



# Genomics-assisted Recurrent Selection and Hybrid Breeding in Cassava

**Xiaofei Zhang, Randall Holley, Giovanni Eduardo Covarrubias Pazaran, Luis Augusto Becerra, Ismail Rabbi**

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Alliance



## Add-value traits from Genebank

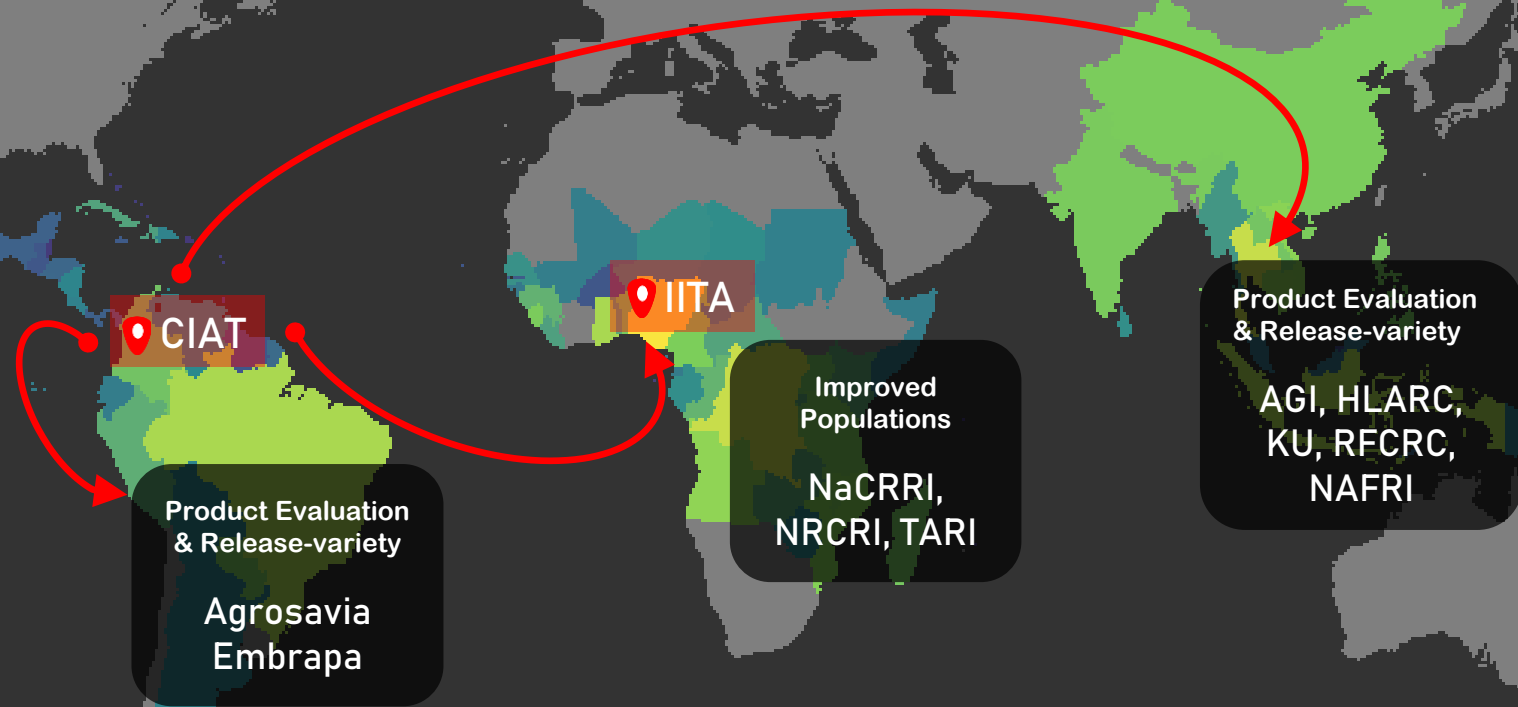
- CMD, CBSD and whitefly resistance
- High pro-vitamin A
- Good cooking quality
- Low hydrogen cyanide (HCN)
- Low Postharvest physiological deterioration (PPD)
- **Drought tolerance**
- **Heat tolerance**
- **Haploid inducer**
- High and stable dry matter
- Waxy starch
- Small granule
- **High amylose**
- **Herbicide resistance**
- **Early maturity**
- **High density tolerance**

Genebank

Alliance



Provide both trait donors and improved breeding populations to IITA and NARS.



1967-2022

Alliance

**Bioversity International**  
International Center for Tropical Agriculture  
Since 1967 Science to cultivate change

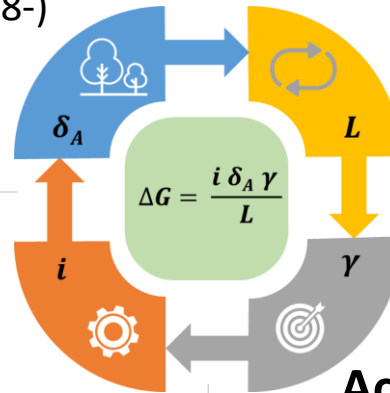
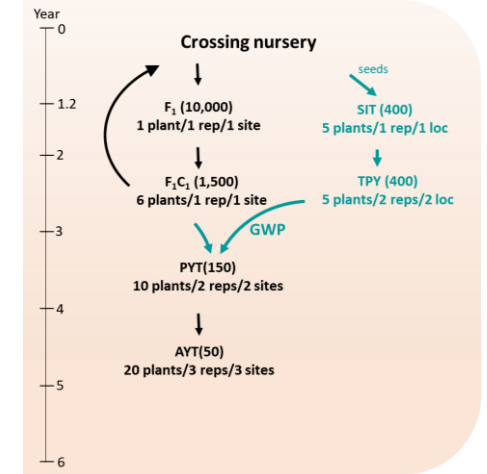
# Breeding Program Modernization

