

## Tropical Tuber Crops: Future Foods for Nutrition, Health and Wellness

Transitioning from the 'food of the poor' to globally recognized future-smart foods, tropical tuber crops (TTCs) like cassava, sweet potato, and yams are reshaping Indian horticulture. Contributing over ₹130 billion annually, these climate-resilient powerhouses secure the livelihoods of 200 million people, including vital tribal and marginal farming communities. Breakthrough biofortified varieties such as beta-carotene-rich *Bhu Sona* and antioxidant-heavy *Bhu Krishna* are tackling hidden hunger head-on. By merging low-input, drought-tolerant cultivation with advanced processing for gluten-free, low-glycemic, and industrial bioeconomic applications, TTCs offer an indispensable blueprint for sustainable national health and climate-resilient agricultural growth.

**Keywords:** Cultivation practices; Mulching; Protected cultivation; Strawberry; Yield

Tropical tuber crops (TTCs) such as cassava, sweet potato, yams, elephant foot yam, taro and other aroids and a few other minor tubers have nourished millions of people across Asia, Africa and Latin America for centuries. Once regarded merely as 'food of the poor', these crops are now increasingly recognized as 'future-smart foods' because of their climate resilience, nutritional richness and immense potential for health-promoting food products. At a time when the world is grappling with climate change, food insecurity, hidden hunger and lifestyle diseases,

tropical tuber crops are emerging as strategic crops for nutrition, health and sustainable agriculture.

**Tropical tuber crops in India: Importance and future prospects:** India cultivates tropical tuber crops in about 0.4 million hectares with an annual production of nearly 10 million tonnes and a market value exceeding ₹130 billion. Cassava, sweet potato elephant foot yam and yams are among the important carbohydrate-rich food crops of the country, supporting the food and livelihood security of nearly 200 million people, particularly smallholders,



Tropical Tuber Crops



tribal communities and marginal farmers. Globally too, cassava ranks among the five most important energy foods, underlining the strategic importance of tropical tubers in ensuring future food and nutritional security.

Tropical tuber crops are highly productive and resilient under adverse conditions. They thrive under marginal soils, tolerate drought and erratic rainfall, and produce substantial quantities of food with relatively low external inputs. Cassava, for instance, is highly efficient in converting solar energy and nutrients into energy-rich food. These crops are therefore increasingly viewed as climate-resilient alternatives to conventional cereals, especially under changing climatic scenarios. Their adaptability to diverse agro-ecological conditions also makes them ideal candidates for sustainable and low-input farming systems.



*Bhu Sona*, an orange fleshed sweet potato



*SP-95/4*, a promising orange fleshed sweet potato



*Bhu Krishna*, purple fleshed sweet potato



*Bhu Arunima*, purple fleshed sweet potato



'*ICAR-CTCRI Jamuni*', recently commercialised purple taro line



East Indian Arrowroot, Dongria Kondh Tribe, Niyamgiri hills, Odisha

**Nutritional richness, nutraceutical value and health benefits:** Apart from being excellent sources of energy, tropical tuber crops possess remarkable nutritional attributes. They are rich in carbohydrates, dietary fibre, vitamins, minerals and several bioactive compounds that contribute to better health and well-being. Sweet potato, particularly the orange-fleshed varieties, is an excellent source of  $\beta$ -carotene, a precursor of vitamin A. Vitamin A deficiency remains a major public health concern in many developing countries, especially among children and pregnant women. Promotion of orange-fleshed sweet potato can therefore significantly contribute towards combating hidden hunger and improving nutritional security.

Purple-fleshed sweet potato varieties contain anthocyanins, natural pigments known for their strong antioxidant properties. Anthocyanins help reduce oxidative stress, inflammation and cellular damage, thereby lowering the risk of chronic diseases such as cancer, cardiovascular disorders and diabetes. These varieties are increasingly attracting global attention as nutraceutical foods and natural sources of health-promoting compounds.

Cassava, though traditionally known as an energy food, is now recognized for its industrial and functional food potential. Cassava starch is highly digestible and widely used in food, pharmaceutical and industrial sectors. Resistant starch fractions present in cassava are particularly important because they function as prebiotics, improving gut health and supporting beneficial intestinal microorganisms. Resistant starch also helps regulate blood glucose levels, improves insulin sensitivity and contributes to better colon health.

Elephant foot yam is another highly nutritious tropical tuber crop that is gaining popularity as a functional food. It is rich in dietary fibre, potassium and several phenolic compounds. Consumption of elephant foot yam has been associated with improved digestive health, reduced cholesterol levels and better metabolic functions. Its low glycaemic index and high fibre content make it suitable for health-conscious consumers and diabetic patients.

