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# Biofortification of Horticultural Crops in Bharat

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The process of adding nutritional value to the crop is called biofortification. In this process, the nutritional value of crops is increased by changing the genetic structure of the plants, as a result of which the crop becomes healthy and nutritious. Biofortification is different from ordinary fortification, as it makes crops more nutritious. Biofortified technology increases the nutritional value of crops. Biofortification can provide practical means to the undernourished rural population, who have limited sources of food and supplements.

**Keywords:** Biofortification, malnutrition, nutritional value

Biofortification is considered to be the best way against the problem of malnutrition spread on a large scale across the world. Due to malnutrition, not only the poor and those who eat inadequate food but also those who consume better diet have poor health. This hinders their physical development. In this way, bio-fortification can be an effective way to deal with the widespread 'hidden hunger' in India and other developing countries. Biofortification can produce micronutrient-rich horticultural crops for years to come, so the basic objective of biofortification is to reduce the rate of micronutrient-related malnutrition, mortality and diseases, and to make food security, productivity and quality of life healthier for poor populations in developing countries. In the future, increasing the production of micronutrient-rich foods and improving dietary diversity can overcome micronutrient deficiencies. No single process can overcome micronutrient deficiencies, whereas biofortification is a good supplement in the current conditions (Kumar *et al*., 2023).

## Mainly three methods of biofortification

**1. Agronomic Method:** Crop biofortification is an easy way to increase nutrients in the parts used in plant feeding. In some countries, the amount of selenium in wheat is improved by the use of selenium-containing fertilizers. In addition, many researchers have focused on biofortification. The amount of these minerals has been found to be limited in some plant-based diets.

**2. Selection/ conventional breeding:** Selection breeding is a traditional method. It requires crops that naturally have high nutritional value. Such crops are hybridized with high-yielding stable varieties. This process can enhance the effectiveness of biofortification by assessing how the desired micronutrients are affected by storage, processing and cooking at the genetic level in crops.

**3. Genetic modification/ Transgenic method:** In this, you can modify the genome of your desired crop by taking genes from the nearest parent. They can increase the production of elements in the desired crop and make it some nutrient rich. Alternatively different genes, which code for different nutrients, can also be used in stack/ pyramid in a crop. High provitamin A and iron-rich cassava is example of transgenic method.

## Objective of biofortification

Biofortification works on practical ways to improve public health by breeding crops with higher quantities of vitamins and minerals, or higher levels of protein and healthier fats. The objectives of breeding for better nutritional quality are to increase the following-

- Quantity and quality of protein
- The content of vitamins
- Micronutrients and minerals content

## Varieties of biofortified Horticultural crops (Devendra *et al.*, 2020)

**1. Pomegranate: Solapur Lal**

- Rich in iron (5.6-6.1 mg/100g), zinc (0.64-0.69 mg/100g) and vitamin-C (19.4-19.8 mg/100 g) in fresh arils in comparison to 2.7-3.2 mg/ 100g iron, 0.50-0.54 mg/100g zinc and 14.2-14.6 mg/100g vitamin-C in popular variety 'Ganesh'.
- Fruit yield: 23.0-27.0 t/ha
- Adaptation: Semi-arid regions of the country
- Developed by: ICAR-National Research Centre on Pomegranate, Pune

**2. Cauliflower: Pusa Beta Kesari 1**

- Bharat's first provitamin-A rich cauliflower
- Rich in provitamin-A (8.0-10.0 ppm) in comparison to negligible content in popular varieties
- Curd yield: 40.0-50.0 t/ha
- Adaptation: Nation Capital Region of Delhi
- Developed by: ICAR-Indian Agricultural Research Institute, New Delhi

**3. Potato: Kufri Manik**

- Rich in anthocyanin (0.68 ppm) in comparison to negligible content in popular varieties
- High in antioxidants
- Tuber yield: 23.0 t/ha
- Maturity: 90-100 days
- Adaptation: Punjab, Eastern Uttar Pradesh, Bihar, West Bengal and Assam
- Developed by: ICAR-Central Potato Research Institute, Shimla

