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Tuber crop diversity among tribal communities

Tribal communities in India cultivate and conserve a wide diversity of tropical tuber crops, which form the backbone of their food and livelihood systems. These crops include greater yam, cassava, sweet potato, aerial yam, taro, elephant foot yam, yam bean, and arrowroot, which are maintained not only in homesteads but also in jhum fields, thereby ensuring the conservation of local landraces. Local landraces are highly adaptable and climate resilient. Odisha leads the country in sweet potato area and production, with tribal farmers in districts such as Koraput, Kandhamal, and Rayagada, etc. Similarly, aerial yam is widely cultivated in the Eastern and Western Ghats, while elephant foot yam and taro are common across tribal belts of Andhra Pradesh, Jharkhand, Chhattisgarh, Kerala, and the North Eastern states. Yam bean and arrowroot are minor tuber crops patronized by tribal communities for food, nutrition traditional folk medicines. Naturally biofortified types are available in case of crops such as sweet potato, yams, and taro, etc. Thus, the conservation and diversified cultivation of tuber crops by tribal communities ensure food and nutritional security and the conservation of valuable genetic resources.

Keywords: Crop diversification, Food and nutritional security, ICAR-CTCRI, Indigenous knowledge, Tribal agriculture

TRIBALS in India lives in inaccessible remote areas of hills and plateau. They depend on monsoon crops and forest collections. However, a wide range of cereals, millet, tubers, pulses, oilseed and vegetable crops can be seen in tribal areas. Introducing crop and enterprise diversification provides greater stability, fulfills the varied requirements of farm families, particularly in tribal communities, acts as a safeguard against crop and market uncertainties, and enhances soil sustainability, making it more beneficial than mono-cropping systems in tribal regions.

TROPICAL TUBER CROPS

Tropical tuber crops rank next in importance to cereals and grain legumes as staple food sources. They serve multiple purposes, including human consumption, medicinal applications, livestock feed, and as raw materials for starch-based industries. The major tropical tuber crops cultivated include cassava, sweet potato, elephant foot yam, taro, *bunda*, swamp taro, *tannia*, lesser yam, greater yam, white yam, aerial yam, yam bean, Chinese potato, and arrowroot, among others.

Tropical tuber crops are excellent sources of energy and carbohydrates, while also supplying a range of other essential nutrients. They exhibit diverse growth habits, tolerate both drought and waterlogging, and have variable crop durations. Although naturally perennial, they are domesticated and cultivated as annual or seasonal crops, enabling staggered harvesting to meet household consumption and market demands.

These crops offer remarkable flexibility in planting and can be easily integrated into various cropping and farming systems. This adaptability is due to their vegetative propagation methods, such as the use of stems, vines, or tuber cuttings. Since the economic parts are swollen roots or modified stems, photoperiod has no significant effect on yield-forming factors. Thus, tropical tuber crops are both thermo- and photo-insensitive. However, extreme temperatures–either high or low–can adversely affect their growth and yield.

Tropical tuber crops perform well in marginal soils with minimal inputs, where most other crops fail to thrive. They are highly resilient to drought and establish quickly, providing extensive ground cover that helps prevent soil erosion. They produce more dry matter per unit area and per unit time than cereals and are among the most efficient crops in converting solar energy. For instance, cassava produces about 250×10^3 kcal/ha and sweet potato about 240×10^3 kcal/ha, in contrast to rice (76×10^3 kcal/ha), wheat (110×10^3 kcal/ha), and maize (200×10^3 kcal/ha). This efficiency makes tropical tuber crops ideal candidates for crop diversification programs.

Their adaptability in mixed cropping systems creates additional opportunities for employment and income generation. Yams and elephant foot yam, for

example, are widely cultivated as intercrops in horticultural and plantation systems. Moreover, as studied by the author in 2021 and 2022, these crops efficiently utilize available resources such as residual moisture and partial sunlight.

