Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 03, Issue: 02 (MAR-APR, 2023)
Available online at http://www.agriarticles.com
©Agri Articles, ISSN: 2582-9882

Bio Fortification: Process to Overcome the Nutrient

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Abstract

More than half of the world's population is affected by micronutrient malnutrition and is considered one of the greatest global challenges facing humanity. Micronutrient malnutrition, often known as hidden hunger, seems to be quite prominent among mothers and preschool children, and is caused primarily by a lack of micronutrients, particularly Zn and Fe. Biofortification, the technique of boosting bioavailable amounts of critical elements in edible sections of crops by agronomic intervention or genetic selection, has the potential to alleviate malnutrition and hidden hunger. In order to boost the bioavailability of Fe and Zn in staple crops such rice, wheat, corn, kidney beans, and cassava, the Consultative Group on International Agricultural Research has investigated genetic possibilities.

Introduction

Biofortification is a strategy that enhances the nutritional content of plant edible sections using mineral enrichment, classical breeding, or transgenic treatments. The method of breeding nutrients into food crops is a relatively low-cost, long-term, and sustainable approach to providing additional micronutrients. Biofortification is a viable method of addressing impoverished rural people who may lack access to commercially marketed fortified meals and supplements. The bio fortification technique aims to introduce the micronutrient-dense trait into cultivars that already have desirable agronomic and consumer characteristics, such as high yield. According to the United Nations Food and Agriculture Organization, around 792.5 million people worldwide are malnourished, with 780 million of them living in developing nations *(McGuire S. 2015)*. In addition, despite increasing food crop production, around two billion people worldwide suffer from "hidden hunger," which is characterised by an insufficient intake of key micronutrients in the daily diet *(Hodge J, 2016)*. *(Gould J. 2017)*. Aside from that, there is increased worry about nutrition.

Why Do We Require Bio Fortification?

1. Because the world's population is constantly growing, biofortification is a crucial technique to meet people's desire for nutritious food.
2. There are 1.5 billion overweight persons worldwide.
3. An increase in malnutrition, underweight, and obesity.

Several Approaches are Included in the Biofortification Pathway

The ultimate objective of bio-fortification is to produce healthy and safe foods in adequate and sustainable quantities. Biofortification of important micronutrients into agricultural plants may be accomplished in three ways: transgenic, conventional, and agronomic, each including the application of biotechnology, crop breeding, and fertilisation tactics. Rice, wheat, maize, sorghum, lupine, common bean, potato, sweet potato, and tomato are among the staple crops addressed by transgenic, traditional breeding, and agronomical techniques. Cassava, cauliflower, and banana have been biofortified using both transgenic and breeding methods, whereas barley, soybean, lettuce, carrot, canola, and mustard have been biofortified using both transgenic and agronomic methods. Transgenic approaches have targeted a greater range of crops, while breeding strategies have increased the practical use of bio-fortification. Cereals are a mainstay.

Rice Transgenic (*Oryza sativa*): Rice has been chosen to solve the worldwide problem of malnutrition. Vitamin insufficiency is one of the biggest issues confronting the disadvantaged people as a result of limited access. Golden rice was a notable breakthrough in this field as an effective source of provitamin A (beta-carotene) with the potential to minimise disease load by expressing PSY and carotene desaturase genes *(Burkhardt et al., 1997).* By targeting the gene producing carotene desaturase, the quantity of beta-carotene precursor, phytoene, was increased up to 23 times. For a healthy pregnancy and to prevent anaemia, folic acid (vitamin B9) is crucial. By overexpressing the genes for aminodeoxychorismate synthase and Arabidopsis GTP-cyclohydrolase I (GTPCHI), rice has been genetically altered to boost its folate content (up to 150-fold).

Pearl millet (*Pennisetum glaucum*): The purpose of this review is to outline the pearl millet's present bio fortification breeding status and potential future options for expanding nutrition markets. A substantial genetic diversity (30-140 mg/kg Fe and 20-90 mg/kg Zn) present in this crop can be efficiently used, according to research on pearl millet, to create high-yielding cultivars with high iron and zinc densities. India was the country to create and introduce open-pollinated pearl millet varieties (Dhanashakti) and hybrids (ICMH 1202, ICMH 1203, and ICMH 1301) with a high grain yield and high levels of iron (70-75 mg/kg) and zine (35-40 mg/kg) densities.

