

# Biofortification of millets

## a sustainable approach to combat malnutrition

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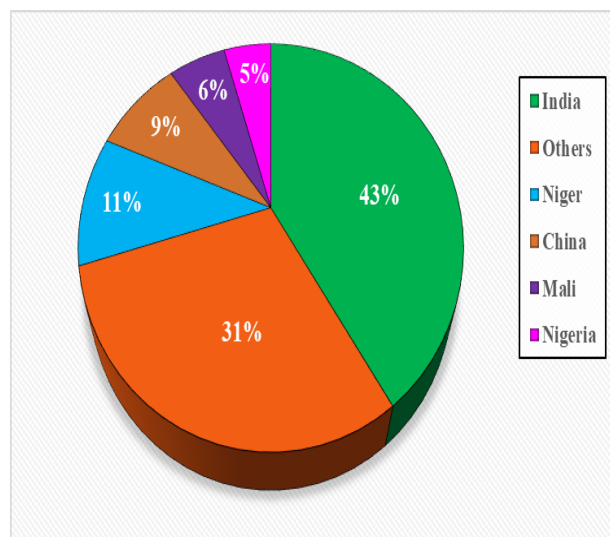
### Introduction

According to the 2024 Global Hunger Index, India placed at 105<sup>th</sup> position out of 127 nations which shows how country is facing food insecurity and malnutrition. Malnutrition is one of the major health problems faced by about 16 percent of population in India. Supplementation of nutrients can be done by various ways but adding nutrition directly to plate can be made

possible only by biofortification of food crops. Among various food crops millets which are popularly known as Nutri-cereals are great source of nutrients help in supply of various nutrients and minerals. Biofortification of these millets further enhance their nutritional status and these can serve as major weapon to combat malnutrition.

### The Nutritional Powerhouse: Millets

Millets which are popularly called as power house of nutrition not only supply high amount of nutrients and minerals but also having high tolerance and resistance to harsh environmental conditions hence, there cultivation is spread over arid and semi-arid regions. Millets are rich source of calcium, iron, zinc, phosphorus and vitamins (thiamine, niacin and riboflavin) hence it is considered as perfect energy food. Africa and Asia are major regions for millets cultivation. Global millet production is about 28.4 million metric tons with India is having a major contribution followed by Niger, China, Mali and Nigeria as shown in fig.1. Millets are basically small grain crops belong to poaceae family with several types are pearl millet, finger millet, kodo millet, barnyard millet, little millet, proso millet and foxtail millet.



**Fig. 1 Global status of millets production**

## Biofortification

Biofortification refers to a process of enhancing bio available concentration of essential elements in edible parts of plants by either through genetic selection or agronomic practices. This help in lowering malnutrition by enhancing nutrients and minerals content in grains or other edible parts which are consumed in diet. Biofortification is one of the efficient and sustainable solution to address the problem of malnutrition by supplying various nutrients and minerals such as zinc, iron and vitamin A. As millets are rich in several nutrients and minerals however their bioavailability lacks behind. Hence there is need to further enhance the nutritional bioavailability of millets by biofortification which gives more perks.

### Approaches of biofortification

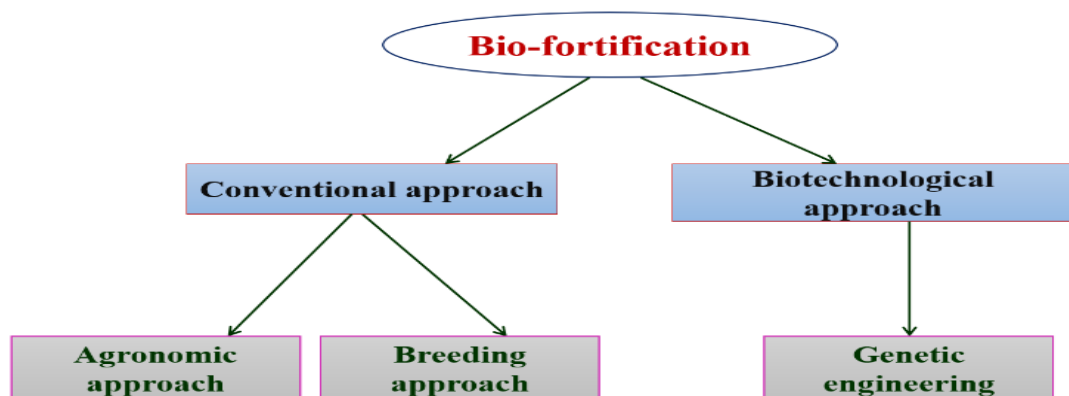
Biofortification can be carried out by several methods which include agronomic approach, conventional breeding and genetic engineering technology.

**1. Agronomic approach:** it is the method by which nutrient status is increased by applying micronutrient enriched fertilizers to the crop. Soil applied nutrients are absorbed by the plants

which ultimately enhance the nutrient content in edible portion of plant. Similarly foliar spraying and seed priming of nutrients can also help in doing same job. It is the easy method which can be practised but may require additional expenditure.

**2. Conventional breeding:** traditional plant breeding methods are used to develop new varieties by crossing between nutrient rich and high yielding ones. This may be time consuming but having high acceptance among the people. Adaptation by farmers is also high as it is one time investment.

**3. Genetic engineering:** method of introducing genes of interest from novel sources for desirable target traits into popular varieties which ultimately help in promoting nutritional value of the produce. It is rapid and has freehand to select genes of interest and introduce to targeted tissues. Well known example is golden rice which is rich in vitamin A ( $\beta$ -carotene). However, there are some issues in release due to controversial opinions regarding their effect on human health and environment.



**Fig. 2 Approaches of biofortification**

**Biofortification** in whole has many benefits to combat malnutrition in developing countries and help in achieving nutritional security through sustainable approach. Various advantages of biofortification are:

- Overall increase in nutritional and mineral status of millets which ultimately help in providing adequate amount of nutrition to children and women through diet.
- It is single time investment as developed seeds can be used repeatedly.
- Biofortified millets will be sustainable way of providing required nutrition to the people of developing countries.
- Increase production and demand of millets ultimately rise of income of farmers producing millets in arid and semi-arid regions.

## Challenges

Lack of awareness among the farmers regarding biofortified varieties and their benefits. The nutritional benefits of biofortified products are not fully comprehended by the consumers. There is a need to study the nutritional impact of biofortified produce so that value will be

recognised. In case of GM technology major constrain is cost to develop fortified crops and their regulatory compliances. Integration of policies such as mid-day meals with biofortified grains help in promoting children health and popularize the products.

## Conclusion

One of the main issues with global health is malnutrition where millets serve as one stop solution to all problems. Millets which are gaining huge importance due to their nutritional value, with biofortification their significance is enhanced. Biofortification of millets is highly sustainable, cost-effective and long-term solution to strongly fight against malnutrition

and hidden hunger in developing nations. However, there are some challenges such as limited awareness, policy makers support and costly in adaptation of biofortified millets. All this constrains can be overcome by making awareness among the people about the importance and benefits of biofortified millets.

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