Nutritionally, tropical tuber crops are rich sources of minerals and vitamins. Many minor tubers are traditionally used in medicine for treating conditions such as piles, diarrhoea, vomiting, rheumatism, headaches, epilepsy, leprosy, ulcers, jaundice, and dysentery. They also serve as laxatives, galactagogues, stimulants, tonics, carminatives, and expectorants. Notably, the root decoction of *Ipomoea carnea* is known to help reduce blood pressure.

Odisha tribal farmer with sweet potato

Sweet potato

Sweet potato is widely cultivated across tropical, subtropical, and warmer temperate regions. In India, it is grown in all states. In Odisha's tribal districts, such as Koraput, Rayagada, Kandhamal, and Mayurbhanj, a rich agro-biodiversity of tuber crops is maintained through generations, with numerous diverse landraces. Odisha ranks first in both area and production of sweet potato, as it is a vital crop for tribal communities in Koraput, Rayagada, Ganjam, Gajapati, Kandhamal, Sundargarh, Keonjhar, Mayurbhanj, Bolangir, Nuapada, Bargarh, Dhenkanal, Deogarh, and Nabarangpur.

Sweet potato is also widely grown in tribal areas of Chhattisgarh, Jharkhand, West Bengal, Andhra Pradesh, Kerala, Karnataka, Telangana, and Tamil Nadu, as well as in the northeastern states.

Sweet potato roots and foliage are highly nutritious and play a crucial role in addressing nutritional deficiencies in many developing regions. The roots are primarily consumed after boiling, frying, steaming, or baking, and are also processed into value-added products such as noodles, liquid glucose, sorbitol, mannitol, yogurt, wine, and ethanol.

In addition to being a good energy source, the roots are rich in water-soluble vitamins including ascorbic acid, thiamine, riboflavin, and niacin, along with relatively high levels of pyridoxine, folic acid, and pantothenic acid. The leaves and tender tips are excellent sources of ascorbic acid and B vitamins, particularly riboflavin, which is often lacking in Asian diets.

Orange-fleshed sweet potato varieties are especially valued for their β-carotene content, containing up to the 14 mg per 100 g of fresh tuber, according to the authors finding in 2012. The Regional Centre of ICAR-CTCRI, Bhubaneswar, has also developed *'Bhu Krishna'*, a purple-fleshed variety rich in anthocyanins (85 mg/100 g fresh tuber). Additionally, green tops and unmarketable tubers are used as livestock feed, while the foliage is an excellent resource for hay making.

Cassava

Cassava is a starchy root crop, widely recognised as tapioca, and is recognized for producing high calorie yield per unit area. It holds major importance in South India, particularly in Tamil Nadu, Kerala, and Andhra Pradesh, and is gradually expanding to Western (Maharashtra), Eastern (Odisha), and North-Eastern states (Assam, Meghalaya, and Tripura). In tribal regions of these states, cassava often serves as a secondary staple food. Being a long-duration crop, it is commonly cultivated in districts such as Koraput, Rayagada, and Gajapati in Odisha where monsoon rain is for 4 months (June-September) and residual moisture is available for 2 months (October-November) due to cyclonic depression. Usually, it is grown as sole crop. Maize and pigeonpea can also be intercropped with cassava for higher returns and soil health.

Cassava tubers are utilized primarily as human food after boiling, frying, baking or steaming. Cassava is an important industrial crop, with its starch serving as a raw material for the production of liquid glucose, dextrin, high fructose syrup, monosodium glutamate, alcohol, and even biodegradable plastics. It is also widely used in the textile industry for warping and in the manufacture of plywood. Cassava produces abundant foliage, capable of yielding up to 5 tonnes of crude protein per hectare annually. Both leaves and tubers are valuable components of animal feed and are extensively utilized in rations for cattle, poultry, and swine. The green foliage is also suitable for silage making, while culled tubers and thippi (starch extraction residue) are commonly used as livestock feed as well as fuel in starch-processing industries.

