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Conceptual Paper

Biofortification of Crops: To Combat Malnutrition

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The problem of malnutrition can be cured by enhancing the plant nutritional in terms of quantity and quality both. Plants can provide us these vital nutrients, and they obtain these from the soil or their growing medium. Agricultural solutions are the other means of reducing micronutrient malnutrition. Agricultural solutions give a way to enhance the micronutrients directly in growing plants that produce the food products. This can be achieved by one of the following ways: fertilization and biofortification.

Enhancement and fortification of foodstuff have been used since decades, for instance, vitamin D added to milk or iodine to salt. Fortified food manufacturing is a long-term strategy that involves high costs to develop and test these food products before launching them in the market. Therefore they are very expensive and unaffordable to the majority of population. Recently, scientists are successfully using process of biofortification for enhancing plant's nutritional properties. This is a relatively new concept, using multiple techniques to increase the nutrient content of the food. Using certain techniques (agronomic, physiological, genetical, breeding, biotechnological, etc.) the plant traits are modified, or the absorption of nutrients from the soil and their accumulation in fruits or seeds is increased. Biofortification should be most beneficial to groups who are vulnerable to deficiencies in micronutrients such as vitamin A, zinc or iron, including children and pregnant and breastfeeding women. Its greatest benefit is in contributing to the prevention of micronutrient deficiencies, rather than treating acute or established deficiencies.

Approaches of biofortification

1. **Agronomic:** Addition of the appropriate nutrient as an inorganic compound to the fertilizer increases the mineral content of the plant as demonstrated successfully in crops like rice, wheat and maize7. However the strategy is difficult to apply generally because of the additional expenses involved and the properties of nutrient and crop

2. **Conventional breeding:** India is one of the mega centres of agro-biodiversity and limited efforts have been made to evaluate the promising germplasm for enhanced nutrients in several crops. With some identified donors for high nutrients, varieties are being developed through conventional breeding by crossing with popular varieties. The breeding lines with adequate amounts of nutrients and promising yield thus developed are evaluated.

3. **Genetic modification technology:** In some cases, genetic variability for desirable target traits for biofortification is not available in the germplasm. Hence, transgenics approach using genetically modified (GM) technology is the only viable option. The methodology involves introduction of genes from novel sources for desirable target traits and has advantages of unlimited access to the genes of interest, targeted expression in tissues of interest, rapid and direct application by introduction into popular varieties and stacking of different genes. Several transgenic experiments in many agricultural crops targeted protein and micronutrient accumulation in target tissues. The popular example is 'Golden Rice' for -carotene. However, limited progress for release has been made so far, mainly due to constraints of intellectual property and regulatory issues.

Even though much development has been made to tackle the malnutrition, the problem of malnutrition seems to be unsettled. Recent estimates suggested that this problem will become more pronounced in the upcoming years. Unfortunately all of our key edible crops are deficient of certain vital micronutrients and vitamins which are crucial for normal growth. Several strategies are there to enhance the quality and quantity of edible crops; among them biofortification seems to be an emerging tool to solve this malnutrition problem by enhancing the concentration of available vitamins and nutrients. This approach owns great promise in achieving improved nutritional status of peoples and should carry on to be explored. Biofortification, therefore, can be a sustainable approach for achieving nutritional security along with dietary diversification, supplementation and commercial fortification strategies.

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