**4. Potato: Kufri Neelkanth**

- Rich in anthocyanin (1.0 ppm) in comparison to negligible content in popular varieties
- High in antioxidants
- Tuber yield: 36-38 t/ha
- Maturity: 90-100 days
- Adaptation: Punjab, Haryana and Uttar Pradesh
- Developed by: ICAR-Central Potato Research Institute, Shimla

Source: www.indiapost.com


Source: www.researchgate.net

**5. Sweet Potato: Bhu Sona**

- Rich in provitamin-A (14.0 mg/100g) in comparison to 2.0-3.0 mg/100g in popular varieties
- Tuber yield: 19.8 t/ha
- Dry matter: 27.0-29.0 %
- Starch: 20.0 %
- Total sugar: 2.0-2.4 %
- Adaptation: Odisha
- Developed by: ICAR-Central Tuber Crops Research Institute, Thiruvananthapuram

**6. Sweet Potato: Bhu Krishna**

- Rich in anthocyanin (90.0 mg/100g) in comparison to negligible amount in popular varieties
- Tuber yield: 18.0 t/ha
- Dry matter: 24.0-25.5%
- Starch: 19.5 %
- Total sugar: 1.9-2.2 %
- Salinity stress tolerant
- Adaptation: Odisha
- Developed by: ICAR-Central Tuber Crops Research Institute, Thiruvananthapuram


**Source:** www.researchgate.net

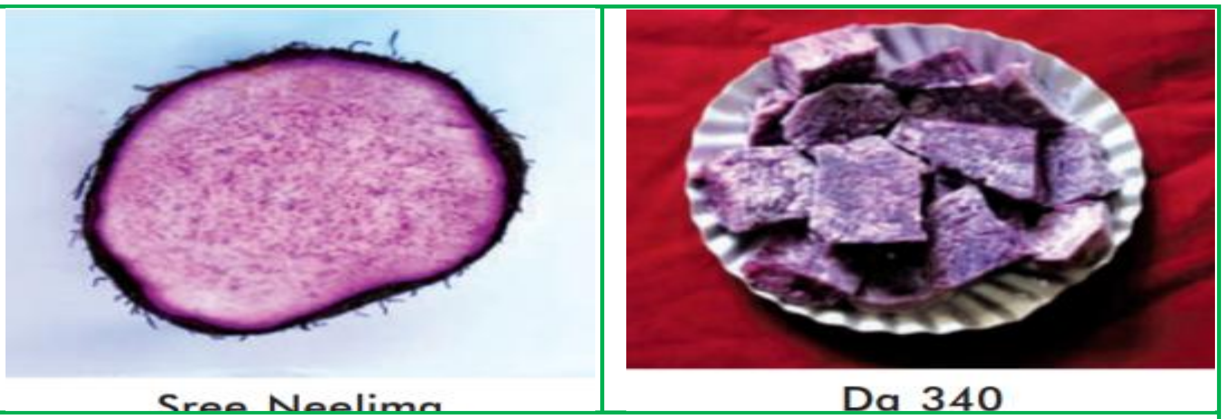
**7. Greater Yam: Sree Neelima**

- Rich in anthocyanin (50.0 mg/100g), crude protein (15.4 %) and zinc (49.8 ppm) in comparison to negligible anthocyanin, 2.7 % crude protein and 22-32 ppm zinc in popular varieties
- Tuber yield: 35.0 t/ha
- Maturity: 240-270 days
- Adaptation: Kerala
- Developed by: ICAR-Central Tuber Crops Research Institute, Thiruvananthapuram

**8. Greater Yam: Da 340**

- Rich in anthocyanin (141.4 mg/100g), iron (136.2 ppm) and calcium (1890 ppm) in comparison to negligible anthocyanin, 70-120 ppm iron and 800-1200 ppm calcium in popular varieties
- Tuber yield: 80.0 t/ha

- Maturity: 240-270 days
- Adaptation area: Kerala
- Developed by: ICAR-Central Tuber Crops Research Institute, Thiruvananthapuram




**Source:** (Singh *et al.*, 2022)

## Summary

Biofortification is evidence-based sustainable and cost-effective approach to address malnutrition through the development, release, and adoption of yield-competitive horticultural crop varieties possessing additional micronutrient content. We recognize that biofortification and other interventions are complementary strategies. However, biofortification is particularly advantageous where households consume large amounts of food staples often poor in micronutrients and are most vulnerable to hidden hunger.

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