

## Biofortification [UPSC Notes for Agriculture]

Biofortification is a term commonly read in the newspapers and is claimed as the phenomenon that will help solve the country's hidden hunger problem. In this article, you can read the important facts about biofortification, which is a part of the [UPSC syllabus](#) under agriculture, economy, etc.

### What is Biofortification?

Biofortification is the process by which the nutritional value of food crops is enhanced by various methods including plant breeding, agronomic practices and modern biotechnological techniques.

- Basically, biofortification is the process of growing crops to increase nutrition value from the seed on.
- **It is different from food fortification** which involves improving the nutritional content of food crops during the processing stage.
- In biofortification, the nutritional value of crops is improved during the plant growth stage, i.e., nutritional micronutrient content is embedded in the crop being grown.
- Crops can be biofortified through selective breeding or genetic engineering. In India, biofortification is done exclusively through selective breeding.
- The focus of biofortification research is iron, zinc and vitamin A deficiencies. These are the micronutrients whose deficiencies affect the most number of people worldwide.
  - In India, the focus is on pearl millet (iron), wheat (zinc), sorghum (iron), rice (zinc), cowpeas (iron) and lentils (iron and zinc).
- Currently, biofortified pearl millet, rice, and wheat are available to farmers in India.

### Techniques of Biofortification

The major techniques or methods by which crops can be biofortified are mentioned below.

1. **Agronomic practices:** This involves the application of fertilizers to increase the quantity of micronutrients in plants grown in soil conditions that are poor in such micronutrients/minerals.
2. **Conventional plant breeding:** This involves traditional breeding methods by which sufficient genetic variations are produced for the desired trait in crops such as high content of any micronutrient. It involves crossing varieties over many generations to ultimately yield a plant with high nutrient content along with other favourable traits. This is the only method used in India for producing biofortified crops.
3. **Genetic engineering/modification:** This involves inserting DNA into the genome of an organism to introduce new or different characteristics such as being resistant to any disease.

### Biofortification Examples

The following are some common examples of biofortification of food crops:

1. Iron biofortification - Rice, sweet potato, beans, legumes, cassava
2. Zinc biofortification - Rice, wheat, sweet potato, maize, beans
3. Provitamin A carotenoid biofortification - Cassava, maize, sweet potato
4. Amino acid and protein biofortification - Cassava, sorghum

## Benefits of Biofortification

The Green Revolution and related movements in India were focussed on eradicating hunger from the country. As a result of the [Green Revolution](#), the country has increased the production of food grains and is largely self-sufficient. There are various schemes and measures undertaken by the government to ensure that the population gets enough food intake in terms of the calorific value.

However, the current focus is on increasing the nutrient content of the food intake. Despite having 'enough to eat', many people are not getting enough nutrients in their food intake. This causes the problem of 'hidden hunger'.

**Hidden hunger is the term used to describe the deficiency of micronutrients such as zinc and iron.**

According to many researchers, hidden hunger can be solved by biofortifying food crops.

- Biofortification helps in achieving overall health improvement in the people.
- Such crops are more resilient to diseases, pests, droughts, etc. and provide better yields.
- It offers a food-based, sustainable and low-dose alternative to iron supplements.
- It has the potential to reach the poorest section of society (who cannot afford food supplements) and will also benefit farmers.
- It is highly cost-effective since once the initial research is done, the process can be easily replicated and scaled.
- Biofortification done through non-genetically modified methods (like traditional plant breeding done in India) is a better alternative than introducing GM crops that face implementation barriers.
- In a country such as India, that faces huge nutritional challenges, biofortification is a sustainable, cost-effective method that can help resolve this challenge.
  - Various studies and reports show that India faces a huge challenge in the form of undernutrition.
  - Anaemia and iron deficiency are problems pervading society especially the economically weaker sections and women.

## Biofortification Challenges

Some of the challenges faced in biofortification and introducing biofortified food grains as part of the daily diet in India are discussed below.

- Due to the colour changes in the grain, people hesitate to accept biofortified food as in the case of golden rice.
- Farmers also should adopt this on a large scale.
- The initial costs also could be a barrier for people to implement.

## Way Forward

The huge variations in the dietary habits of Indians across geographical regions mean that biofortification should be catered to the local needs of the population.

---