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Call for Action to Address Hidden Hunger: Harnessing Biofortification to Combat Micronutrient Deficiencies

The Problem of Micronutrient Deficiency in Uganda

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The Uganda Demographic and Health Survey (UDHS) report notes that, although the prevalence of vitamin A deficiency (VAD) among children under five years has declined (nine percent in 2016 from 33 percent in 2011), anemia prevalence shows mixed results across the population. In fact, iron deficiency anemia (IDA) among children (6-59 months) increased from 49 to 53 percent between 2011 and 2016. Women of reproductive age (WRA) in Uganda increased from 23 percent to 32 percent in the same period (UBOS and ICF, 2018). Although iron deficiency is a major cause of anaemia, other causes also affect its prevalence rates including malaria, worm infestations, and genetic conditions.

Anemia is a serious concern for children and WRA because it can impair cognitive development in children and may lead to poor birth outcomes in pregnant and lactating women. Poor cognitive development and poor birth outcomes have long been associated with long-term health and economic consequences. Anemia related illnesses are a leading cause of mortality among women and children; and low productivity at the population level.

Micronutrient deficiencies therefore remain a significant public health challenge. Since 2004 in Uganda, staple crop varieties have been enriched with essential nutrients through plant breeding and agronomic practices in a process referred to as biofortification. Evidence suggests biofortifying common staple food crops provides an opportunity to enrich diets with key micronutrients like vitamin A, iron and zinc. Biofortification of common staples can potentially enrich diets as well as provide opportunities for affordable sources of quality micronutrients for many low-income families. Consumption of iron-rich beans in particular can significantly contribute to anemia reduction, as the beans can provide up to three quarters of the daily average requirements for iron among WRA (Hass et al., 2016, HarvestPlus, 2016). The scaling of biofortified crop varieties could address significant micronutrient gaps in Uganda as well as contribute to productivity improvements and climate resilience for local agriculture.

Policy Actions/Successes to Date

Numerous policies and strategies lay the groundwork to address malnutrition and hidden hunger in Uganda. The National Agriculture Plan (2013), the Uganda National Seed Policy (20182023) and Uganda Vision 2040 reflect the strong commitment of the Government to ensure the achievement food and nutrition security and improve household incomes through coordinated sustainable agricultural productivity and value addition. The National Development Plan – NDP III and Agriculture Sector Strategy Plan II – 2019/2020 explicitly mention biofortification as a potential approach to addressing micronutrient deficiencies and out broad strategies for scaling up the delivery of biofortified crops and food.

In a consistent manner, the Uganda Nutrition Action Plan II (UNAP 2018-2025) mirrors the commitments on biofortification as stated in the NDP III and ASSP II, in its objective 2 and through strategies 2.1, 2.3, and 2.8, by highlighting the utilization and consumption of biofortified foods among children, women of reproductive age (WRA) and older persons.

The lifecycle approach and multi-sectoral nature of the UNAP aligns Uganda's efforts to global and regional efforts of combating malnutrition and food insecurity. As the government moves away from sector-based planning to programme-based planning, it is envisaged that biofortification could emerge among key actions to promote under the agriculture and health sectors to push for a common nutrition agenda in the NDP III. However well-structured and adequately resourced reforms to scale biofortification are yet to be clearly laid out in both agriculture and nutrition policies.

Role of Bio-fortification in Combating Micronutrient Deficiencies

Biofortification is a process by which the nutritional quality of a staple food crop is improved with additional micronutrients (vitamins and minerals) through a conventional plant breeding process (WHO). This differs from food fortification in that fortification is a post-harvest industrial method to enhance the nutritional quality of food products. Biofortification presents an opportunity to reach communities where supplementation and fortification interventions may be costly to implement. Biofortification offers many advantages.

First, biofortification is based on locally available foods which are consumed as staple foods by the majority of the people in the country including the poor and vulnerable. In Uganda approximately 41% of the population cannot afford a basic nutritionally adequate diet (SOFI, 2020). Biofortification of staple crops allows large numbers of low-income households to affordably and regularly access micronutrients as a part of their daily diets.

Secondly, bio-fortification of staple crops is a cost effective method to reach tens of millions of people on a sustainable basis. Biofortification involves a one-time investment into a crop system that continue to fortify and sustain thereby keeping recurrent costs low. Several studies have used Disability-Adjusted Life Years (DALYs) in cost effectiveness analyses to quantify the effect of crop biofortification in different countries. All of these studies suggest that biofortification can be a highly cost-effective micronutrient intervention, which often costs only a few dollars per DALY saved, far below the World Bank's (2020) threshold of $270 for cost effectiveness. After the initial outlay of funds, the recurrent costs are minimal. The beneficiary farmers continue to grow and benefit from the crops.

Third, biofortified varieties are only released once they have reached a highly competitive level of yield. Biofortified crops provide sustainable income gains for poor farmers through yield gains. Importantly a subset of biofortified varieties (vitamin A maize, iron beans and vitamin A cassava) are climate smart in that they are drought tolerant and mature early against the changing rainfall patterns.

Based on available evidence, biofortification has been recognized as a "game changing solution" by AU-NEPAD under the CAADP/Malabo declaration frameworks. Finally, biofortified products are highly impactful as captured in the evidence document here.

In Uganda, HarvestPlus has been working with the National Agriculture Research Organization to release Iron Beans, vitamin A maize and Orange Flesh Sweet Potato (OFSP). The HarvestPlus Office works with more than 45 partners from government, business and civil society. The office improves nutrition and public health in Uganda by promoting vitamin A orange sweet potato and iron beans in diets. Sweet potatoes rank third among the common food staples in Uganda and are often eaten with beans in many parts of the country. HarvestPlus Uganda supports the National Agricultural Research Organization (NARO) to breed, test, and release varieties of OSP developed in partnership with the International Potato Center (CIP), and iron beans developed through the International Center for Tropical Agriculture (CIAT).

