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Biofortification: A Strategy to Improve Human Nutrition

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Micronutrient deficiencies lead to hidden hunger which distress more than two billion individuals, or one in three people, globally. When vitamin and mineral intake and absorption are insufficient to maintain a reasonable level of health and development, these deficiencies emerge. Agriculture is currently undergoing a transition from generating large amounts of food crops to providing enough nutrient-rich food crops. This will aid in the fight against hidden hunger, especially in poor and emerging nations whose diets are dominated by basic foods that are low in micronutrients. More micronutrients can be delivered over a long period of time and at a relatively low cost by biofortification, the process of breeding. This approach not only will lower the number of severely malnourished people who require treatment by complementary interventions but also will help them maintain improved nutritional status (Singh *et al*., 2016).

Biofortification for human nutrition

Biofortification refers to enhanced nutrition in food crops with increased bioavailability to the human that are developed and grown by using transgenic techniques, conventional plant breeding, or agronomic practices. Biofortification provides a comparatively costeffective, sustainable, and long-term means of delivering more micronutrients. Human beings need around forty known nutrients in adequate amounts to live healthy lives (Aggarwal *et al*., 2020).The nutrients required in very small amounts in the human body are termed as micronutrients—namely iron, zinc, copper, manganese, iodine, selenium, molybdenum, cobalt, nickel, and vitamin A while the other class of essential mineral elements which is required in small quantity includes—sodium, potassium, calcium, magnesium, phosphorous, chlorine, and sulfur (Prashanth *et al*., 2015)).

Together, these nutrients play crucial roles in human‘s physical and mental development. Micronutrients regulate important functions and metabolic processes in our body by acting as cofactors for the functioning of various enzymes in the human body. Agricultural products such as rice, wheat, cassava, and maize are the primary source of nutrients especially for those living in developing countries. However, it contains insufficient amounts of several nutrients such as vitamin A, iron, zinc, calcium, manganese, copper, iodine, or selenium with respect to meeting daily requirements. Nutrient deficient food leads to unhealthy lives, sickness, disability, reduced development/ stunted growth/ childhood stunting, arrested mental and physical growth, diminished livelihoods, and reduced national socioeconomic development. More than30% of the world‘s population has been reported to be anemic and suffering from hidden hunger. Micronutrient deficiency affect about 38% of pregnant women and 43% of pre-school children worldwide. Evaluations have specified that almost half of this is attributed to iron deficiency (Yoon *et al*., 1997).

Different approaches for biofortification

1. **Crop breeding and genetic modification approach:** Biofortification using crop breeding involves the science of improving micronutrient content of staple crops, using the conventional breeding methods and current biotechnology. Crops are bred and genetically modified to improve absorption capacity and nutrient content. Screening of germplasm for sufficient availability of genetic diversity, prebreeding of parental genotypes is necessary for conventional breeding to be achievable. During subsequent screening for parent, agronomic and plant type features are described. If variability is present in the strategic gene pool i.e. unadapted sources, pre-breeding is necessary prior to use of the trait, while if variation is present in the adapted gene pool, it can be directly used to develop new varieties. In this Biofortification approach, parent lines with high nutrients crossed with recipient line having desirable agronomic traits for many generations results with plant having desired nutrient and agronomic traits. Genetic engineering of crops has facilitated modification of crops in unique ways and is a tool for addressing global agricultural challenges. Improved knowledge of DNA led to speedy advancement of agricultural biotechnology as a field. Agricultural biotechnology uses modern biology techniques to alter living beings or their components for cogent purpose in crops. As a result, it permits infusion of genes from the wild. Such cannot be done using conventional breeding. Although plant breeding is the most practiced sustainable method in fortification (Mayer *et al*., 2008).

2. **Agronomic biofortification approach:** Agronomic method of biofortification of crops with micronutrients is envisaged as a fast and easy way out of the inadequacies of these essential minerals in soils and plants. It involves cultivation of varieties that are rich in minerals and vitamins. This method uses fertilization as a strategy to increase micronutrient content of cultivated crops such as cereals and legumes. It is pertinent to emphasize that the agronomic biofortification method could be more beneficial in developing countries.

Biofortification: Strategic Advantages

The biofortification strategy seeks to take advantage of the consistent daily consumption of large amounts of food staples by all family members, including women and children who are most at risk for micronutrient malnutrition. As a consequence of the predominance of food staples in the diets of the poor, this strategy implicitly targets low-income households. After the one-time investment is made to develop seeds that fortify themselves, recurrent costs are low and germplasm may be shared internationally. It is this multiplier aspect of plant breeding across time and distance that makes it so cost-effective. Once in place, the biofortified crop system is highly sustainable. Nutritionally improved varieties will continue to be grown and consumed year after year, even if government attention and international funding for micronutrient issues fade. Moreover, biofortification provides a truly feasible means of reaching malnourished populations in relatively remote rural areas, delivering naturally fortified foods to people with limited access to commercially marketed fortified foods, which are more readily available in urban areas. Biofortification and commercial fortification, therefore, are highly complementary. Breeding for higher trace mineral density in seeds will not incur a yield penalty. In fact, biofortification may have important spin-off effects for increasing farm productivity in developing countries in an environmentally beneficial way. Mineral packed seeds sell themselves to farmers because, as recent research developments proved that seeds rich in trace elements are stronger to resist against biotic and abiotic stresses including diseases and environmental stresses (Bouis, 2003). Further, fortified or enriched seeds also have more plant vigour, seedling survival, faster initial emergence and grain yield.

References

1. Aggarwal, N., Upadhyay, P., & Tigadi, S. B. (2020). Biofortification to improve nutrition: a review. *International Journal of Current Microbiology and Applied Sciences*, *9*, 763-779.
2. Bouis, H. E. (2003). Micronutrient fortification of plants through plant breeding: can it improve nutrition in man at low cost?. *Proceedings of the Nutrition Society*, *62*(2), 403-411.
3. Mayer, J. E., Pfeiffer, W. H., & Beyer, P. (2008). Biofortified crops to alleviate micronutrient malnutrition. *Current opinion in plant biology*, *11*(2), 166-170.
4. Prashanth, L., Kattapagari, K. K., Chitturi, R. T., Baddam, V. R. R., & Prasad, L. K. (2015). A review on role of essential trace elements in health and disease. *Journal of dr. ntr university of health sciences*, *4*(2), 75.
5. Singh, U., Praharaj, C. S., Chaturvedi, S. K., & Bohra, A. (2016). Biofortification: Introduction, approaches, limitations, and challenges. In *Biofortification of food crops* (pp. 3-18). Springer, New Delhi.
6. Yoon, P. W., Olney, R. S., Khoury, M. J., Sappenfield, W. M., Chavez, G. F., & Taylor, D. (1997). Contribution of birth defects and genetic diseases to pediatric hospitalizations: a population-based study. *Archives of pediatrics & adolescent medicine*, *151*(11), 1096-1103.