



Biofortified Sweet Potato: Nature's Answer to Malnutrition

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Malnutrition remains a critical challenge in India, particularly among children, pregnant women, and marginalized rural populations. Despite the country's strides in agricultural production and food security, hidden hunger the chronic lack of essential micronutrients continues to affect millions. Among these micronutrient deficiencies, vitamin A deficiency (VAD) is one of the most widespread and dangerous, impairing immune systems, reducing vision and cognitive development, and increasing the risk of child mortality. The National Family Health Survey (NFHS-5) data indicates that a significant percentage of children under five suffer from vitamin A deficiency-related symptoms, especially in low-income and tribal regions. VAD affects an estimated 190 million preschool-aged children globally, and over 40% of Indian children are estimated to be at risk (WHO, 2009). Addressing this widespread deficiency requires not just treatment but preventive, food-based strategies that are sustainable, affordable, and culturally acceptable. One such approach is biofortification enhancing the nutritional value of crops through conventional plant breeding. The orange-fleshed sweet potato (OFSP), biofortified with beta-carotene, is emerging as a scientifically proven, field-tested, and farmer-friendly solution to tackle VAD. Unlike synthetic supplements or industrial fortification (which often miss the rural poor), biofortified crops like OFSP deliver essential nutrients directly through everyday diets. Rich in beta-carotene (a natural precursor of vitamin A), OFSP provides an excellent source of pro-vitamin A, especially for children and women. Just 100 grams of cooked OFSP can meet more than 100% of the daily vitamin A requirement of a child (Low *et al.*, 2007). Additionally, OFSP is adaptable to a wide range of agro-climatic conditions, matures in a short duration (90–120 days), and thrives in rainfed and marginal soils making it a suitable crop for small and marginal farmers across India. Thus, the orange-fleshed biofortified sweet potato is not just a crop it is a nutritional intervention. It serves as "nature's answer to malnutrition", combining health benefits with economic potential, while empowering both farmers and communities. This article discusses the relevance, adoption, and potential of biofortified sweet potato in India's ongoing fight against hidden hunger.

Why Biofortified Sweet Potato

Rich in Beta-Carotene (Vitamin A): Orange-fleshed sweet potatoes contain up to 10,000 µg/100g of beta-carotene, which can meet more than 100% of the daily vitamin A requirement of children and women (Low *et al.*, 2007).

Climate Resilient & Farmer-Friendly: Sweet potato is a hardy crop that requires low inputs, matures within 90–120 days, and can be grown even on marginal lands. This makes it ideal for rainfed and tribal areas.

Economically Beneficial: Biofortified varieties offer good yields (15–25 t/ha), have high market value, and provide income to small and marginal farmers.

Versatile in Diets: Sweet potatoes can be boiled, roasted, fried, used in bakery products, or processed into value-added items like chips, flakes, flour, and baby food.

Promising Biofortified Sweet Potato Varieties in India

Variety Name	Beta-Carotene (mg/100g)	Yield (t/ha)	Region/State	Remarks
Bhu Sona	9-10	20–28	Odisha, East & NE	High beta-carotene
Sree Kanaka	10-12	22–27	All-India (testing)	Very high beta-carotene
Bhu Krishna	(Anthocyanin rich) 90-100	20–24	Odisha, West Bengal	Purple-fleshed, antioxidant-rich

ICAR-CTCRI (2023)

Impact of Biofortified Sweet Potato on Nutrition and Health

Biofortified sweet potato, especially orange-fleshed sweet potato (OFSP), has emerged as one of the most effective and field-tested food-based solutions for combating vitamin A deficiency (VAD), particularly in low-income and nutritionally vulnerable populations. Unlike synthetic supplements or industrial fortification programs which often fail to reach rural or tribal households biofortified sweet potato delivers nutrition directly through regular dietary intake, making it both accessible and sustainable. Its consumption has shown proven health benefits across different age and gender groups.

