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Biofortification: Ensuring Nutrient-Rich Food Production

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Abstract

Biofortification usually refers to the enhancement of the nutrient content of crops through advanced breeding techniques. The main aim behind the development of biofortified crops is to retard malnutrition grasping our population. Biofortification is focused on the rural poor population who primarily rely on the local foods as their essential source of nourishment. Several biofortified staple crops such as provitamin A-biofortified sweet potato ('orange sweet potato'), iron-biofortified beans ('iron beans'), and zinc-biofortified rice ('zinc rice') have been introduced into developing countries to reduce micronutrient deficiencies.

Introduction

Energy deficit in developing countries is a common issue and have been witnessed in the past decades. According to the Food and Agriculture Organization (FAO), the prevalence of undernourishment in the global population has declined from 18.6% in 1990–92 to 10.9% in 2014–16, when one in nine people in the world is still suffering from hunger (FAO, 2015). Despite this progress, more than 2 billion people or one in every three globally is suffering from micronutrient deficiency, also known as hidden hunger. The effect of malnutrition is more common in growing kids as compared to adults as their nutrient requirement varies according to growth and developmental phases. Over the last 15 years, another strategy termed biofortification has come into light which is an effective complement to these approaches dealing with micronutrient deficiency and related health problems. Biofortification usually involves breeding staple food crops to increase their micronutrient content, mostly targeting foods widely consumed by low-income families throughout the globe.

Status of Malnutrition in India

About 46.6 million stunted children in India are stunted which is a third of the world's total as per Global Nutrition Report 2018. Nearly half of all under-5 child mortality in India is attributable to undernutrition. As per Global Hunger Index (GHI) 2018, India ranked 103rd among 119 countries while the worldwide level of hunger declines from 29.2 in 2000 to 20.9 in 2018. In India, 43% of children under 5 years are underweight and 48% are stunted, due to severe malnutrition (3 out of every 10 children are stunted). Micronutrient deficiencies result in various health issues like poor neurological function, impaired eyesight, hypertension, weak immunity, food allergies, diabetes, rashes, thinning hair, leaky gut. These deficiencies are mainly due to low intake of quality diet rich with proteins, vitamins and minerals. One of

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the important reasons for decreasing dietary quality is the ever-increasing price of non-staple commodities. In developing countries, agricultural products are the prime source of nutrition. However, the main theme of the green revolution was laid on food security, not on ensuring food quality. So in the battle of enhancing production for an increasing population, somehow we lacked in maintaining the nutrient quality of our produce.

What is Biofortification?

Biofortification is the process by which the nutrient density of food crops is enhanced through conventional plant breeding, or improved agronomic practices and/or modern biotechnology without deteriorating any essential characteristic that is preferred by consumers or peasants (Saltzman *et al.,* 2016). It is regarded as a nutrition-sensitive-agriculture intervention attributed to reducing vitamin and mineral deficiency. Other than quality upgrade, micronutrient provides additional benefits like yield increment, biomass improvement and disease reduction in micronutrient deficit soils. A healthy balanced diet must include protein, vitamin, dietary fibre and minerals in an adequate amount.

Need for Biofortification

Biofortification of staple crops is an effective option to reach large numbers of rural poor scattered across the globe. After the initial outlay of funds, the recurrent costs are minimal. Biofortification of staple crops is a cost-effective method to reach tens of millions of people on a sustainable basis. In the current scenario, numerous biofortified crops *viz*. provitamin A-rich OSP, provitamin A yellow cassava, provitamin A orange maize, iron bean, iron pearl millet, zinc rice and zinc wheat, have been released in more than 30 countries and are being tested and grown in more than 40 countries (Table 1).

Organizations Working for Biofortification

Harvest Plus is the pioneer organization dealing with development and dissemination of quality staple food crops. It is an interdisciplinary program active in over 60 countries and carried out in collaboration with both public and private sectors, researchers and NGOs. It works in collaboration with various other organizations as the International Centre for Tropical Agriculture (CIAT), International Rice Research Institute (IRRI), International Institute for Tropical Agriculture (IITA), National Agricultural Research and Extension Systems (NARES), Consultative Group on International Agriculture Research (CGIAR) and the World Health Organization (WHO) and are devoted to the development of nutritional rich biofortified crops. Collaborative international interdisciplinary efforts are required to solve the problem of malnutrition in developing nations.

Table 1: Few examples of biofortified crops and their respective dates and countries of release

Sl. No.	Crop	Country	First year(s) of release
1	Provitamin A sweet potato	China, Uganda	2001, 2004
2	Provitamin A OSP	Uganda, Mozambique, South Africa	2008, 2011
3	Provitamin A cassava	Nigeria, Democratic Republic of Congo	2008, 2011
4	Provitamin A maize	Zambia, Nigeria, Ghana, China	2012, 2012, 2012, 2015
5	Iron cowpea	India	2008
6	Iron pearl millet	India	2012
7	Zinc rice	Bangladesh	2013
8	Zinc wheat	India	2014
9	Iron beans	Rwanda, Democratic Republic of Congo	2010, 2011
10	Iron and zinc lentils	India, Nepal, Bangladesh	2012, 2013, 2013

Merits

Biofortification is based on the food practices of a poor household. It concerns the most economically poor individuals, living in far off rustic territories with no entrance or cash for monetarily showcased invigorated food sources. Regardless of whether individuals begin considering everything, growers proceed to develop and eat their biofortified crops, presently considered as harvests. It produces more significant returns in a harmless to the ecosystem way. It is the one-time venture to create seeds that invigorate themselves keep intermittent costs low and the germplasm, the living tissue from which the plants can be developed can be shared all around the world, making it exceptionally practical.

Conclusion

As of now, an immediate pathway towards better nourishment is expected to create impressive financial advantages. There is a desperate need to guarantee food security, guaranteeing nourishing promotion and reacting to dietary suggestions. Hence, diverse plans ought to be carried out to address the issue of malnutrition in a synchronized way. The constant weight of lack of healthy sustenance ought to

be submitted to serious examination by devoted researchers from numerous disciplines. Biofortification is an enduring and self-supporting method. Biofortification can be regarded as a sustainable approach to upgrade the nutritional profile of food crops. This practice has gained widespread importance and has been included in many breeding programs in the past decade. The key micronutrients targeted have been, zinc, iron, iodine, selenium, carotenoids, and folates. So, in a nutshell it can be stated that biofortification seems to emerge as a powerful technique to check malnutrition and hidden hunger in targeted populations. Along these lines, indeed, we can reason that we can take care of the world through biofortification and tomorrow we can envision a world liberated from hidden hunger.

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