## Genetic Diversity

- New traits, e.g., CBSD res., CMD res., good cooking quality et al.
- Sequencing of progenitors (2020-)
- **Hybrid Breeding** (2018-)

## Duration of Selection Cycle

- Flower Inducing (2016-)
- **Genomewide Prediction** (2019-)

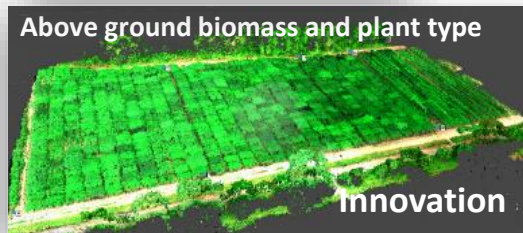
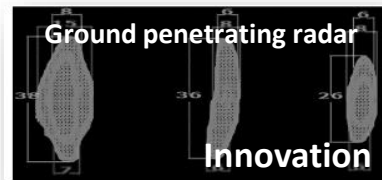


## Intensity

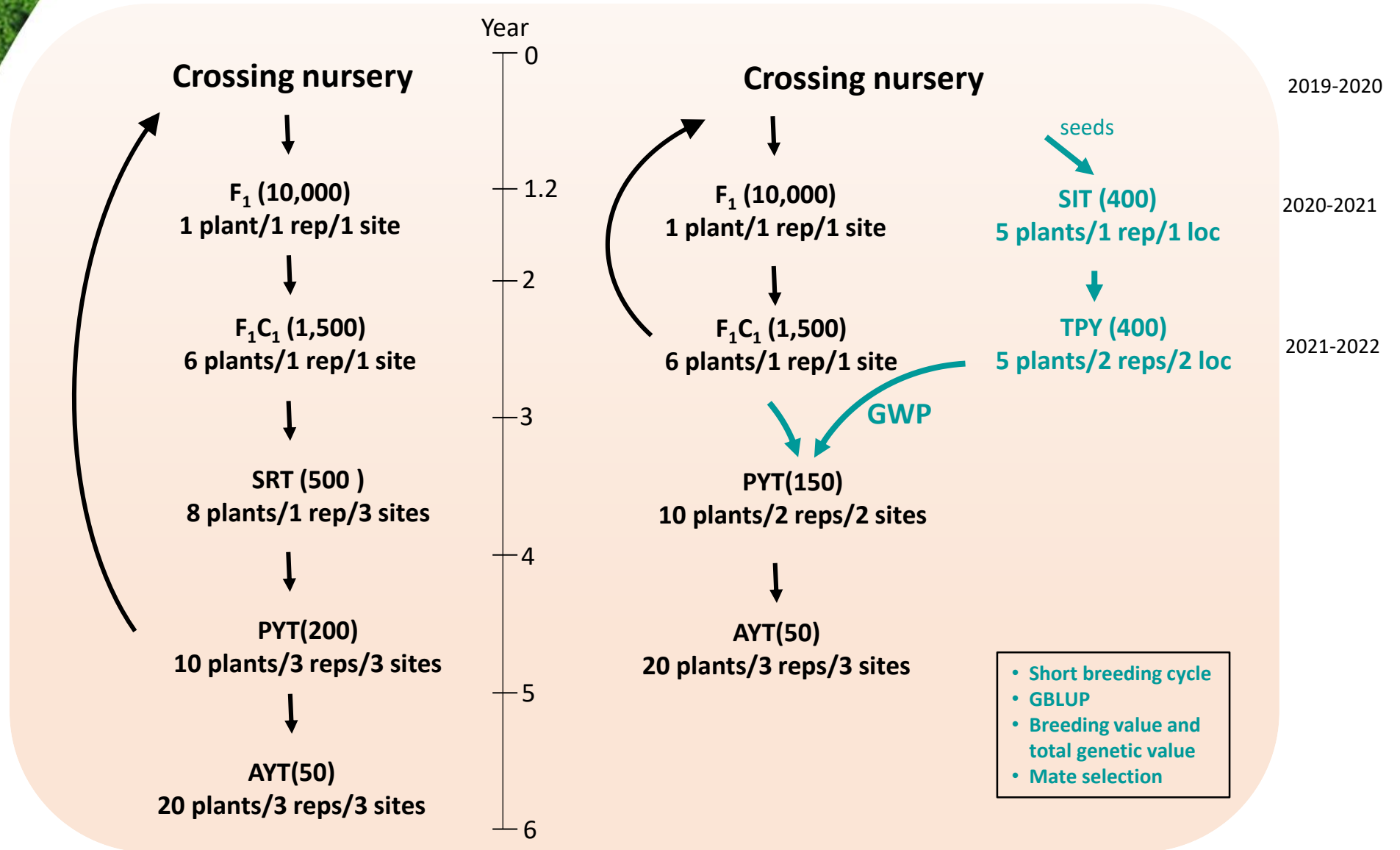
- High throughput phenotyping

## Accuracy

- CassavaBase, Fieldbook & Barcode (2018-)
- Quality control and MAS (2021-)
- TPE,  $\geq 2$  Environments (2020-)
- $\geq 5$  Checks, BLUP and GBLUP (2020-)
- Selection Index (2012-)
- NIRS & Image Analysis (2012-)
- Stage&Gate System (2020-)
- Operational Excellence (2019-)