Maize (*Zea mays*): A valuable cash crop, maize is raised for human food, industrial usage (as a source of ethanol, sugar, oil, and starch), and animal feed. Researchers have found plants with high quantities of provitamin A in their natural state. In order to tackle vitamin A deficiency, Harvest Plus is utilising these lines to produce biofortified high-yielding maize varieties with increased amounts of provitamin A. One of the major developments in bio-fortification is the provitamin A maize. Since 2013, biofortified orange maize varieties have been produced commercially in Zambia (GV662A, GV664A, and GV665A), Ghana (CSIR-CRI Honampa (OPV)), Nigeria (Ife maizehyb-3, Ife maizehyb-4, Sammaz 38 (OPV), and Sammaz 39 (OPV)) *(Pixley et al., 2013).*

Wheat (*Triticum aestivum*): The predominant crop to be bio-fortified is wheat because it is a staple. Wide variations in grain iron and zinc contents have been documented in wheat and closely related wild species, and these variations can be used to improve current elite cultivars *(Monasterio and Graham, 2000).* Harvest-Plus has produced numerous wheat types with 4–10 ppm more zinc using this modification. In 2014, India produced six high zine wheat cultivars (BHU 1, BHU 3, BHU 5, BHU 6, BHU 7, and BHU 18), while in 2015, Pakistan released four varieties (NR 419, 42, 421, and Zincol).

The Benefits of Bio Fortification

1. Getting in touch with rural areas without access to pharmaceutical supplements or fortified foods and boosting long-term nutritional status.
2. More resistant to social and economic changes than quick fixes.
3. Possibility of having a significant influence on a lot of people for little money per person.
4. Recurring expenses are cheap when the initial investment is made to create seeds that can bolster themselves, and germplasm may be transferred worldwide.

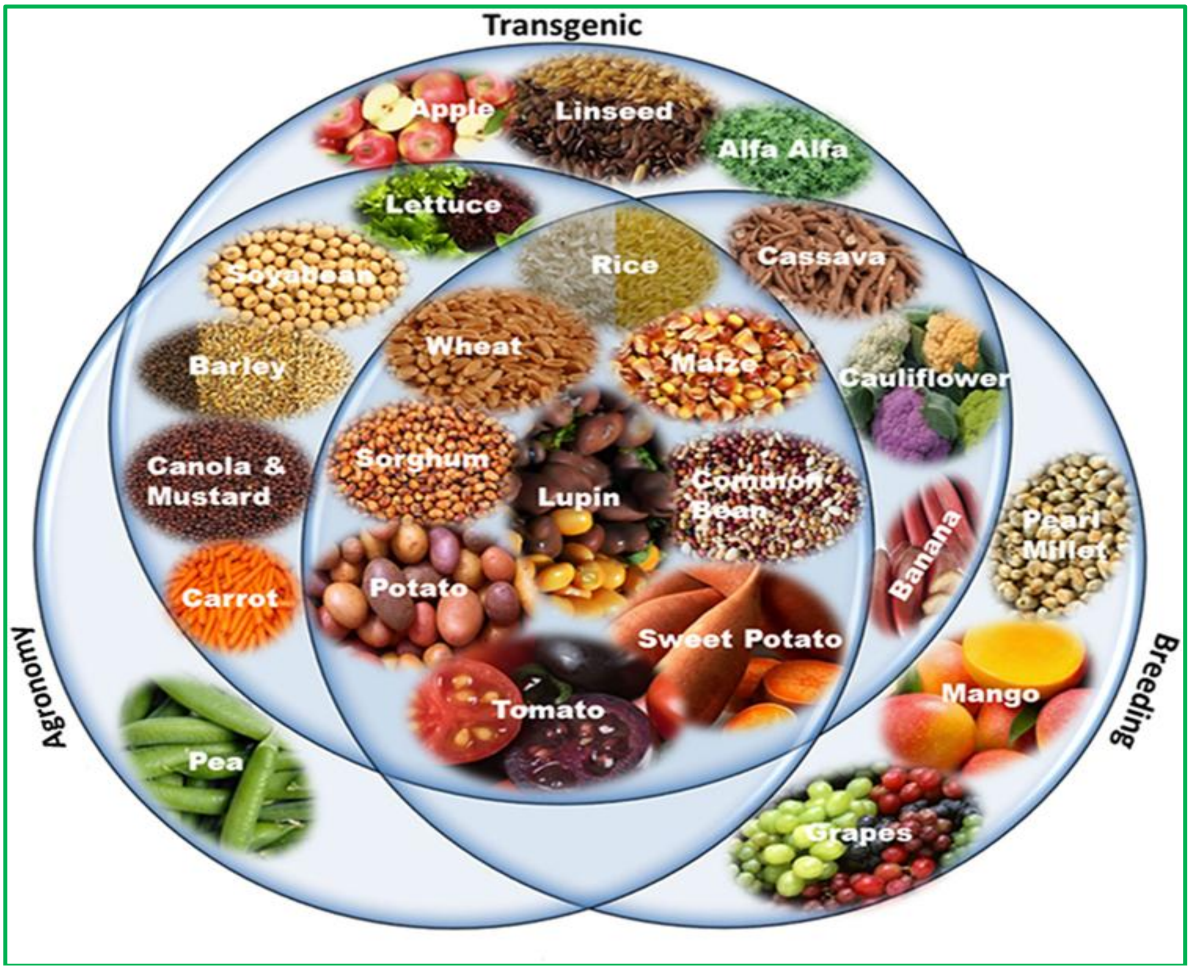

Figure 1: - Biofortification of different cereals

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