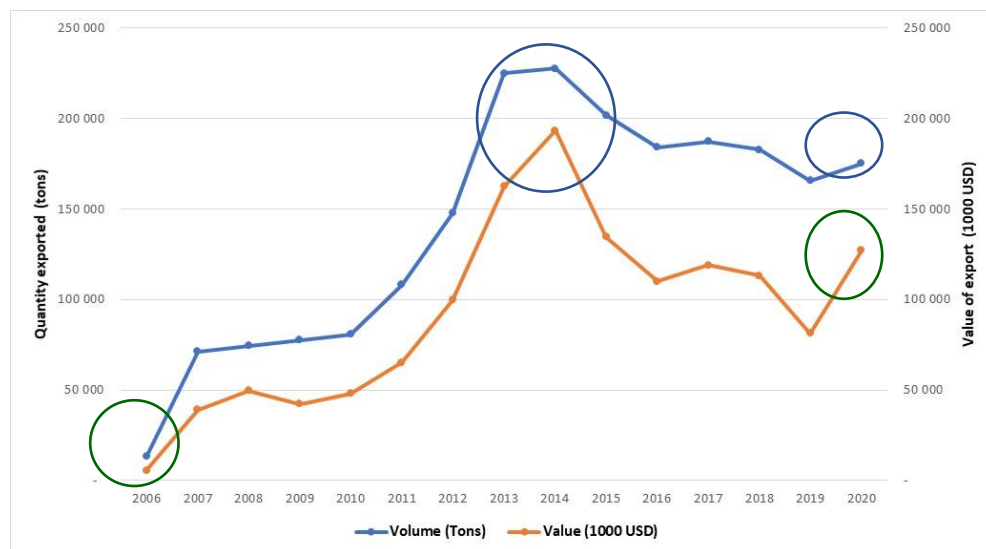




Trends in total production (tons), area (ha) and yield (kg/ha) of dry bean in [Ethiopia](#) between 2003 to 2020 (FAO, 2020)



Trends in total production (tons), area (ha) and yield (kg/ha) of dry bean in [Tanzania](#) between 2003 to 2020 (FAO, 2020)



Dry bean export quantity (tons) and its value (1000 USD) from [Ethiopia](#) between 2006 to 2020 (FAO, 2020)

# Impact - case examples

## II. Iron and zinc enriched climate smart bean 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%)
- Farmer's preferences
- Availability and extended time of bean consumption from own production
- 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)



# Impact - case examples

## III. *Striga*-resistant sorghum varieties (TARISOR1 and TARISOR2 ) in Tanzania, 2018

- DLB alumnus
- 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

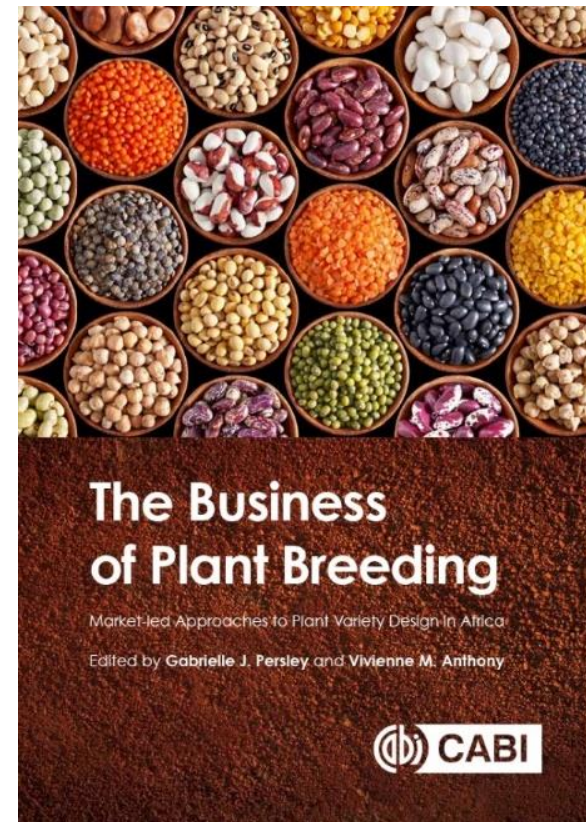
The African Centre for Crop Improvement (ACCI) – South Africa





# Resources

- A textbook – The Business of Plant Breeding
- DLB Product Profile Tool and Practitioners' guide
- 400 DLB alumni (24 workshops)
- DLB Community of Practice
- DLB curricula integrated in academic institutions in Africa
- Further deployment - public and private sectors
- A pan-African hub launched: Bioversity-CIAT/Kenya



<https://www.cabi.org/bookshop/book/9781786393814/>

[www.demandledbreeding.org](http://www.demandledbreeding.org)

Resources, publications and community of practice

# Summary and Perspectives

- The need - effective development, release, dissemination, and adoption of improved and demand-led varieties
- DLB approaches follow the principles and processes of stakeholder involvement during cultivar design, development and commercialization
- Implementing the DLB approach promotes improved variety adoption in Africa
- Need – committed investment in Africa's training centres, breeding programmes and crop improvement enterprises, through public-private partnerships - long term
- Essential public-private partnerships for innovation, access to facilities, germplasm, expertise, and links to full value chain
- Need - expanded partnerships between NAREs and CGIAR for research, training and supervision
- Focus - entrepreneurial approach and business enterprises - to support breeders to create new seed enterprises

# Demand-led breeding: initiative and partners



UNIVERSITY OF  
KWAZULU-NATAL  
INYUVESI  
YAKWAZULU-NATALI



biosciences  
eastern and central africa



syngenta foundation  
for sustainable  
agriculture



Australian Government  
Australian Centre for  
International Agricultural Research