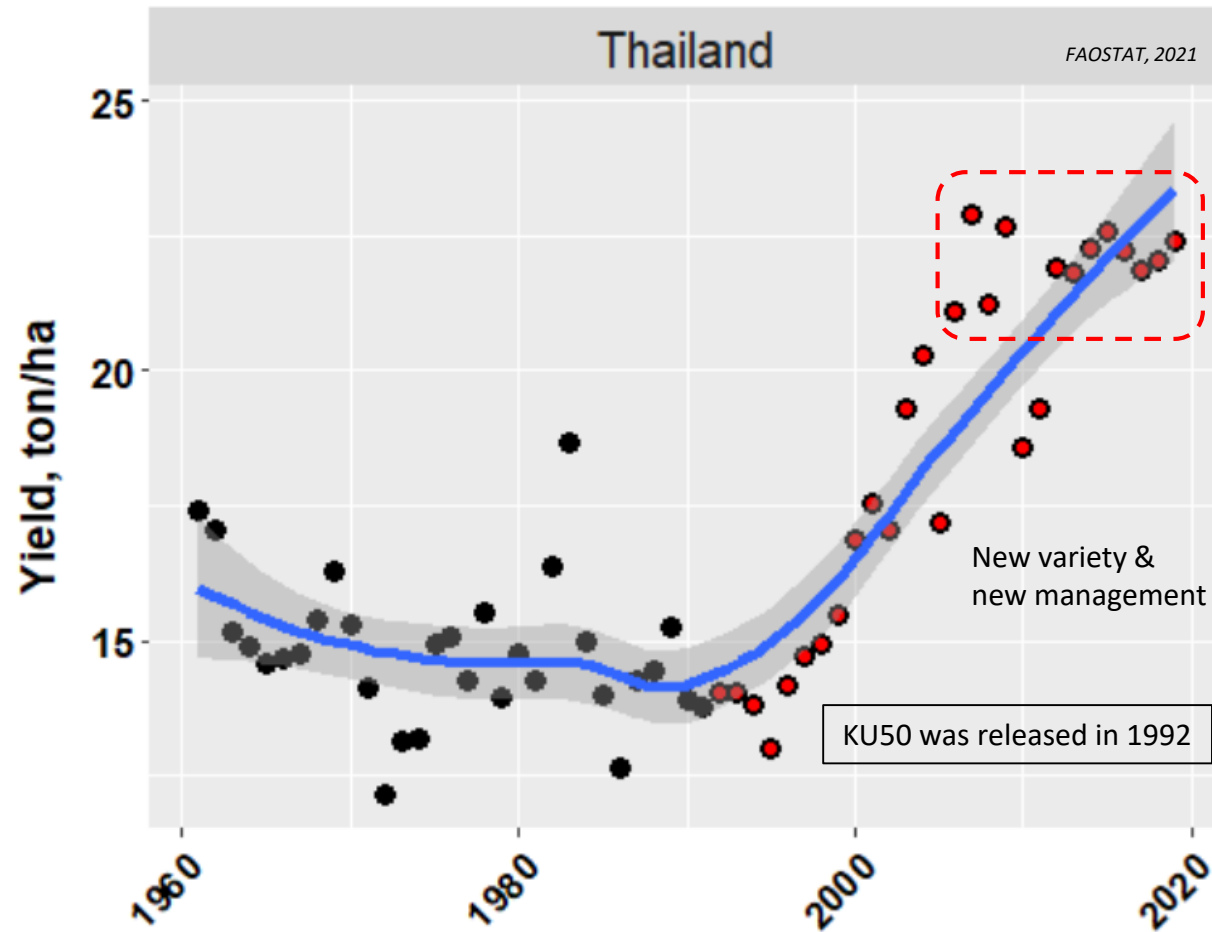


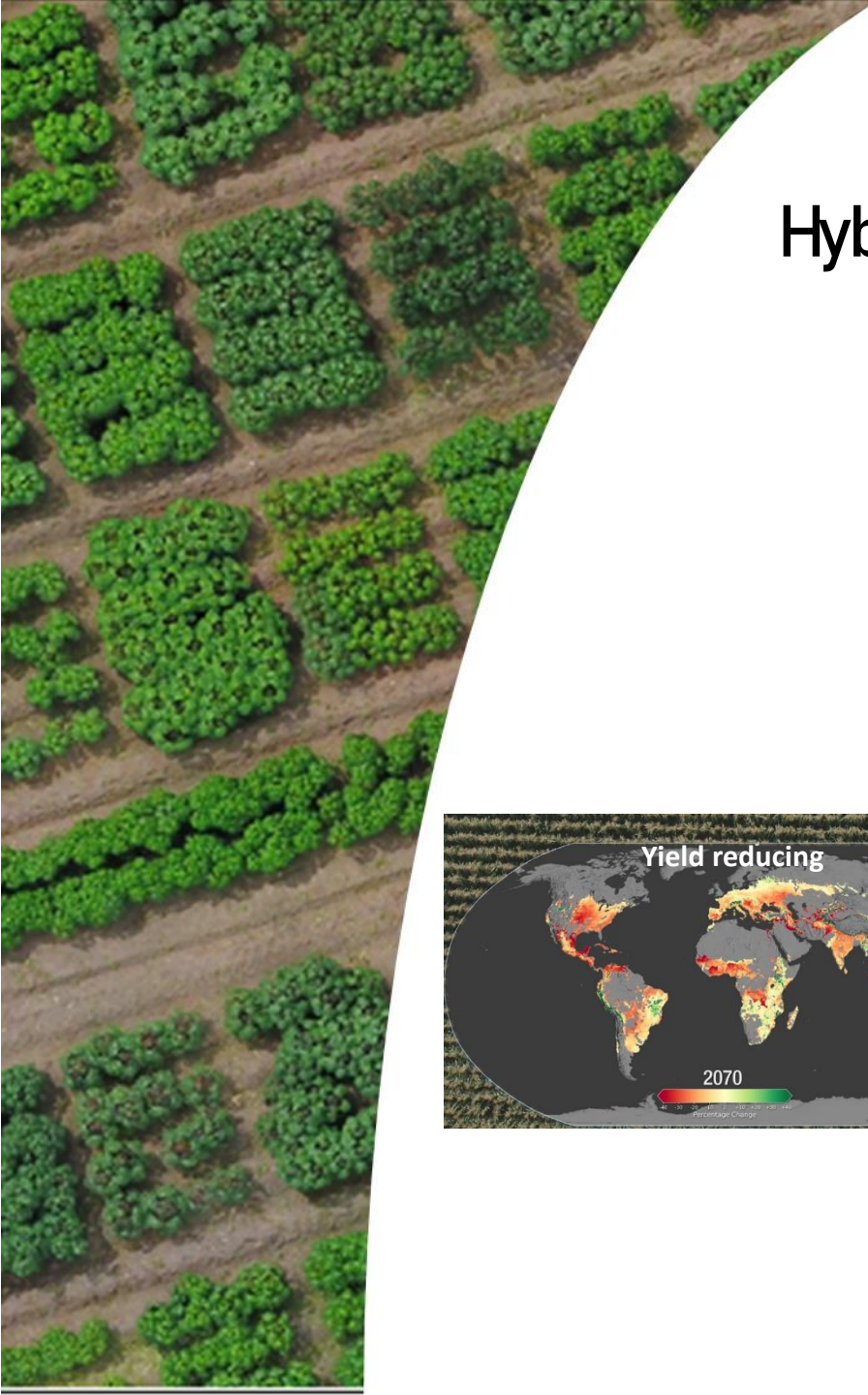
# Recurrent Selection and Prediction



# The Success Breeding Story

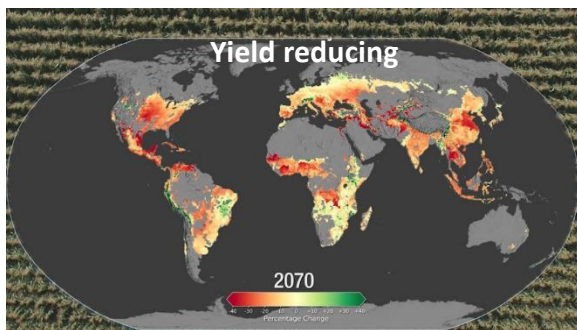
## - KU50 in Southeast Asia





# Hybrid Cassava Breeding\_ Justification 1

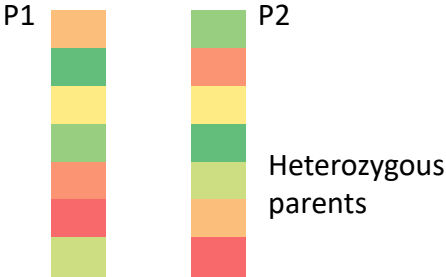
**“ In a changing world, we must change quickly. ”**



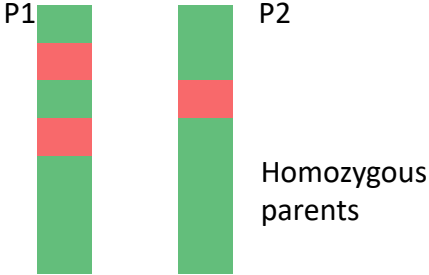
Climate change  
Disease and insect outbreak  
Nutrition requirement