Yams are rich in carbohydrates, minerals and bioactive compounds such as diosgenin, which possesses antioxidant, anti-inflammatory and therapeutic properties. Certain yam species are traditionally valued in indigenous medicine systems for their role in improving immunity and general health. Similarly, taro contains easily digestible starch with small granule size, making it suitable for infants, elderly people and individuals with digestive disorders. Taro is also a good source of potassium, magnesium and mucilage compounds beneficial for gut health.

Modern nutrition science increasingly recognizes tropical tuber crops as nutraceutical foods because they provide both nourishment and health protection. Their nutraceutical value arises from the presence of bioactive compounds such as carotenoids, anthocyanins, flavonoids, resistant starch, dietary fibre and polyphenols. These compounds contribute to lowering cholesterol, reducing oxidative stress, strengthening immunity and minimizing the risk of lifestyle diseases such as obesity, diabetes and cardiovascular disorders.

### ***Biofortified varieties and value-added products:***

Recognizing the growing importance of nutrition-sensitive agriculture, ICAR-Central Tuber Crops Research Institute (ICAR-CTCRI) have developed several biofortified and climate-resilient varieties of tropical tuber crops. Important achievements include  $\beta$ -carotene-rich sweet potato varieties, anthocyanin-rich purple sweet potatoes, drought-tolerant cassava genotypes and nutrient-efficient varieties suitable for sustainable farming systems. Such varieties not only improve productivity and resilience but also help address micronutrient deficiencies.

Biofortification has immense relevance in India where deficiencies of vitamin A, iron and zinc continue to affect large sections of the population. Inclusion of biofortified sweet potato and yams in programmes such as PM-POSHAN, Integrated Child Development Services (ICDS) and other nutritional interventions can substantially improve dietary quality among vulnerable populations. Climate-resilient and nutrient-rich tuber crops can therefore play a major role in future nutrition and public health strategies.

Another major strength of tropical tuber crops lies in their enormous potential for value addition and processing. ICAR-CTCRI has developed a wide range of technologies for producing snack foods, pasta, noodles, bakery products, nutribars, instant mixes, resistant starch, biodegradable packaging materials and functional foods from tropical tubers. These technologies are creating new opportunities for entrepreneurship, rural industrialization and employment generation.

Consumer demand for gluten-free, high-fibre and low glycaemic foods is steadily increasing across the world. Tropical tuber crops are naturally suited for the preparation of such products. Cassava flour and starch are increasingly used in gluten-free foods. Purple sweet potato-based beverages and bakery products are gaining popularity because of their antioxidant properties. Vacuum-fried chips, resistant starch formulations, health snacks and nutraceutical powders prepared from tuber crops are also emerging as important health-oriented products.

The industrial importance of tropical tuber crops is equally significant. Cassava starch finds application in textiles, paper, pharmaceuticals, adhesives, biodegradable plastics and bioethanol industries. The growing demand for eco-friendly and biodegradable materials is expected to further increase the relevance of tuber crops in the bioeconomy and circular economy sectors.

The future prospects of tropical tuber crops are therefore enormous. Climate change, increasing health consciousness, diversification of food habits and expansion of functional food markets are likely to drive their demand in the coming decades. Tropical tuber crops can contribute simultaneously to food security, nutritional security, climate resilience, sustainable livelihoods and industrial development.

Recognizing the strategic importance of these crops, a proposal for a 'National Mission on Tropical Tuber Crops (NMTC)' has been suggested to mainstream tropical tubers into India's food, nutrition and climate agendas. The proposed mission envisages strengthening certified



Value added commercialised food products from orange and purple fleshed sweet potato



'Tapioca Murukku', commercialised in K-Innam brand of Government of Kerala



'Taro chips', commercialised in K-Innam brand of Government of Kerala



'Tapioca Murukku', commercialised in K-Innam brand of Government of Kerala

seed systems, promoting decentralized processing units, supporting FPO-led value chains, encouraging biofortified varieties, integrating tuber crops into nutrition programmes and expanding entrepreneurship opportunities for rural youth and women. The mission also aims to link tropical tuber crops with schemes such as MIDH, PM-FME and PM-POSHAN so as to improve farmer income, reduce post-harvest losses and create sustainable livelihoods while enhancing nutritional security.

However, realizing the full potential of these crops requires focused efforts in research, policy support and value-chain development. Expansion of quality planting material production, strengthening seed systems, promotion of biofortified varieties, development of processing industries, market linkages and consumer awareness are essential for accelerating growth in the sector. Greater integration of tropical tuber crops into public nutrition programmes, school feeding systems and health-oriented food policies will also help mainstream these crops into India's food and nutrition agenda.

