Mainstreaming Cassava Biofortification in Africa:

A contribution towards reducing malnutrition and hunger

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Preamble

Cassava biofortification has been a successful strategy focused on reducing the menace of micronutrient deficiency among the most vulnerable groups of people (pregnant women and children under age of 5) in Africa. Strategic integration of innovative research activities with delivery and dissemination platforms (Fig.1) has yielded significant impact in producing and promoting biofortified food products with increased nutritional value. Cassava varieties bred for higher levels of provitamin A content have been released and distributed in Nigeria and DR Congo with research in progress in over 10 other countries in Africa.

Problem: Malnutrition and vitamin A deficiency (VAD) are widespread throughout Africa

Goal: To mitigate micronutrient deficiency among vulnerable groups in Africa

Outcome

- Increased cultivation and consumption of PVAC foods across target African countries

Outputs

- PVAC varieties selected and released to farmers
- PVAC value chain developed and strengthened
- Technical support for cultivation provided
- Beneficiaries trained on enterprise development, processing and storage

Activities

- Develop productive cassava varieties with high contents of pro-vitamin A (PVAC) in the roots
- Promote cultivation of, and consumption of products from PVAC varieties through:

- decentralized multiplier mechanism of planting materials
- awareness of efficiency of food based intervention and PVAC potential
- collaboration with government and strategic partners

Figure 1. Activity flow chart for development, delivery and impact of PVAC varieties

Breeding Approach

Hybridization generates large populations of families for screening, selection (Fig. 2a & b) and further evaluated in different breeding stages (Fig. 3). A total of seven biofortified cassava varieties with total carotenoid content (TCC) ranging from 8–12 µg/g fresh wt. have been released (Table 1).

Figure 2: Male and female flowers for Hybridization (a) and populations in seedling nursery (b)

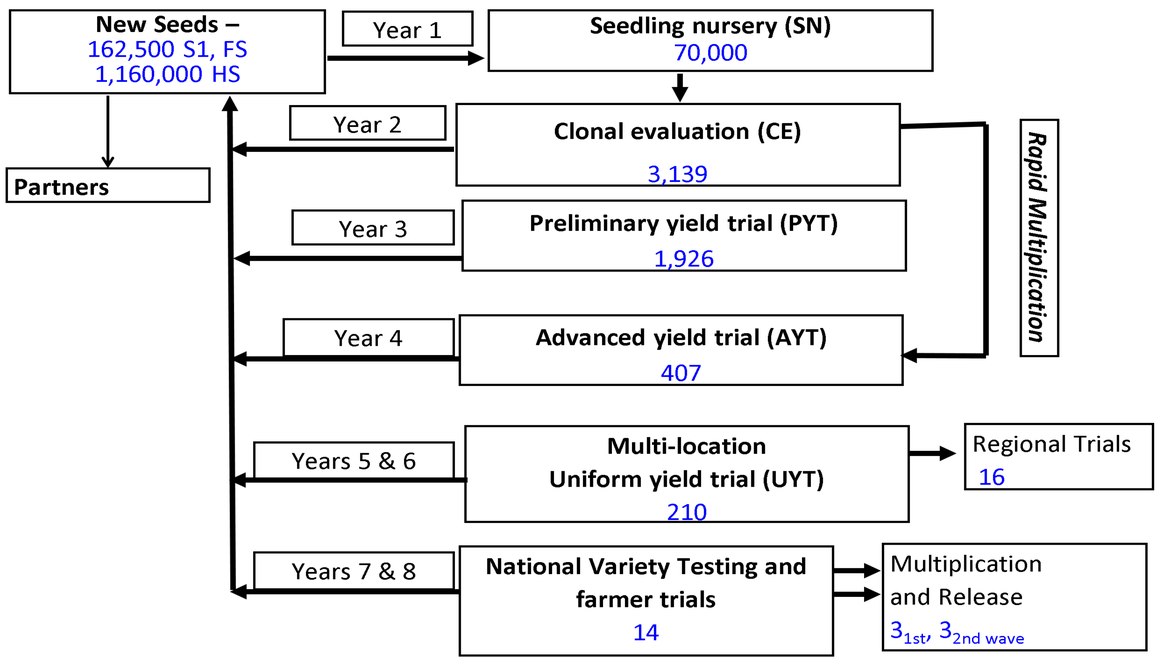

Figure 3. Schematic representation of the PVAC breeding cycle in 2014

Delivery and Dissemination Approach

HarvestPlus has mainstreamed cassava biofortification delivery through a decentralized stem multiplier mechanism. Starting with four states in Nigeria in 2011, subsequent expansion in later years through well coordinated in-country partnerships with multi-stakeholders, NARS partners, media and entertainment industry and ministries of agriculture, health, and education. Nutritious food fairs and Farmers Field Day's (FFD) were organized in Nigeria (Fig. 4) and Ghana to publicize nutritional benefits of biofortified foods among rural and semi-urban communities. Agroshops and online marketing also helped scaling-up of dissemination with over 5 million stem bundles of PVAC varieties disseminated in Nigeria and DRC during 2011-2014.