# Pain Point in Cassava Breeding



**Inbred progenitor** is essential to change quickly.



Mix up everything

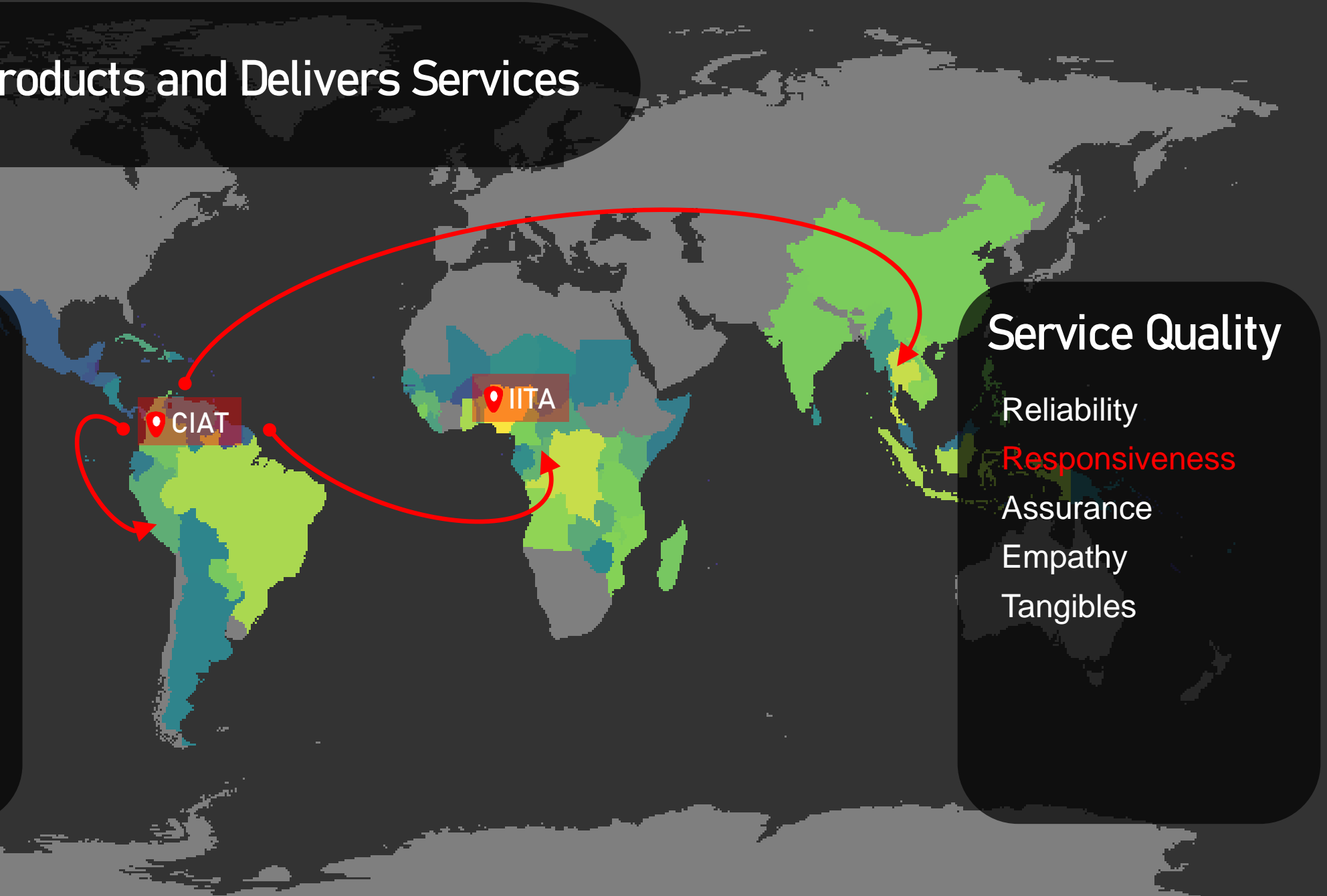


Targeted improvement



# CGIAR Provides Products and Delivers Services

- ### Product Quality
- Performance
  - Features
  - Reliability
  - Conformance
  - Durability
  - Serviceability
  - Aesthetics
  - Perceived quality



- ### Service Quality
- Reliability
  - Responsiveness
  - Assurance
  - Empathy
  - Tangibles