### **SUMMARY**

Over the past six decades, India has transformed tropical tuber crops from underutilized staples into scientifically advanced, nutritionally important and



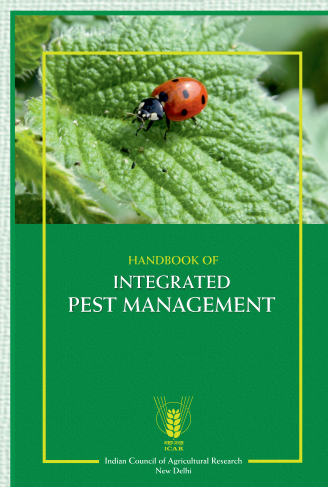
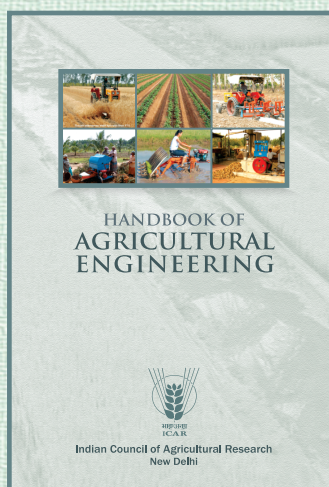
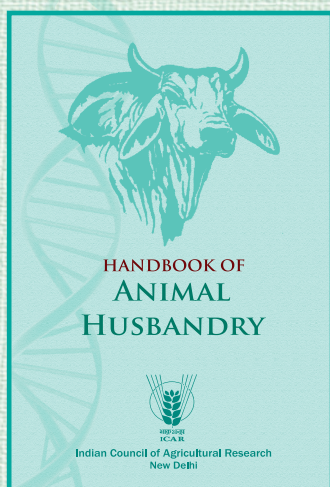
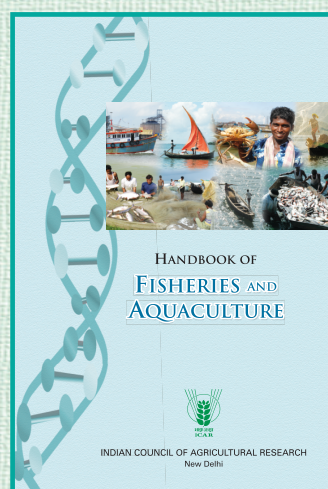
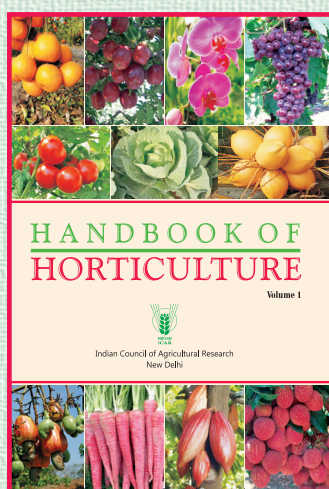
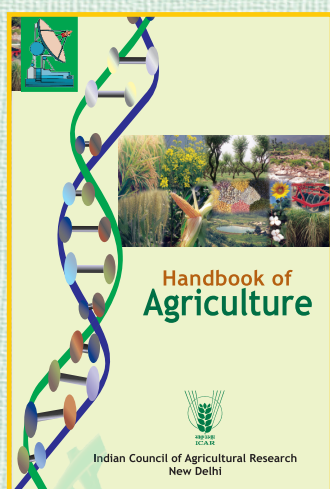
economically valuable crops. Continued investments in science, innovation and entrepreneurship can further position tropical tuber crops as pillars of sustainable agriculture and healthy diets. In the years ahead, tropical tuber crops are poised to emerge not merely as alternative staples but as ‘super foods’ for the tropics – nourishing people, supporting farmers, promoting wellness and

strengthening climate-resilient agriculture in an era of unprecedented global challenges.

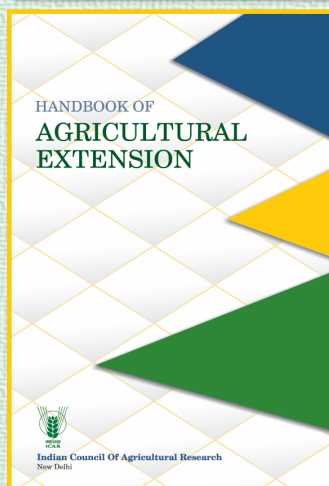
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