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Biofortification of Rice for Diminishing Malnutrition in the Human Population

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Abstract

More than two-thirds of the world's population consume food that is low in one or more crucial micronutrients. The most prevalent micronutrient deficiencies in staple foods, particularly wheat and rice, are those of iron and zinc, which can cause major issues in people, particularly in pregnant women and small children. More than half of the world's population suffers from iron and zinc deficiency, which impairs growth and development and damages immune systems. These micronutrients are essential for the functional and structural integrity of biological systems in humans. By dietary diversity, food fortification, and biofortification, deficiencies in important nutrients can be treated. By increasing the concentration of micronutrients in edible crops that are available to impoverished people living in distant locations, biofortification, one of these strategies, tries to address micronutrient insufficiency. It tries to use genetic and agronomic methods to increase the nutritional status of cereal's edible sections.

Introduction

A short meal may allay hunger, but there is also a deeper issue of concealed hunger, which is satisfied by food that has been nutritionally enhanced. A balanced diet is a distant ideal for those who live in poverty around the world. Worldwide consumption of a diet high in carbohydrates, such as rice, wheat, and maize, mostly aids in reducing hunger. However, there is still unreported hunger in the world. When the body is depleted of necessary micronutrients, hidden hunger results. It remains undetected and buried, coming to light only when a deficiency's symptoms are identified. At least two billion people worldwide suffer from malnutrition and nutrient deficiencies, primarily in South Asia, Latin America, and

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Africa. Micronutrient malnutrition is a secret epidemic problem. It gradually impairs the immune system, stunts physical and intellectual development, and can even result in death. Iron deficiency and iron deficiency anaemia (IDA), zinc deficiency, and vitamin A deficiency (VAD) are common and have major repercussions when there is a micronutrient shortage. More than 20,000 individuals worldwide pass away every day as a result of concealed hunger and malnutrition. Food must be fortified with various biological and chemical additives, and food processing processes must be changed, to overcome these inadequacies. For populations with limited access to a variety of dietary resources, biofortified staple food crops are a sustainable option.

Rice Biofortification

Rice and other food crops can be enhanced with biofortification to provide more micronutrients. It is also a viable and sustainable method of addressing micronutrient deficiencies in populations that mostly consume rice and have limited access to a variety of foods and high-quality healthcare facilities. Rice biofortification is an international research endeavor for maintaining, enhancing, and adding new micronutrients to rice grain. Below are three major areas where rice biofortification is significant.

Three types of rice:

- High iron content rice,
- High zinc content rice,
- Golden rice

High Iron Content Rice

According to data from the ten most populous Asian nations collected by the WHO Nutrition Landscape Information System (NLIS), Pakistan had the highest percentage of anaemic children (61%) in 2011 and India had the highest percentage of anaemic pregnant women (51.5%) in 2016. In these affected nations, the production of high iron milled rice as part of a biofortification project might be successful in combating IDA.

High Zinc Content Rice

In Bangladesh, where rice alone accounts for 69% of the diet's zinc for women and 49% of the diet's zinc for children, rice is the primary source of zinc consumption. Eight types of rice with zinc biofortification have been accepted by about 1.5 million farming households and are now being grown. IET 23832 (DRR Dhan 45), a biofortified semi-dwarf,

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medium duration (125 days), non-lodging plant type variety, was created by the Indian Institute of Rice Research in Hyderabad. Its polished grain contains 22.6–24.00 ppm of zinc.

- **Golden Rice**

Golden rice is rice that has been biofortified with vitamin A (-carotene). Dietary carotenoids have a number of positive health effects, including a lower risk of cancer and eye illness. Many carotenoids, including -carotene, lycopene, lutein, and zeaxanthin, have been examined for their potential to improve human health, cell differentiation, glycoprotein synthesis, growth, and bone development.

Regulatory Challenges of Biofortified Rice

Because conventional breeding has a very restricted scope, the future of improving rice nutrition mostly hinges on molecular breeding techniques, particularly iron, zinc, and provitamin-A fortification. A screening of more than 20,000 rice types from Asia, Latin America, and the Caribbean turned up no high iron- and zinc-fortified rice (in polished grain), and traditional breeding has so far been ineffective in the generation of high iron polished rice. In comparison to cross-bred cultivars, wild rice varieties including Oryza rufipogon, Oryza nivara, Oryza latifolia, and Oryza Officinalis have more Fe and Zn. However, their poor yield is a significant drawback. More than half of the world's population gets up to 70% of their daily calories from rice, which is a significant source of nutrients. Micronutrient deficiencies are common in impoverished countries' diets, therefore having access to biofortified rice in these situations would be a viable remedy.

Conclusion

Rice is a staple food of Asia and is consumed by half of the world's population. Similar to how malnutrition has become a conscious issue in many developing nations worldwide. The demand for biofortified crops in these nations is currently quite high. Because they contain micronutrient deficiencies and provide assistance in the battle against malnutrition, biofortified crops are extremely beneficial for human health. For biofortification to be successful, it is, therefore, necessary for a variety of stakeholders to work together, including consumers, plant breeders, national governments, multilateral organizations, and researchers. Because of this, biofortified crops need to have characteristics like disease resistance, high-stress tolerance, high yielding capacity, and other crucial elements for plant breeders to accept them. Therefore, efforts should be made to raise public awareness and

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motivate farmers to produce biofortified rice, which can reduce micronutrient deficiencies and improve the nutritional condition of people all over the world.