Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 02, Issue: 04 (JULY-AUGUST, 2022)
Available online at http://www.agriarticles.com
©Agri Articles, ISSN: 2582-9882

Biofortification: A Boon for Agriculture

(*Monika Yadav and Lovneesh)
Chaudhary Charan Singh Haryana Agricultural University, Hisar-125004, Haryana
*Corresponding Author's email: monikarao2805@gmail.com

The process of enhancing a crop's nutritional worth is known as biofortification. To alleviate the detrimental effects of vitamin and mineral shortages in humans refers to the nutrient enrichment of crops. Biofortification is an emerging, promising, affordable, and sustainable method of providing micronutrients to a population with limited access to varied meals and other micronutrient therapies. The terms "biofortification" and "biological fortification" relate to food crops that have been designed and grown using contemporary biotechnology techniques, traditional plant breeding, and agronomic practices and are nutritionally enriched with greater bioavailability to the human population.

Biofortification is the process of adding nutritional value to the crop. It refers to nutrient enrichment of crops to address the negative economic and health consequences of vitamin and mineral deficiencies in humans.

Need for Biofortification

According to the United Nations Food and Agriculture Organization, 780 million of the world's estimated 792.5 million malnourished people reside in developing nations. In addition, despite increased food crop production, almost two billion people worldwide experience a different sort of hunger known as "hidden hunger," which is brought on by an insufficient intake of vital micronutrients in the daily diet. In addition, there is rising worry over overnutrition. Until now, the primary goals of our agricultural system have been to boost crop productivity and grain yield, not human health. This strategy has caused a sharp increase in the lack of some micronutrients in dietary grains, which has increased micronutrient malnutrition among consumers. Agriculture is transitioning from producing more food crops in significant quantities to generating enough nutrient-rich crops. This will aid in the fight against "hidden hunger" or "micronutrient malnutrition," especially in emerging and underdeveloped nations where diets are dominated by staple foods that are low in micronutrients. Therefore, biofortification of many crop kinds offers a long-term and sustainable strategy for giving people access to high micronutrient crops.

Methods of Biofortification

The ultimate goal of biofortification is to produce safe, wholesome foods adequately and sustainably. Three basic methods—transgenic, conventional, and agronomic—involve biotechnology, crop breeding, and fertilisation techniques, respectively, to biofortify vital micronutrients into crop plants. Transgenic approaches have targeted more crops, while breeding techniques have increased the practical application of biofortification.

1) **Agronomic Biofortification:** Fertilisers are applied to boost the micronutrient content of edible components. The best micronutrients for agronomic biofortification include zinc, foliar sprays of zinc sulphate, iodine, and selenium (as selenate). Se concentrations increased more than 10-fold due to the use of inorganic Se fertilisers. The quickest and

most straightforward way to apply nutrients to plants to fortify them with micronutrients (Fe, Zn, Cu, etc.) is through foliar spraying.

2) **Conventional Plant Breeding**: For the previous 40 years, traditional breeding has mostly prioritised yield qualities and resistance breeding, with less emphasis placed on nutritional features, resulting in lower nutrient status levels in the existing varieties. Identifying target populations is the first step in biofortification through traditional plant breeding. Determine target nutritional levels, Gene and germplasm screening by cultivating bio-enhanced crops, new crop varieties' test results, the number of nutrients that crops and food retain, create methods for disseminating seeds, and Encourage the sale of and consumption of biofortified foods, Boost target groups' nutritional status.
3) **Transgenic Method:** When there is little to no genetic variation in nutrient content among plant varieties, the transgenic technique can be a viable alternative for generating biofortified crops. The transfer and expression of desirable genes from one plant species to another, regardless of their evolutionary and taxonomic status, depends on access to an infinite genetic pool. Genetic engineering presents a viable alternative for boosting the concentration and bioavailability of micronutrients in the edible crop tissues when there is insufficient variation among genotypes for the desired character/trait within the species or when the crop itself is not suitable for conventional plant breeding (due to lack of sexuality; for example, bananas).

Horticultural Biofortified Crops

Biofortification works have been practised in most horticultural crops like Banana, Cassava, Beans, Potato, Orange sweet potato (OSP).

1) **Orange sweet potato (OSP):** A specific kind of biofortified sweet potato called orange-fleshed sweet potato (OFSP) has a lot of beta-carotene. An organic red-orange pigment called beta-carotene is widely present in plants and fruits. OFSP's orange hue comes from beta-carotene, which is also transformed into vitamin A in the body after consumption to offer extra nutritional advantages.
2) **Bio Cassava+:** However, a regular cassava-based diet only offers 10% to 20% of the daily requirements for iron, zinc, and vitamin A and less than 30% of the minimal amount of protein. Through the creation and distribution of genetically modified cassava with increased nutritional (zinc, iron, protein, and vitamin A) levels, the BioCassava Plus (BC+) programme has used contemporary biotechnologies to improve the health of Africans. Increased shelf life, safe levels of poisonous cyanogenic glycosides, and viral disease resistance are additional characteristics that BioCassava Plus targets. Vitamin A) levels.
3) **Nutri banana:** Bananas that have been fortified add 2.6 mg of iron per 100 grammes of banana to the 0.4 mg of iron found in unfortified bananas. Bananas are bio-fortified by having higher levels of beta carotene (up to 20 ppm), alpha-tocopherol, and iron. When bananas constitute the primary staple food source and have high consumer acceptance, biofortification efforts on the fruit will be advantageous.
4) **Transgenic Carrot:** One of the most consumed vegetables, carrots are rich in vitamins, minerals, and beta-carotene but, like many other vegetables, are low in calcium. Arabidopsis H^+/Ca^{2+} transporter expression has improved the bioavailable calcium level in transgenic carrots.

Conclusion

The improvement of people's general health is made possible by biofortification. These crops yield more and are more resistant to diseases, pests, droughts, etc. It provides a low-dose, food-based, sustainable substitute for iron supplementation. It could benefit farmers as well as the most vulnerable members of society who cannot buy food supplements. Since the technique can be easily repeated and scaled up after the initial research is completed, it is quite cost-effective. The introduction of non-genetically modified biofortified crops is a better option than introducing GM crops, which have implementation challenges. Biofortification is a sustainable, economically viable solution that can assist in resolving this dilemma in a nation like India, which confronts significant nutritional challenges.