## Hybrid Cassava Breeding\_ Justification 2

**“ Need to explore cassava yield potential to feed the future. ”**

Heterosis is proven successful in increasing yield and yield stability



# Cassava and Maize are Similar



**Diploid**

**Cross-pollinated**

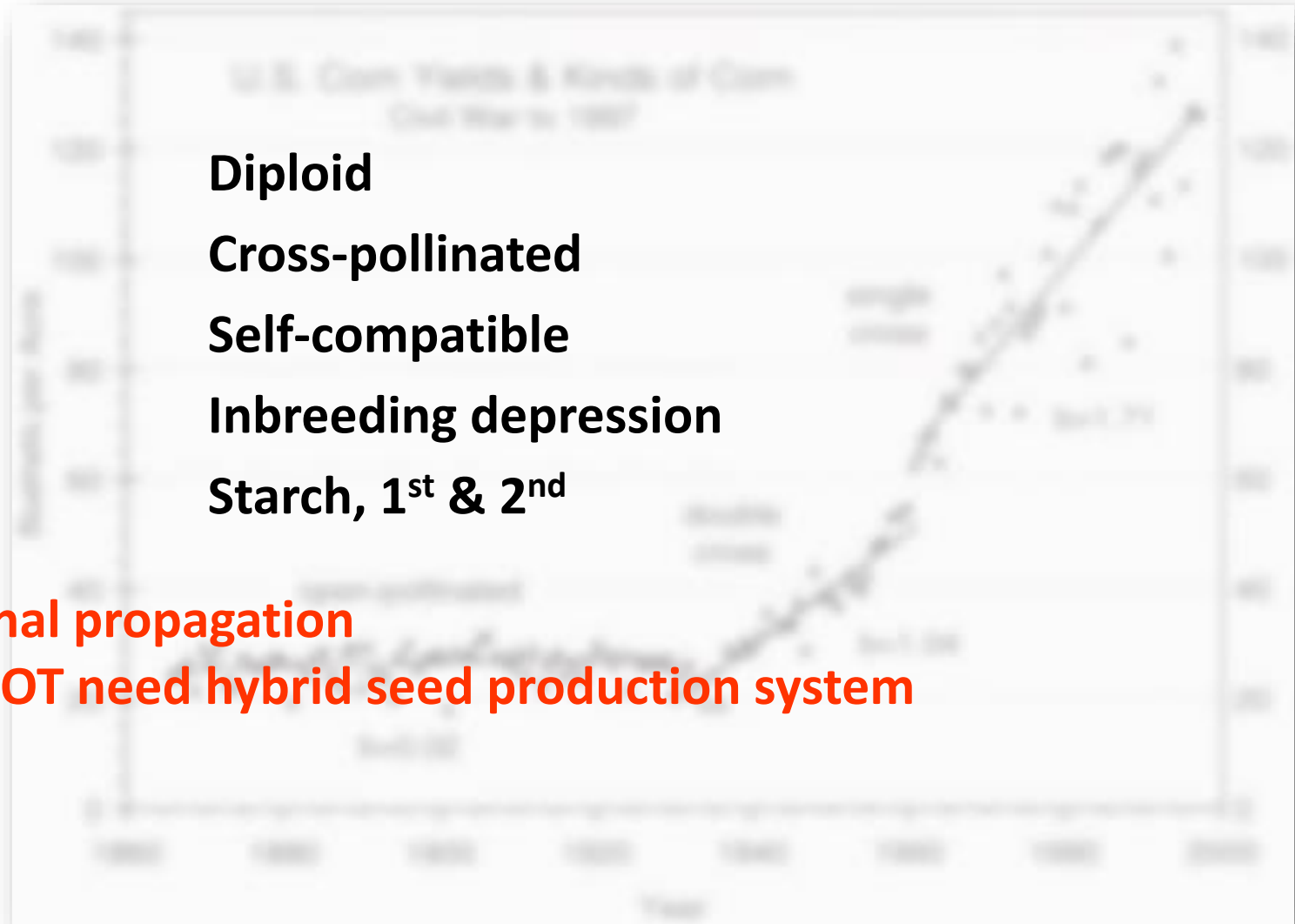