Greater yam

Greater yam is cultivated widely across the tropics and subtropics, thriving in regions with adequate rainfall. In India, it is commonly grown in homestead gardens in almost all states and is especially prevalent in tribal areas. Commercial cultivation is concentrated in specific regions of Andhra Pradesh, Bihar, Gujarat, Kerala, Odisha, Madhya Pradesh, Tamil Nadu, and Rajasthan. The tubers are typically consumed after boiling, baking, or frying, while the crop also contains tannins, alkaloids, and steroids, which possess pharmaceutical significance.

Aerial yam

Aerial yam is one of the important tuber crops grown

in tribal areas of eastern Ghats in Odisha, Chhattisgarh and Jharkhand as well as western Ghats in Karnataka, Maharashtra and Goa. In Maharashtra, more specifically Konkan region, it is grown and consumed to a large extent. The soil and climatic condition of these regions are suitable for aerial yam. This crop has also potential for growing in eastern part of Sahyadri ranges, including eastern part of Nandurbar, Dhule, Nasik, Ahmadnagar, Pune, Satara and Kolhapur. This crop is already grown in eastern Vidarbha region (Gadchiroli, Bhandara, Chandrapur, Gondia and some part of Satpura hills) of Maharashtra.

Aerial yam is one of the yam species producing aerial tubers, which is modification of auxillary buds into bulbils. Their aerial bulbs as well as subterranean tubers are edible. The carbohydrate rich aerial bulbs are consumed after boiling, baking, roasting and frying as a vegetable in India. Aerial yam is the only starchy tuber available for consumption to those who do not eat underground root and tubers. Aerial yam offers a variety of health benefits due to their rich nutrient content. They are a good source of fiber, vitamins, and minerals, and can contribute to improved digestion, blood sugar regulation, and potentially even reduced inflammation. It has been used as a folk remedy to treat conjunctivitis, diarrhoea, and dysentery, among other ailments.

Meghalaya tribal farmer with colocasia

Andhra Pradesh tribal farmer with yam

Elephant foot yam

Elephant foot yam, also known as *Suran* or *Jimmikand*, is cultivated for its edible corms in India, the Philippines, and Malaysia. It is increasingly popular due to its high yield potential and diverse culinary applications. In India, cultivation is widespread across Andhra Pradesh, Bihar, Maharashtra, Gujarat, Tamil Nadu, Kerala, the North-Eastern states, Odisha, Uttar Pradesh, and West Bengal. The starchy corms are rich in dietary fibre, ash, and essential minerals such as potassium, calcium, phosphorus, and zinc, along with vitamins. They are consumed as vegetables after boiling, baking, or frying, while the young leaves are eaten as a cooked-green. Beyond their nutritional value, elephant foot yam corms are used in traditional medicine for treating piles, dysentery, asthma, pulmonary swelling, vomiting, abdominal pain, and as a blood purifier. Additionally, corm paste is applied externally to relieve arthritic pain.

Taro

Taro is one of the most important oldest crops. Taro otherwise known as cocoyam is grown throughout the tropical and sub-tropical countries. Taro is commonly cultivated across India, with two main types: the eddoe type, popularly known as *arvi*, and the dasheen type, referred to as *bunda*. The eddoe type is more widely consumed as a vegetable. While taro is grown in almost all states, commercial cultivation is concentrated in Andhra Pradesh, Tamil Nadu, Kerala, Odisha, Uttar Pradesh, Maharashtra, and Gujarat. The tubers are eaten after boiling and seasoning and are also processed into chips and starch. Taro starch has industrial applications, including its use in talc formulations along with kaolin. In addition, young leaves and petioles are consumed as leafy vegetables, while culled tubers serve as animal feed, particularly for pigs.

