SABUJEEMA
Volume 3 - Issue 12– December,2023
An International Multidisciplinary e-Magazine

The Possibility of Reducing Hidden Hunger Via Biofortification of Crops

[Article ID: SIMM0330]

[1]K.Samyukta,[2] Mita Meher
[1]*B.Sc. (Ag.), GIETU, Gunupur*
[2]*Ph.D. Scholar, IGKV, Raipur*

Introduction

Biofortification is the process of enhancing food crops' nutrient content by traditional plant breeding, agronomic techniques, and contemporary biotechnology. Biofortification is derived from the Greek words 'bios' which Means "life" and 'fortificare' which means "to strengthen." Often, it refers to the process of creating foods with higher nutritional content. The food's flavour, aroma, or textures are not changed. It is a practical method that doesn't need people to alter their eating routines or patterns.

Importance

- Judicious nutrition supplementation: Biofortification makes it possible to include particular nutrients into a given crop through genetic engineering or selective breeding.
- Humans function less effectively when they lack the essential nutrition, which is a serious worry. Supplying nutrients in an efficient manner can greatly increase productivity.
- Reduces the need for excessive spending on food. In underdeveloped countries, where the bulk of the population cannot afford to spend more money on nutrient-rich food, biofortification is a lifesaver.
- In order to improve the nutritional value of everyday diets.

Biofortification's effectiveness depends on:

High nutrient density together with high yields and high profitability should be included in a breeding programme that is successful. The impact of fortified foods must be proven; it must be proved that human subjects' micronutrient status improves when

consuming the biofortified versions as they are typically consumed. Hence, these nutrients need to be bioavailable and hold up through processing and cooking. Farmers must grow these biofortified foods and must connect with large numbers of people who are micronutrient malnourished.

Methods of Biofortification

Biofortification can be achieved through three strategies:

* Agronomic biofortification
* Conventional plant breeding
* Genetic engineering

1. Agronomic biofortification: In agronomic biofortification, fertiliser is applied to the soil or sprayed on plant leaves. Foliar applications have been shown to be successful in biofortifying Fe and Zn by enhancing the nutrients in plant tissue and edible components. The most crucial micronutrients for agronomic biofortification (foliar treatments of ZnSO4) are selenium (as selenate), iodine (soil application of iodide or iodate), and zinc. The foliar spray of micronutrients (Fe, Zn, Cu, etc.) is a cost-effective and quick method of providing micronutrients to plants.

2. Conventional plant breeding : By carefully choosing breeding stock to improve nutritional efficiency, conventional breeding procedures help to enhance the concentration of -carotene, caroteniods, amino acids, amylase, carbs, and other minerals. These are the steps in traditional plant breeding's biofortification process:

Discovery:

* Determine the target demographics.
* Set target levels for nutrients.
* Gene and germplasm screening

Development:

* Cultivate bio-fortified plants.
* Performance of new crop types under test.
* Measure the amount of nutrients that crops retain.
* Analyze the impact and absorption of nutrients.

Dissemination:

* Create plans for seed dissemination.
* Incentivize the sale and consumption of biofortified food

Outcomes: Boost target groups' nutritional status.

3. Genetic engineering: The severity of mineral and vitamin insufficiency is being addressed globally with the use of biotechnology, an effective biofortification method. The present advancement of genetic engineering techniques and instruments enables the incorporation of features that conventional breeding cannot produce. Through the transfer of desired traits from one organism to another to produce elite cultivars, genetic engineering techniques use an infinite pool of genes to create unique cultivars, increasing their value. Transgenic crops are genetically modified plants that provide protection against a variety of biotic stressors, such as diseases, viruses, and insects, in addition to having better nutritional value.

What is +F logo?