1. Improves Vitamin A Status in Children

Vitamin A is critical for child growth, immune response, and visual health. Several studies have demonstrated that daily consumption of OFSP significantly improves serum retinol levels, thereby reducing the risks of:

- Night blindness (xerophthalmia)
- Recurrent infections (like diarrhea and measles)
- Growth faltering and stunting

Low et al. (2007) conducted a landmark study in Mozambique which showed that introducing OFSP into children's diets raised vitamin A intake by 42% and improved serum retinol concentrations by 15% within 5 months.

Just 100 grams of cooked OFSP can supply over 100% of the recommended daily allowance (RDA) of vitamin A for children aged 3–5 years.

2. Supports Maternal and Family Nutrition

In rural India, pregnant and lactating women often suffer from multiple micronutrient deficiencies, including vitamin A. Incorporating OFSP into household diets can help improve:

- Maternal health during pregnancy
- Lactation outcomes (higher quality of breast milk)
- Postpartum recovery
- General dietary diversity of the household

Hagenimana et al. (1999) found that in Western Kenya, women's knowledge and regular use of OFSP led to improved feeding practices and reduced prevalence of clinical VAD symptoms in young children.

3. Integrates Easily into Diets and Public Programs

OFSP can be boiled, mashed, steamed, or incorporated into:

- Mid-Day Meals (for school children)
- ICDS Anganwadi feeding programs
- Hospital diets and nutritional rehabilitation centres

Because of its naturally sweet taste and soft texture, OFSP is especially suitable for young children and elderly individuals. When processed into purees, chips, or flour.

Government & Global Support for Biofortified Sweet Potato

The promotion and adoption of biofortified sweet potato (especially orange-fleshed varieties) is not just a scientific innovation it is part of a broader national and international movement to tackle hidden hunger and improve public health through nutrition-sensitive agriculture.

Government of India Initiatives

1. POSHAN Abhiyaan (National Nutrition Mission)

Launched in 2018, POSHAN Abhiyaan is India's flagship program to reduce malnutrition in a mission mode. It emphasizes the importance of diet diversity, micronutrient intake, and local food solutions.

- Biofortified crops, including OFSP, are promoted through Anganwadi Centres, Village Health & Nutrition Days, and IEC (Information, Education & Communication) campaigns.
- States like Odisha, Karnataka, and Maharashtra have piloted the use of biofortified sweet potato in school meals and ICDS feeding programs.

2. Mid-Day Meal Scheme (PM POSHAN)

The government encourages the integration of locally available, nutritious crops like OFSP into school feeding programs. This provides pro-vitamin A to children while promoting local agriculture.

3. ICAR-AICRP on Tuber Crops

The Indian Council of Agricultural Research (ICAR) supports the development and field testing of biofortified sweet potato through the All India Coordinated Research Project (AICRP) on Tuber Crops.

- Varieties like **Bhu Sona**, **ST-14**, and **Sree Kanaka** have been developed and tested in multiple agro-climatic zones.
- Frontline demonstrations, farmer training, and nutrition awareness are carried out through **Krishi Vigyan Kendras (KVKs)** and State Agricultural Universities.

4. National Biofortification Program (under ICAR & MoA&FW)

Recognizes biofortified crops as a strategic tool in combating micronutrient malnutrition. Sweet potato is listed among the key crops promoted for vitamin A delivery.

Conclusion

Biofortified sweet potato, especially orange-fleshed varieties, offers a simple, natural, and effective solution to combat vitamin A deficiency and improve public health. Rich in beta-carotene, adaptable to diverse climates, and easy to grow, it supports both nutrition security and rural livelihoods. With strong backing from research institutions, government programs, and global partners, biofortified sweet potato is becoming a key tool in the fight against hidden hunger. Scaling its adoption through awareness, seed availability, and market support can help build a healthier and self-reliant India.

“A humble root crop, yet a powerful ally against malnutrition”.

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