

Country Prioritization for Biofortified Crop Interventions across Africa, Asia, and Latin America

Introduction: Globally, two billion people suffer from micronutrient malnutrition. Micronutrient malnutrition impedes proper health and development also leading to a lifetime of income losses (Alderman et al., 2006). Biofortification, the process of breeding staple food crops to have higher micronutrient content, has proven to be efficacious and cost-effective in addressing micronutrient malnutrition (Bouis and Saltzman, 2017). To determine where and in which crop-micronutrient combinations to invest, this research develops an improved Biofortification Prioritization Index (BPI). This paper improves upon the original methodology, includes an additional eleven crop-micronutrient combinations, and utilizes updated data for 128 countries in Africa, Asia, and Latin America.

Methods: The BPI is a composite, crop-specific index which accounts for the intensity and level of supply and demand of a specific crop, in a country, and the micronutrient deficiency rates for the micronutrient(s) that can be bred into the specific crop(s) (Asare-Marfo et al., 2013). Three necessary conditions must be met for a country to be considered for a biofortified crop intervention: (1) the country must be a producer of the crop, (2) the country's population must consume a large portion of the crop, and (3) the country's population suffers from micronutrient deficiencies. The production sub-index is comprised of three variables while the consumption sub-index is comprised of two, with both indices utilizing three year-averaged data to smooth seasonality or shocks. Each of the micronutrient deficiency sub-indices (vitamin A, iron, and zinc) are comprised of two variables. A geometric mean is used for the BPI analysis so that the sub-indices complement one another. A country's BPI is calculated by using secondary, country-level data primarily compiled from the Food and Agriculture Organization, the World Health Organization, UNICEF, the World Bank, and Wessels et al. (2012). Where needed, data imputations were calculated based on available data to address data constraints.

Findings and Interpretations: The country-crop-micronutrient specific BPIs rank countries both globally and within regions (Africa, Asia, and Latin America) according to their suitability for biofortification intervention investments. Preliminary results show that Africa is the priority region for the introduction of vitamin A enriched crops, with first country crop rankings as follows: vitamin A maize (Malawi), vitamin A cassava (Angola), vitamin A sweet potato (Equatorial Guinea), vitamin A banana (Burundi), and vitamin A plantain (Gabon). An African country ranks number one in five of the six iron-crop combinations: iron bean (Burundi), iron pearl millet (Niger), iron cowpeas (Niger), iron sorghum (Burkina Faso), and iron potatoes (Malawi). While Africa is not the priority region for the introduction of zinc biofortified crops, two African countries rank number one for the introduction of zinc sorghum and zinc potatoes; Burkina Faso and Malawi, respectively.

Further analysis will calculate area-weighted and population-weighted BPIs for each crop-micronutrient combination which decision-makers may prioritize given their agenda. As is evidenced, Africa remains the prioritized region of the world which can most readily benefit from the introduction of biofortified staple food crop interventions. While BPI results can be used to inform biofortification investment decision-making, they should not be used as the sole tool.

Conclusions: As biofortification continues to prove its efficacy and effectiveness in alleviating micronutrient malnutrition, analyses are needed to help identify the most fruitful areas of investment and implementation. This research develops an improved Biofortification Prioritization Index (BPI) which

ranks sixteen country-crop-micronutrient combinations for their biofortification potential across 128 countries in Africa, Asia, and Latin America. Africa ranks as the priority region for the introduction of the five vitamin A biofortified crops and five of the six iron crops. While Asia ranks as the priority region for zinc biofortified crops, two African countries, Burkina Faso and Malawi, are ranked as the priority country for zinc sorghum and zinc potatoes. Due to Africa's great potential benefit from biofortified crops, continued efforts in developing biofortified crop varieties is essential while also conducting nutrition and economics research to maximize impact and build the evidence base.

The BPI can guide biofortification investment decisions but should not be the sole tool used for decision-making. While the level of analysis in this research is at the national level, subnational BPIs are also being developed to identify proper areas for biofortification interventions within heterogeneous countries such as Ethiopia (Funes et al., 2015) and Nigeria (Herrington et al., 2018).

References:

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