The Food Safety and Standards Authority of India (FSSAI), which created the "+F" logo for fortified foods, states that food fortification is necessary to counteract the long-term effects of malnutrition and inadequacies. Consumers will be able to tell which goods are nutrient-dense thanks to the recently introduced blue marker +F on packs of common commodities including oil, milk, double-fortified salt, wheat flour, and rice.To control the provisions relating to fortified foods, FSSAI introduced the Food Safety and Standards (Fortification of Foods) Regulations, 2018, on August The following are some of the important features of the regulations:

* It outlines the rules for adding micronutrients in order to fortify food. Producers of fortified foods must submit a quality assurance undertaking.
* Packaging and labeling must include the food fortificant, the +F emblem, and the slogan

"Sampoorna Poshan Swasth Jeevan".

* It is also important to abide by the Food Safety and Standards (Packaging and Labeling) Regulations.

Table 1: Biofortified varieties of fruits in India

Sl. No	Fruit crop	Mineral content	Variety
1.	Pomegranate	Iron-5.6-6.1 mg/100 g Zinc-0.64-0.69mg/100g Vitamin-19.4-19.8 mg/ 100g	Solapur lal
2.	Grape	Antioxidants	Pusa navrang
3.	Mango	βcarotene, Vitamin C	Pusa surya, Pusa pitamber
4.	Banana/Plantain	Provitamin A, carotenoid	

Table 2: Biofortified varieties of cereals in India

Sl. No	Cereal crop	Mineral content	Variety
1.	Rice	Protein -10. 3%	CR Dhan310
2.	Wheat	Zinc-42. 0ppm , Iron-40. 00 ppm	WB 02
3.	Pearl Millet	Iron 73.0ppm, Zinc 41.0ppm	HHB 299
4.	Maize	Provitamin-A8.15 ppm, Lysine 2.67% Tryptophan 0.74%	Pusa Vivek QPM9 Improved

Table 3: Biofortified varieties of vegetables

Sl. No	Vegetable	Mineral content	Variety
1.	Potato	Anthocyanin100µg/ 100g	Kufri Neelkanth
2.	Carrot	Carotene(38 mg/100 g)	Ooty-1
3.	Pumpkin	Carotene (3333 IU)	Arka Chandan
4.	Brinjal	Anthocyanin	Punjab Sadabhar
5.	Tomato	VitaminC(31.2mg/100g)	Pusa Rohini

Conclusion:

Future predictions indicate that vitamin and mineral deficiency will become increasingly harmful, and biofortification is emerging as a viable remedy. The current nutritional issues connected to micronutrients are addressed via biofortification. Given a low-cost, straightforward, and crop-based approach, the biofortification technology has tremendous promise for tackling the problem of micronutrient deficiencies in the developing countries. Additionally, it only needs to be invested once, and farmers can multiply seeds over years at almost no marginal cost. The introduction of various biofortified crop varieties has resulted in significant advancement in this field and is helping the target populations overcome micronutrient deficiencies. With further planned research and sensible legislation, biofortification may see significant success in the years to come.

Reference:

* https://www.google.com/url?sa=t&source=web&rct=j&url=https://www.researchgate.net/publication/328602083_Biofortification_in_Horticultural_Crops&ved=2ahUKEwjv0r2Oy39AhXbUGwGHXJqBmoQFnoECAEQAQ&usg=AOvVaw0Vp1YqV0OpAyaWCiolISEK
* https://www.google.com/url?sa=t&source=web&rct=j&url=https://www.pphouse.org/upload_article/58863243_3_IJEP_9_3_Aug_2022_Kumar

i_et_al.pdf&ved=2ahUKEwjWooWSy39AhXHSmwGHRCECgA4ChAWegQIJRAB&usg=AOvVaw0VOLO8Jv54vgPAb-gNvw7L

* https://www.google.com/url?sa=t&source=web&rct=j&url=https://icar.org.in/files/BiofortifiedEnglish_.pdf&ved=2ahUKEwiv6r9yu39AhUecGwGHeyCA0oQFnoECGAQAQ&usg=AOvVaw36SGY3lrAyKIpv06tikf3X