

Biofortification

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Source: *The Hindu*

Manifest pedagogy: Food fortification and biofortification are novel biotechnology solutions to fight India's hidden hunger. If implemented across the country proactively, the child health indicators in specific and all social indicators in general will improve. The food processing and the agricultural research have to get impetus in this regard. The new fortified and biofortified products are important for Prelims. The concept and the positive effects are important for Mains.

In news: A biofortified carrot variety has been benefitting local farmers in Junagadh, Gujarat since 2017.

Placing it in syllabus: Biotechnology

Static dimensions:

- What is fortification?
- Biofortification

Current dimensions:

- Benefits of biofortification
- Current examples

Content:

What is fortification?

- Fortification is the **addition of key vitamins and minerals** such as Iron, Iodine, Zinc, Vitamins A & D **to staple foods** such as rice, wheat, oil, milk and salt to improve their nutritional content.
- These **nutrients may or may not have been originally present** in the food before processing or may have been lost during processing.

- **Micronutrient malnutrition, also known as hidden hunger,** is a serious health risk.
- Sometimes due to **lack of consumption of a balanced diet, lack of variety in the diet or unavailability of food** one does not get adequate micronutrients.
- Hence fortification of food is a safe method of improving nutrition among people as the **addition of micronutrients to food does not pose a health risk** to people.
- **It does not alter the characteristics of the food like the taste, aroma or the texture of the food.**

According to the **National Family Health Survey (NFHS-4)**

- 58.4 percent of children (6-59 months) are anaemic.
- 53.1 percent of women in the reproductive age group are anaemic.
- 35.7 percent of children under 5 are underweight.

In August, 2018, FSSAI introduced the **Food Safety and Standards (Fortification of Foods) Regulations, 2018,** to regulate the provisions regarding fortified food.

Features:

- It **prescribes the standards of addition of micronutrients** for the purpose of food fortification. The manufacturers of the fortified food have to provide a quality assurance undertaking.
- **Packaging and labelling has to state the food fortificant added, +F logo and the tagline "Sampoorna Poshan Swasth Jeevan".**
- It should be in **compliance to** the Food Safety and Standards (Packaging and Labeling) Regulations, 2011.

Fortified salt: In 1950, Indians were among the first countries in Asia to implement mandatory salt iodisation. It is fortified with Iodine.

Fortified wheat: The flour is fortified with iron, vitamin A and folic acid.

Fortified rice: Iron, Folic Acid, Vitamin B12.

Fortified milk: Studies suggest the intake of fortified milk by children not only increased mean serum vitamin D levels but also decreased morbidity rates. It is fortified with Vitamin A, Vitamin D.

Fortified oil: Is fortified with vitamin A and D.

Biofortification:

- Biofortification is the process by which the **nutritional quality of food crops is improved through agronomic practices, conventional plant breeding or modern biotechnology.**
- Biofortification differs from conventional fortification in that biofortification **aims to increase nutrient levels in crops during plant growth** rather than through manual means during processing of the crops.

Plants are bred using any of the below methods:

Selective breeding: Using this method, plant breeders search existing varieties of crops which are naturally high in nutrients and then crossbreed these high-nutrient varieties with high-yielding varieties of crops, to provide a seed with high yields and increased nutritional value. This method is prevalent at present, as it is less controversial than genetically engineering crops.

Genetic modification: Golden Rice is an example of a GM crop developed using genetic modification. It contains genes from a common soil bacterium *Erwinia* and contains increased levels of beta-carotene which can be converted by the body into vitamin A.



Seed Priming: Seed priming before sowing maximizes the natural potential of seed to set the plant for maximum yield potential with respect to both quality and quantity. Positive effects on the shoot and root growth of seedlings of wheat can be observed when treated with iron-oxide nanoparticles.

Benefits of biofortification: Increasing the micronutrient levels in staple crops can help **prevent and reduce the micronutrient deficiencies in the poor**. E.g. In a trial in Mozambique, eating **sweet potatoes biofortified with beta-carotene** reduced the incidence of vitamin A deficiency in children by 24%.

It **reaches the country's most vulnerable people living in remote rural areas** with no access or money for commercially marketed fortified foods.

It is cost effective after an initial large research investment. The **recurrent costs are low and the germ plasm can be shared globally** making it highly cost-effective.

Biofortification is sustainable. It **produces higher yields** in an environmentally friendly way.

Current examples:

Rice: *CR Dhan 310, DRR Dhan 45* which contain high protein and high zinc in polished grain.

Wheat: *WB 02, HPBW 01, Pusa Tejas (HI 8759), Pusa Ujala (HI 1605), MACS 4028 (d)* which are rich in zinc and iron.

Other biofortified crops are **maize** (which possess high provitamin-A, tryptophan and lysine), **Pearl millet, Mustard** (contains low erucic acid), **Soybeans, Sweet potato** which contains high β -carotene, **Pomegranate** which contains high iron, zinc and vitamin C.

Recent one:

- **Vallabhbhai Vasrambhai Marvaniya**, a farmer scientist from **Gujarat** has developed **Madhuban Gajar**, a biofortified carrot variety with **high β -carotene and iron content**. (He has been conferred with a National Award by the President of India during Festival of Innovation (FOIN) in 2017 and was also conferred with Padma Shri in 2019 for his extraordinary work in this field).
- Madhuban Gajar has been **cultivated in** over 1000 hectares of land in *Gujarat, Maharashtra, West Bengal, Rajasthan and Uttar Pradesh*.
- It is used for several value-added products like carrot chips, juices, and pickles.
- It possesses a significantly higher root yield and high plant biomass.
- It has been **tested by National Innovation Foundation (NIF) of India**, an autonomous institute under the Department of Science and Technology during 2016-17.

Mould your thought: What is bio fortification? What are its benefits?