Figure 4. Participants at the HarvestPlus stand during 2017 FFD held at Ago-owu, Osun state, Nigeria

Training and Capacity Development

Over 4000 individuals have been trained on processing and storage of biofortified cassava-based products. Additionally, NARS partners have been trained on carotenoid quantification using iCheck™ (Fig. 5). 260 participants were collectively trained on cassavabase and data collection using the fieldbook application in Ghana, Uganda, Tanzania and Nigeria between 2015-2017.

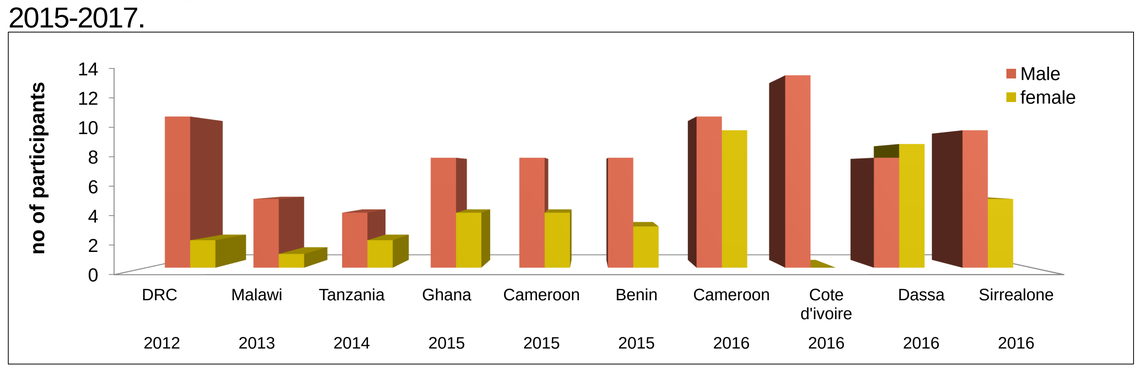

Figure 5. iCheck™ training for NARS partners in different countries from 2012 to 2016 disaggregated by gender

Table 1. Biofortified cassava varieties released in Nigeria and DRC

Variety Name	Total Carotenoids (µg/g fresh wt.)	Fresh Root Yield (t/ha)	Dry Matter (%)
Nigeria – Released in 2011 - 2014			
IITA-TMS-IBA011371	8	20.1	30.7
IITA-TMS-IBA011412	7	29.8	30.1
IITA-TMS-IBA011368	7	26.7	33.4
IITA-TMS-IBA30572 (white control)	0.9	23.2	37.1
NR07- 0220	12	25	32
IITA-TMS-IBA070593	12	27	33
IITA-TMS-IBA070539	11	25	30
DRC – Released in 2008			
IITA-TMS-IBA011661	9	34.9	30
Butamu (Check)	4.4	35.0	35

TCC - total carotenoid content, FW- fresh weight, µg/g
* Pro-vitamin A content is approximately 80% of total carotenoid content (fresh weight) Notes: Data from two years of multi-locational NCRP testing at 9 sites during 2008/09 and 2009/10 (Nigeria).

Future Releases

More than 50 biofortified cassava genotypes with total carotenoid content higher than the best released variety are in the pipeline in advanced breeding stages and national performance trials. To scale biofortification, partners are testing genotypes with total carotenoids content for incorporation into national breeding programs (Fig. 6). Genotypes in current national performance trials include IITA-TMS-IBA141092, IITA-TMS-IBA141099 and IITA-TMS-IKN120016 with total carotenoids content ranging between 13-17 µg/g fresh wt.

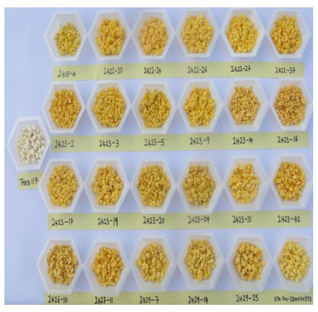

Figure 6. Genotypes with total carotenoids levels higher than the best released variety.

Conclusion

Through our various strategies, it is expected that more than 2 million farming households will be planting PVAC varieties and at least 17 million people will be consuming vitamin A food products in their regular diets in 2018 resulting in a vibrant and stronger cassava value chain with multi-sectoral engagement and new nutrition based markets for cassava in Africa.