**Self-compatible**

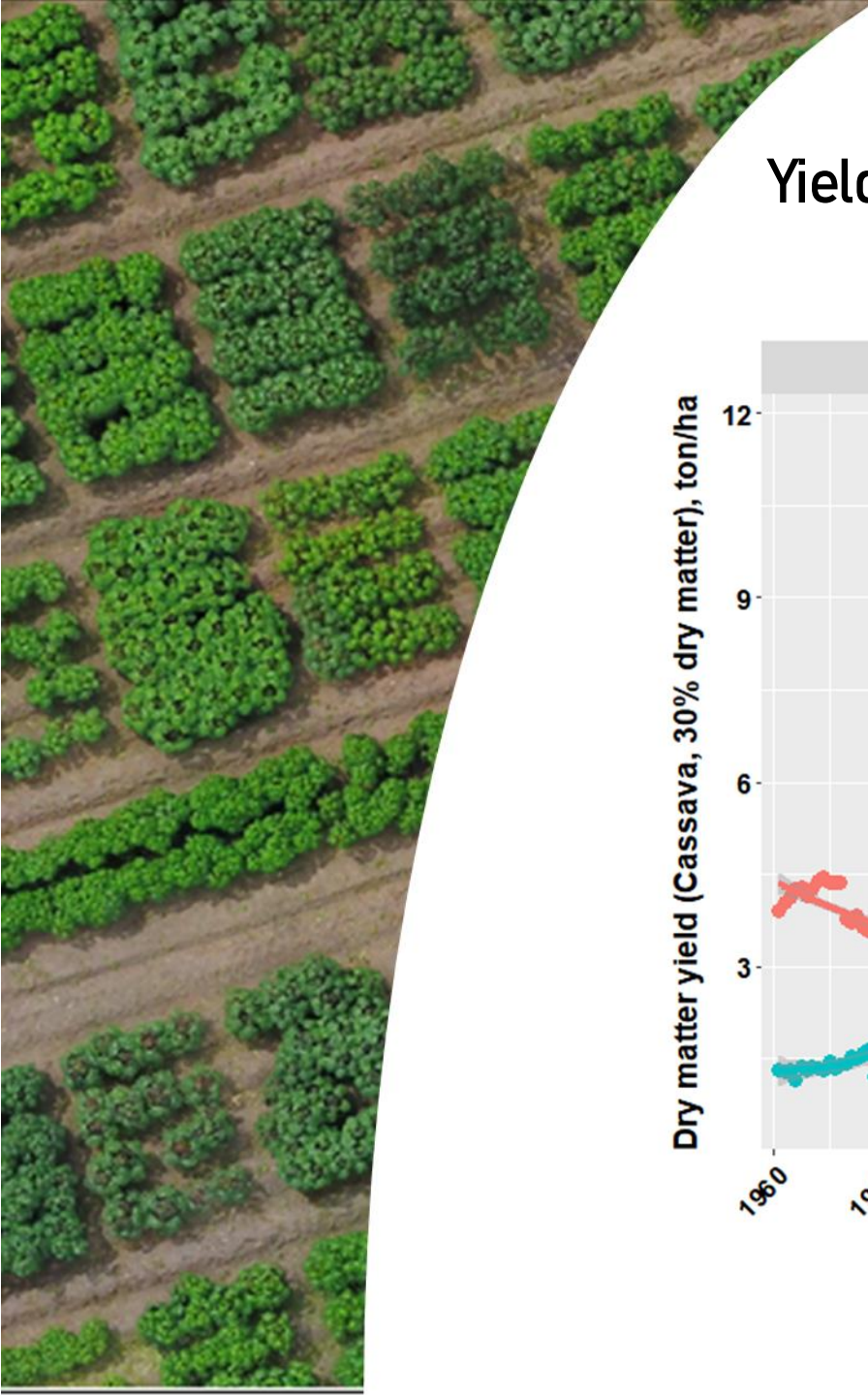
**Inbreeding depression**

**Starch, 1<sup>st</sup> & 2<sup>nd</sup>**

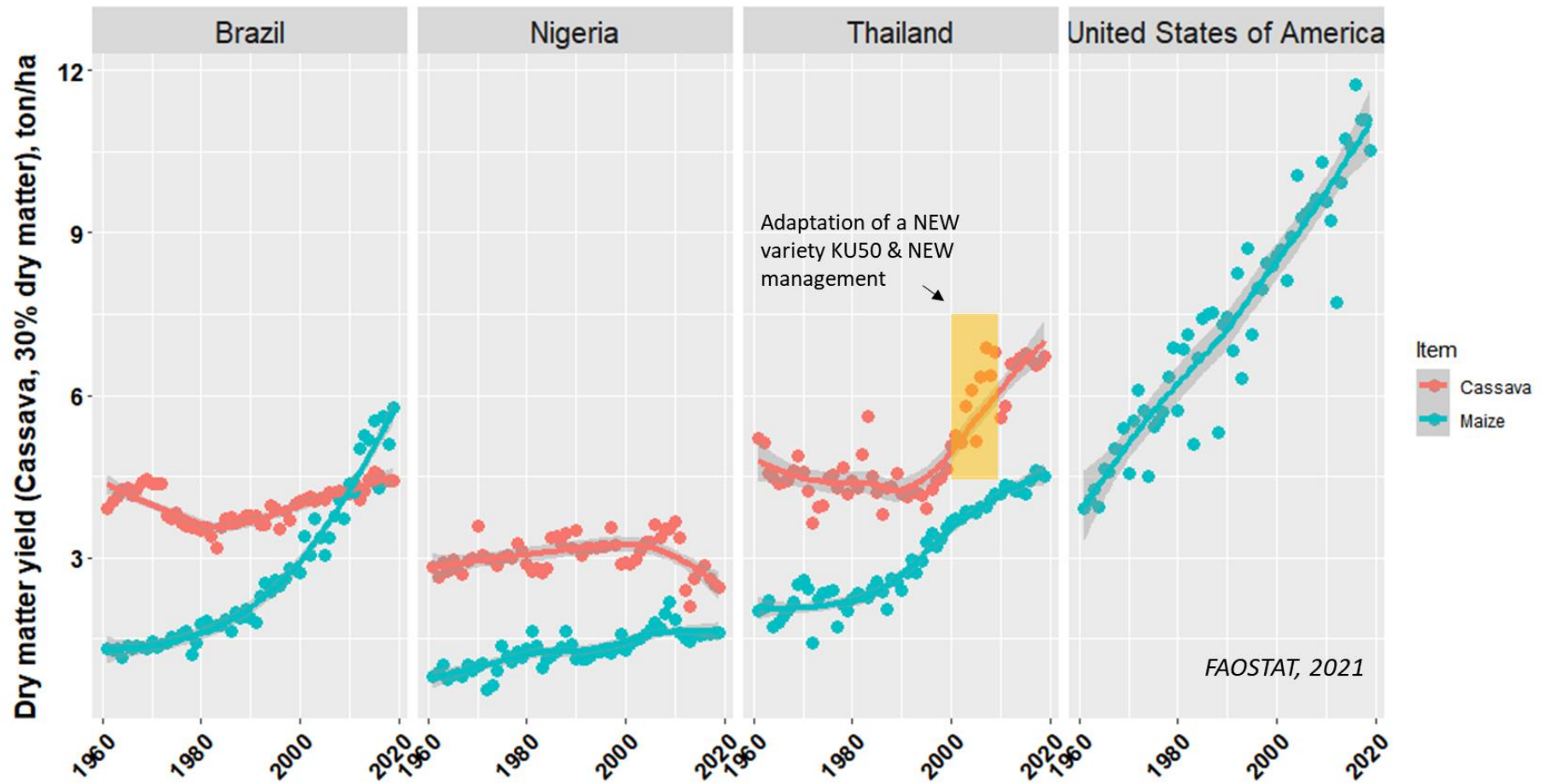
**Clonal propagation**

**-- NOT need hybrid seed production system**





# Yield of Cassava and Maize