

Chapter 14


Crop Biofortification

Innovative Solutions for Micronutrient Deficiency


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ABSTRACT

Micronutrient deficiency is a significant global health issue that affects nearly half of the world's population, leading to stunted physical and mental development in children and a variety of illnesses. It is particularly prevalent among young girls, women, and pre-school children due to insufficient intake of vitamins and micronutrients. In response to this widespread challenge, biofortification has emerged as a promising and cost-effective approach to increase the essential micronutrient levels in staple crops. The quality and nutrient content of produce can be further improved using micronutrient fertilizers. Developing countries with high rates of malnutrition are increasingly interested in integrated biofortification, which combines modern agricultural practices with genetic enhancements of food crops. As a result, maize, rice, wheat, beans, pearl millet, sweet potato, and cassava have been successfully biofortified with higher levels of iron, zinc, or provitamin A in various developing nations.

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INTRODUCTION

Micronutrient deficiency, often referred to as 'hidden hunger,' occurs when the body lacks essential vitamins and minerals. There are nearly 30 of these vital nutrients that the body cannot produce in sufficient quantities on its own, making it crucial to meet our nutritional needs through diet rather than relying solely on supplements. Despite appearing to consume an adequate amount of food, many individuals suffer from invisible hunger due to the insufficient micronutrient content of staple crops, hindering proper growth and development. Globally, over two billion people are affected by this deficiency, with severe and long-lasting consequences that can span generations. Pregnant women and children under five are particularly vulnerable to negative health impacts resulting from micronutrient deficiency, especially among impoverished communities whose diets consist mainly of inexpensive staple crops lacking in higher-value nutrients. Micronutrient deficiencies often lead to increased mortality and morbidity, placing a significant health burden on affected populations and causing substantial economic costs in the developing world. To address this issue, targeted interventions such as food supplementation, industrial fortification, and nutrition education programs have been implemented. Additionally, biofortification, an agricultural approach involving the breeding of staple food crops with higher micronutrient content has gained much attention as a potential solution. By cultivating and consuming biofortified crops, particularly among disadvantaged communities, there is potential to improve nutritional status, leading to significant health benefits and economic advantages. While the potential benefits of biofortification are evident, the development and release of biofortified crop varieties remain limited. Plant breeders are actively working on these efforts, yet the true impact of biofortification is still uncertain. This article aims to analyze the status of biofortification in various developing countries, exploring its agricultural aspects and potential implications for addressing micronutrient deficiency. Utilising chemical fertilisers has been a long-standing technique that has significantly enhanced agricultural output. But they cause a mineral imbalance inside the soil, which in turn destroys the soil's structure, fertility, and overall ecology. These are major problems that will persist for a long time. To address the issue, it is important to create smart materials that can disperse nutrients to specific locations while also helping to maintain a clean environment. The potential of graphene as a nutrition transporter for plants has been the subject of recent research. It can improve crop yield with little environmental effect by slowly and controlled releasing nutrients to the plants (Kabiri et al., 2017). The total nanotechnology market was worth \$1 trillion in 2015 suggesting that nanotechnology might be the game-changer in this area of agriculture (Zulfiqar et al., 2019). Plants are still people's principal food source, and most of the people's health is dependent on the quality of their diet. Staple foods are those that make up the bulk of a community's typical diet since they are often high-calorie and eaten often. People in rural areas and low-income areas often rely on staple foods as their main source of nourishment because there are few alternative options for them. In these regions, people often eat food that is deficient in important micronutrients. With devastating consequences, they have emerged as a worldwide problem (Burchi et al., 2011). Roughly half of the world's youngsters suffer from vitamin and mineral deficiencies, leaving them susceptible to illness and reducing their cognitive capacity. Inadequate levels of iron and zinc are responsible for a disproportionate number of child deaths and other worldwide health problems (Datta & Vitolins, 2016). Dietary variety, medication, and industrial fortification are some of the hypothesised solutions to nutritional deficits (P. Sharma et al., 2017). On the other hand, due to factors such as the people's economic level, the social content, and some methodological details, Sharma et al. pointed out that these interventions have not been entirely successful (Datta & Vitolins, 2016). Even if it is suggested as a long-term cure, the poor

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