Table 1. Policy Findings, Implications and Proposed interventions for Scaling Biofortification

Key Policy Finding	Policy Implication	Proposed Action
The National Seed Policy of 2018 recommends a seed class referred to as Quality Declared Seeds (QDS).	The availability of the National Seed Policy with its provision for safe and high-quality seed for increased food and nutrition security provides an entry point for scaling up production and supply of biofortified seeds.	Ministry of Agriculture should define and include biofortified seeds as one of the seed varieties to be promoted within the NDP III and other national agriculture projects with a clear budget line for R&D and early generation seed.
The inclusion of biofortification in the National Development Plan III, the UNAPII and the Zero-Hunger Strategy provides opportunity for integrating biofortification in existing policies and strategies.	As provided for in the draft Zero-Hunger Strategy, MAAIF is required to develop a food security action plan. This is an opportunity for inclusion of biofortification.	MAAIF to integrate biofortification interventions in the up-coming Food Security Action Plan and strengthen already running programmes with biofortification interventions
		Local governments to integrate biofortification in plans
The UNAPII, the Zero-hunger Strategy and the NDPIII-human capital program provide for promotion of school gardens and homegrown school feeding. The Agro-industrialization Program of the NDPIII also provides for enhanced agricultural production and productivity.	This provides opportunity for promoting use of biofortified seeds in school gardens and surrounding communities. This model has been implemented under the multi-sectoral food and nutrition security project led by MAAIF.	Support the expansion of the Multi-sectoral Food and Nutrition Security Project to more schools and communities.
The absence of clear policy and guidance on standards for biofortified seeds and crop varieties may be an impediment to scaling up biofortification, as quality seeds cannot be guaranteed.	The lack of an explicit policy and standards for biofortification provides opportunity for intervention.	Varietal release should set iron and Vit A content standards so that a larger percentage of varietal development funds naturally get allocated to biofortification.
		Support agriculture research stations, standards bodies and seed certification agencies to develop comprehensive supervision for adherence to standards.
Work to develop biofortified crop varieties is still limited to National agricultural research stations, with limited involvement of the private sector.	There is need to involve private seed businesses in biofortification and make the trade more appealing as a business.	Work with NARO to support and strengthen the private businesses to start and sustain production of biofortified seeds at scale with an allocation for technical assistance for seed companies and outgrowers.
		Government should support commercial farmers to produce biofortified seed.
Budget Analysis reveals that the Agricultural Ministry, Departments and Agencies have budget allocation codes for crop technology development and promotion.	This makes it feasible for future inclusion of specific budget allocations for biofortification technology development and promotion.	MAAIF should ensure specific budget allocation for biofortification in the key MDAs where biofortification programs are integrated. Analysis indicates that even a USD 7-8 Million investment can strongly enable the national expansion of crops like high iron beans and Vit A Maize.
The formal seed sector works closely with National Seed Certification Service (NSCS) to regulate and certify developed seed varieties. NSCS is the government entity under the MAAIF which is responsible for certification of seed	There is need to expand the services of the NSCS to the private sector to enhance certification of seed generally and specifically biofortified seeds	Support the NSCS to certify private sector seed players for biofortified seeds.
Absence of timely national data on biofortification interventions.	There is a need to collect timely national data on biofortification, including more metrics on agriculture and food and nutrition security.	Support Uganda Bureau of Standards to integrate biofortification metric indicators in routine surveys like the Demographic Health Survey and the Uganda Nation Panel Survey including the Living Standards Measurements Study- Integrated surveys on agriculture (LSMS-ISA).

Despite its recognition across key policy documents, more needs to be done to really scale biofortification for country wide impacts in Uganda. Some of the challenges to scale include an evolving seed industry where research, early generation seed and seed multiplication and certification for biofortification need focused capacity development; the absence of a cohesive set of actions cutting across agriculture and nutrition to support biofortification and the lack of clear public investment for scaling biofortified crops.

Priority Actions ("The Solution")

Based on the demonstrated national commitment (through policy instruments) and the proven impacts of biofortification, it is important for the government to continue to advance and scale-up biofortification in Uganda to bring sustainable solutions to the problem of undernutrition. This up-scaling requires coherent and well-coordinated investments across the value chain.

Policy Findings, Implications and Proposed interventions for Scaling Biofortification

Table 1 highlights key policies to prioritize as well as existing programmes into which biofortification can be integrated and strengthened to promote the development, propagation, and use of biofortified crop varieties and products.

Summary Roadmap

Coordinated policy, strategy and public investment support for scaling biofortification requires collaborative effort across multiple sector stakeholders. A multi-stakeholder engagement process was initiated through a workshop with the support of the Office of the Prime Minister in October 2021. Follow up steps determined at the workshop include:

- Ministry of Agriculture, Animal Industries and Fisheries (MAAIF) to identify key point person/ champion to help drive the agenda in a sustained manner.
- Integration of biofortification budgets in ASSP II and Seed Quality Management System.
- Conduct a planning and budgeting workshop for addressing budgetary support as identified under table above.
- Varietal release committee should facilitate micronutrient content standards for iron beans and Vit A Maize.
- Scenario and investment analysis for R&D Policy for dedicated budgetary line for biofortification with medium term budgetary support.
- Studying and advocating for technical assistance allocation for NARO and NSCS.
- Establishing a technical assistance facility for small and medium enterprises participating in biofortified seed, grain and food value chains.