in the Largest Production Countries



# Target Product for Hybrid Breeding

02



+ BC&CQ

03



+ CQ

04



+ WX / SG

05



+ PQ

01

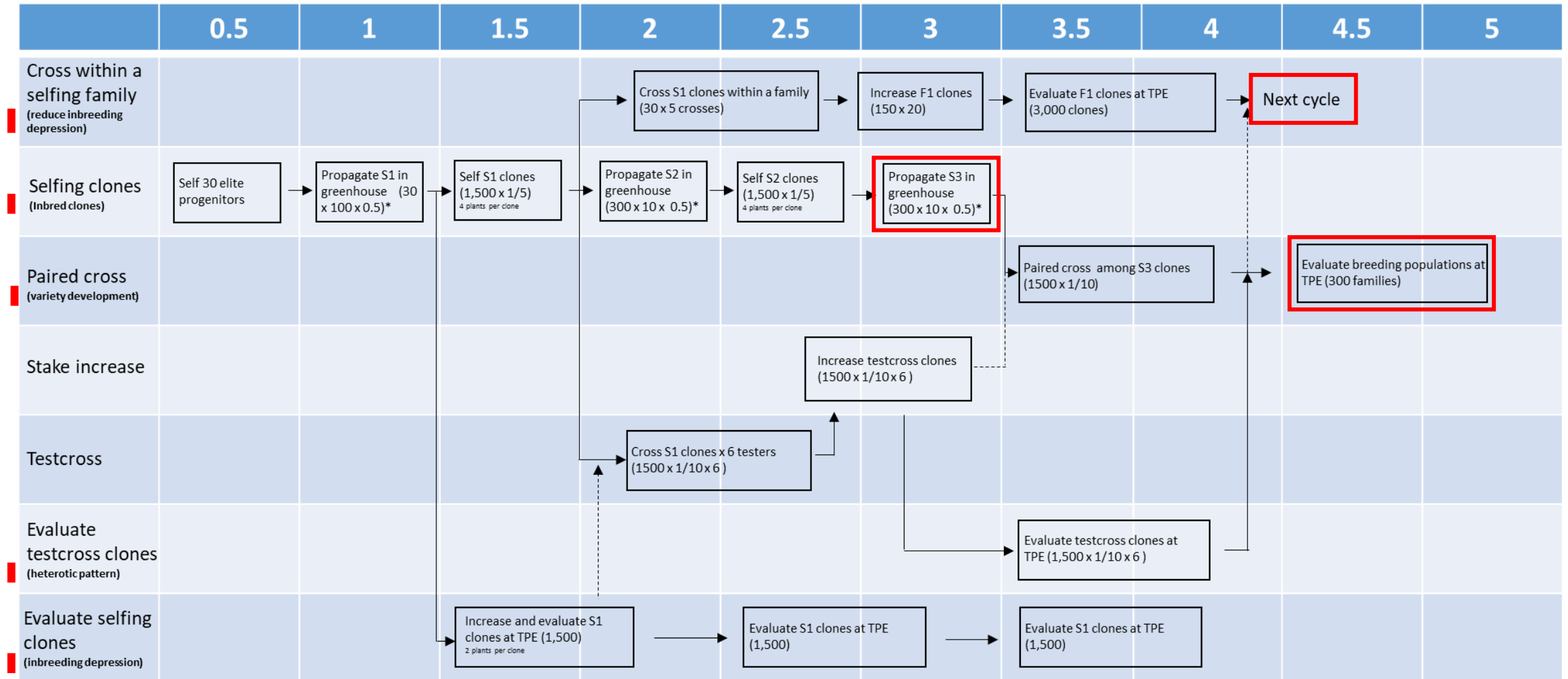


Erect plant type, High dry matter,  
High fresh yield, Resistant to CBB,  
Resistant to CMD, Resistant to CBS