Yam bean

Yam bean, commonly known as potato bean, is cultivated in several parts of India where it is referred to as '*Mishrikkand*' in Bihar, '*Kesaru*' in Eastern Uttar Pradesh, and '*Sank alu*' in Odisha, West Bengal, and Assam. The crop produces starchy, conical, or turnip-shaped fleshy tubers that are consumed for their sweet taste, which is due to their high sugar content. Fresh tubers are eaten raw as salads or processed into chips. Young tubers are particularly valued for their crisp, juicy, and refreshing flesh, whereas over-matured tubers become fibrous and unsuitable for consumption.

Arrowroot

Arrowroot is cultivated throughout India primarily for starch extraction. In Odisha, where it is locally known as *Palua*, three distinct types of arrowroot are grown exclusively for this purpose:

- West Indian arrowroot (*Maranta arundinacea*)
- East Indian arrowroot (*Curcuma* spp.)
- Queensland arrowroot (*Canna edulis*)

DIVERSITY OF TUBER CROPS IN TRIBAL COMMUNITIES

Tribal communities contribute significantly for conservation and diversification of tuber crops. In case of North eastern India, in general, tribal communities in Meghalaya and neighbouring states maintain diverse landraces of aroids (*Colocasia, Xanthosoma, Alocasia*) under both *jhum* (shifting cultivation) and backyard farming. Specific landraces are used for different purposes: *Tasakrek* is a low-oxalate type preferred as baby food, while *Tamachongkham* is acrid but widely grown and consumed with meat. Coming down to central India, tribals utilize different species of wild edible tubers such as *Dioscorea* spp., *Curcuma* spp., and *Colocasia esculenta*. These serve as staple foods, famine reserves, and medicines. For instance, *Dioscorea* species are consumed, used as fish poison, and in traditional healing. Ethnobotanical knowledge of Bastar tribals highlights the use of *Curcuma angustifolia* for starch preparation (*sherbet*, *halwa*, *barfi*) and *Amorphophallus paeoniifolius* as a vegetable, contributing to dietary diversity and resilience against food insecurity. Root and tuber crops such as sweet potato, cassava, taro, yam, yam bean, and arrowroot are grown by tribals, in eastern India. In Odisha alone, sweet potato covers 43,460 ha. Under the Tribal Sub Plan (TSP), improved varieties (e.g., yam 'Orissa Elite', taro '*Muktakeshi*', yam bean 'RM-1') were introduced, leading to higher yields and farm income. The Kanikkar tribes of the Southern Western Ghats classify and utilize wild *Dioscorea* species (e.g., *D. wallichii*, *D. pubera*, *D. tomentosa*). They distinguish them by morphology and use them for food, medicine, and even antidotes for insect bites. While some species like *D. oppositifolia* (*Kavalakizhangu*) are considered delicacies, others like *D. hispida* are toxic but used with detoxification methods. This shows their indigenous knowledge system in managing crop diversity.

CONCLUSION

A wide variety of tropical tuber crops are seen in tribal areas and these crops are most suitable for crop diversification in both upland and low land ecosystem. One of the most remarkable features of tropical tuber crops is their flexibility in planting and harvesting, allowing them to fit well into diverse cropping and farming systems. These crops provide reliable yields even under adverse conditions such as drought and floods, as their economic parts are formed underground through vegetative growth. Their productivity is significantly higher than that of cereals and pulses, thereby contributing to higher farm income. Research has shown that tuber crop-based integrated farming systems can enhance farmers' earnings by two- to threefold. In addition to being rich in carbohydrates, tropical tuber crops supply essential vitamins and minerals, ensuring both food and nutritional security. Under changing climatic scenarios, they hold a unique position in crop diversification strategies aimed at doubling farmers' income.

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World Soil Day

World Soil Day is celebrated every year on 5 December, to raise awareness about the vital role of healthy soil in sustaining life, ensuring food security, and supporting ecosystems. The 2025 theme, **"Healthy Soils for Healthy Cities,"** focuses on urban soils and the challenges of soil sealing, emphasizing the importance of sustainable soil management in building resilient cities, preserving biodiversity, and securing food for the future. Led by the Food and Agriculture Organization (FAO), the day calls on everyone to take action to protect and restore soil health worldwide.