



## Iron and Zinc enriched Beans – Biofortified Beans

Lessons drawn from practical evidence on how agriculture can contribute to nutrition and health outcomes”.

### 1. Main objective of the research

Biofortification is a new public health intervention that seeks to improve the micronutrient content of staple foods consumed by most poor people using conventional plant breeding techniques so as to make a measurable impact on the magnitude of micronutrient malnutrition. Recently, plant breeders have developed biofortified varieties of beans that contain higher concentrations of iron and zinc. Biofortified beans are also referred to as micronutrient rich beans or nutrient dense beans.

### 2. Nutrition objectives the research address

Malnutrition is of public health concern in developing countries particularly in sub-Saharan Africa. All forms of malnutrition exist; these are: Undernutrition, Micronutrient malnutrition and Over nutrition.

Vitamin A, iron and zinc are among the three micronutrients that are widely recognized by the World Health Organization as public health problems. Iron deficiency anaemia (IDA) affects over 2 billion people globally, and the prevalence in sub-Saharan Africa still remains high, with pregnant women and young children being at greatest risk. In Malawi the national micronutrient survey of 2001 found the highest prevalence of IDA in preschool children at 80% followed by women in childbearing age group at 27% and then in men at 17% (MDHS, 2004). Generally malnutrition is high among the rural communities than the urban areas.

If the introduction of nutrient dense beans is successful, this could have a significant impact on the prevalence of iron deficiency in Malawi and elsewhere in sub-Saharan Africa, where it is a major public health concern. The consequences of micronutrient malnutrition are massive; and include, more illness and diseases; low cognitive ability; low capacity for physical labor; impaired growth; poor reproductive health and decline in productivity leading to low Gross Domestic Product (GDP)

### 3. How does the research address those objectives?

A number of strategies exist for combating micronutrient malnutrition and these include;

- Supplementation – provision of tablets/capsules (e.g. vitamin A capsule given to children iron tablets given to pregnant women. This is a short term strategy, expensive and has limited coverage.
- Food fortification – Addition of vitamin and mineral to commercially produced food e.g. cooking oil and sugar with vitamin A – medium to long term strategy.
- Dietary diversity – Promotes consumption of a variety of food groups – long term

Biofortification- is a Novel technology

It is a sustainable agricultural strategy for reducing micronutrient malnutrition because low cost, pro-poor and sustainable food based approach to combating micronutrient deficiencies. A novel strategy for delivering micronutrient on a daily basis- Biofortified foods form the daily diet and it complements existing nutrition interventions mentioned above.

#### 4. Pan Africa Bean Research Alliance (PABRA) Focus Research Area

CIAT has initially targeted six staple foods crops for biofortification. PABRA which is facilitated by CIAT has its focus is on beans.

#### 5. Will Bio-fortification of beans work?

The following issues were of concern in the development of biofortified beans.

- Can breeding increase nutrient levels enough to improve human nutrition?
- Will the extra nutrients be bio-available at sufficient levels to improve micronutrient status?
- Will farmers adopt crops and will consumers buy/eat in sufficient quantities?

To address the above issues the following were done

#### i) Targets were set to increase: 3 fold iron content in beans

Iron content in bean

- Baseline = 50 micrograms/gram
- Target = 94 micrograms/gram
- Estimated bio-fortification target increment = 44 micrograms/gram

Zinc content in bean

- Baseline = 30 micrograms/gram
- Target = 47 micrograms/gram
- Estimated bio-fortification target increment = 17 micrograms/gram

To achieve this CIAT screened a number of lines and selected promising varieties. These were distributed to partners, in Malawi the Department of Agriculture and Research (DARS) at Chitedze Agricultural Research and fast tracked promising lines high nutrient dense. Two varieties were released in 2009. NUA 45 and NUA 59. Currently DARS is multiplying basic seed through its partners to obtain enough quantities of certified seed that can be made available for access by communities for planting and subsequently consumption.

#### ii) Consumption –How much beans one should consume to improve the iron status.

- 200 grams/day – for a women;
- 100 grams/day – for children 4-6 years of age;
- 50 grams/day – for 1-3 year olds children

Assuming iron retention - 85% (that is iron that remains that considering losses due to processing and cooking before the bean is consumed

Assuming absorption - 5% (this is the amount of iron that is taken up by the body)

*How much beans do Malawian consume per day???. We do not know – Research area.*

iii) Will intake of additional Iron from beans improve micronutrient status?

Considering that beans contain a number of anti-nutritional factors that makes iron and zinc content availability for human body utilization low. A number of studies have been conducted in other countries to evaluate and remove/destroy these anti-nutritional factors. Results will be share across countries. Studies on different cooking and processing options for increasing adequacy of iron intake have been done on other countries as well and results will also be shared across countries.

Methods for increasing iron intake from beans includes

- Recipes development
- Food baskets
- Development of Bean Based food products that address target nutrient deficiencies in children – composite complementary flours suitable for both households and industrial level processing.

**6. Finally how would the agriculture-nutrition-health linkages and value chain be enhanced through such research as the current one, to unleash agriculture’s potential to improve nutrition and health more**

Multidisciplinary teams/platforms involve players for all sectors will be required to unleash the agriculture’s potential to improve nutrition and health. For example that currently DARS has released two varieties of micronutrient rich beans, NUA 45 and NUA 59. DARS through partners which includes Catholic Relief Services and private seed companies are multiplying foundation seed to obtain enough quantities of certified seed that can be accessed by the community.

Biofortification strategy has already been recognized by the nutrition and health sectors as one of the strategy that would contribute to combating malnutrition. The nutrition sector will stimulate widespread adoption based on the nutritional benefit of nutrient dense beans based on the scientific evidence coming from the studies. The health sector will require promoting micronutrient rich dense beans as one of the bifortification strategy for improving iron and zinc status. Value adding should remain key issue to be pursued besides eating cooked whole beans. The role of the food industry private sector will be important processing beans in the form that is accessible even by children and other vulnerable groups who are not able to consume whole beans.

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