- 1) Cassava for **starch** and animal feed
- 2) **Biofortified** cassava for human consumption
- 3) Fresh and dried roots for **human consumption**
- 4) Cassava for **specialty** starch
- 5) Processing- **granulated** and paste for human consumption

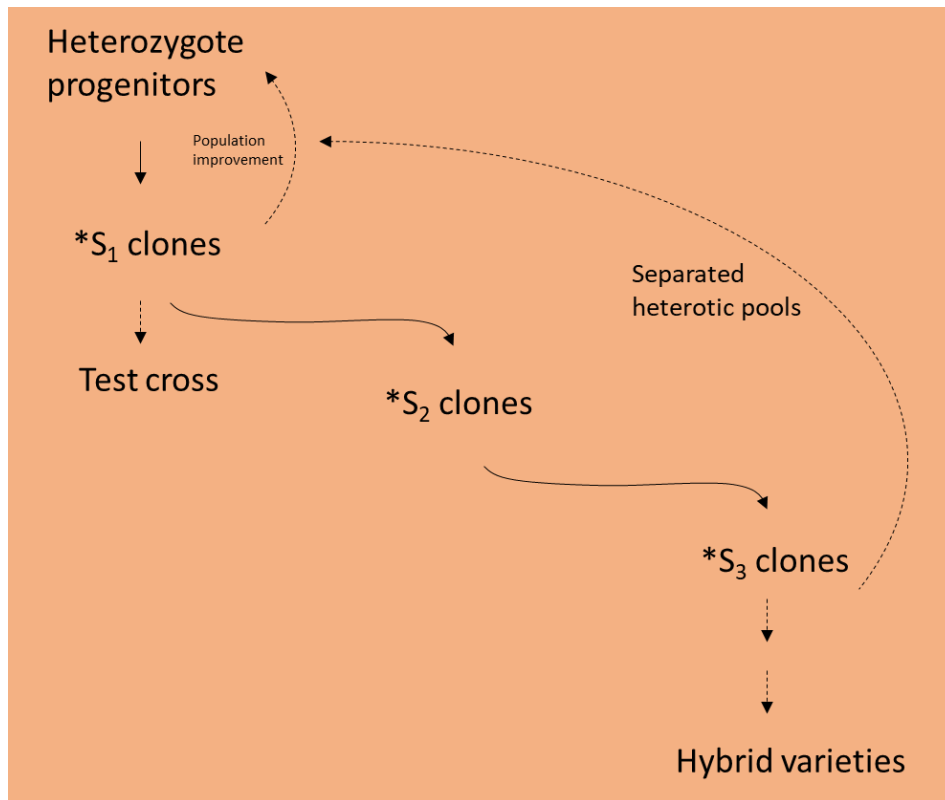
BC, Beta-carotene; CQ, cooking quality; WX, waxy starch; SG, small granule starch; PQ, processing quality

# Inbred Progenitors and Hybrid Variety



\* Genomewide marker; 0.5, germination rate; 1/5 or 1/10, selection pressure; solid arrow, germplasm delivery; broken arrow, information sharing.

# 5-Year Outcomes in Hybrid Cassava Breeding



Inbreeding depression

Genetic architecture of traits

Heterotic groups

Heterosis in Cassava

Hybrid breeding scheme

Hybrid variety candidates

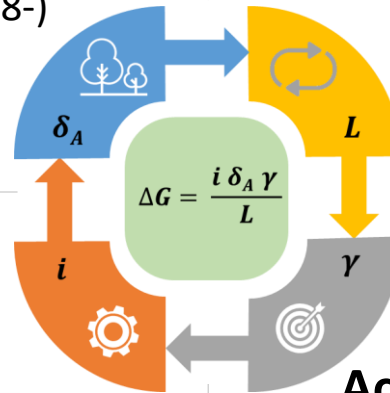
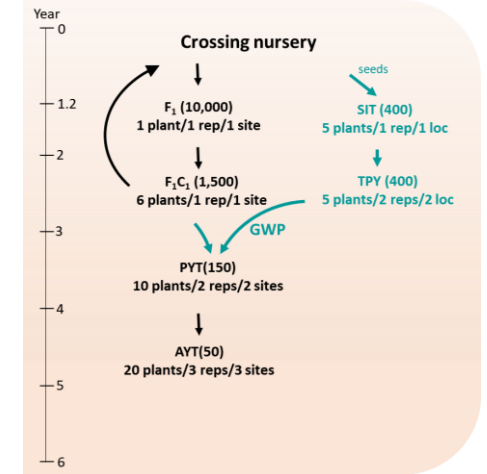
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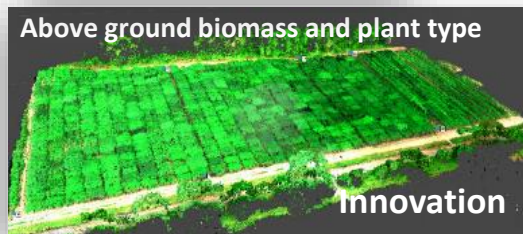
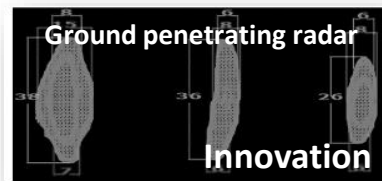


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**JOIN  
OUR TEAM**  
— BE PART OF OUR STORY —

[xiaofei.zhang@cigar.org](mailto:xiaofei.zhang@cigar.org)

Alliance



Recruiting: **Plant Geneticist – cassava**