

# Tropical Root and Tuber Crops

## Treasures from the Soil

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**T**HE lush green plant canopy covering the earth is a fascinating feast for the eyes, making our planet more beautiful and inhabitable by giving oxygen we breathe. Leaves are the plant factories that synthesise food by photosynthesis. But have you ever wondered about the enchanting underground world of plants, especially the roots, hidden below the soil?

Plants need roots to anchor and absorb water and nutrients from the soil, and nitrogen fixation in legumes through a symbiotic association of *Rhizobium* bacteria in roots. The food synthesised in leaves is stored in the seeds (cereals), stem (sugarcane) or roots of some plants, which humans and animals consume. We commonly refer to the root storage organs as tubers, although roots and tubers are different biologically. Roots are low in dry matter and proteins when compared to tubers and primarily contain sugars, while tubers are underground stems that store starch.

According to the Food and Agriculture Organisation, Rome, 'roots and tubers' are plants yielding starchy roots, tubers, corms and stems and exclude crops that are cultivated mainly for feed or processing into sugar (sugar beets) and those classified as 'roots, bulb and tuberous vegetables' such as onions, garlic and beets (FAOSTAT, 2022). Potatoes are stem tubers, while cassava, sweet potato, carrot, radish, horseradish, beetroot, and turnip are root tubers or edible root vegetables. Ginger and turmeric are rhizomes categorised under spices and condiments. Most root and tuber crops are cultivated in the world's warm tropical and sub-tropical

regions (near the equator) and hence referred to as tropical root and tuber crops. However, potatoes, carrots, radishes, etc., are grown in cooler climates of temperate regions.

### Tropical Root and Tuber Crops

Tropical root and tuber crops are major sources of carbohydrates or staple food next to cereals in sustaining food security and as income sources in resource-poor countries of the tropical region. They are alternate crops and emergency foods that can ensure food security in global climate change, population explosion, and dwindling cultivable land area. A few domesticated crops cannot meet these grave challenges. The major tropical root and tuber crops are Cassava or tapioca, sweet potato, yams and aroids. These crops are climate-resilient and survive under marginal and extreme environmental conditions such as drought, high-temperature stress, soils of low fertility, etc.

Tuber crops have high biological efficiency (250 kcal/ha/day) and most efficiently convert solar energy to produce the highest dry matter rate per unit area in a day. They have high yield potential, lower incidence of insect pests and diseases, and commercial and industrial uses. The high starch content (15–35%) and excellent physicochemical and biochemical properties are advantageous in preparing several value-added products. They also produce bioactive compounds of medicinal and pharmaceutical value. Ethnic tribes also cultivate minor tuber crops for their food, feed and medicinal value. Roots and tubers buried inside the soil are thus rightly reckoned as the 'hidden (or buried) treasures from the soil' considering their importance in the global economy.

Among the tropical root and tuber crops, cassava and sweet potato are most important globally and in India. In addition, yellow Guinea yam (*Dioscorea cayenensis*), Aerial or Potato yam (*Dioscorea bulbifera* L.), Bitter yam (*Dioscorea dumetorum*), Asiatic bitter yam or intoxicating yam (*Dioscorea hispida*), Sand or Ginger or Fibrous yam (*Dioscorea pentaphylla*), Chinese yam (*Dioscorea opposita*), Cush-cush yam (*Dioscorea trifida*), *Cyrtosperma merkussi*, Indian swamp taro (*Colocasia stoloniferum* (L.) Schott), minor crops such as Winged bean (*Psophocarpus tetragonolobus* (L.) Walp.), *Vigna capensis* (L.) Walp., *Typhonium spp.*, *Costus speciosus* (Koeng) Sm., *Curcuma spp.*, Ethiopian potato (*Plectranthus edulis* (Vatke) Agnew), Palmyra palm (*Borassus flabellifer* L.), Jerusalem artichoke (*Helianthus tuberosus*), Lotus (*Nelumbo nucifera* Gaertner), Chinese water chestnut (*Eleocharis dulcis*), etc. are also cultivated for tubers, but few are mostly restricted to tribal belts.

Tropical root and tuber crops belong to diverse families such as Euphorbiaceae, Convolvulaceae, Dioscoreaceae, Leguminosae, Cucurbitaceae, Marantaceae, Araceae, etc., and are diverse in habitat. Cassava can be grown in dry laterite soils, while taro can grow in swampy or marshy waterlogged soils or lowlands and is shade-tolerant. Sweet potatoes and yams are vines with twining or trailing stems on the ground and require support for growth. Cassava, sweet potato, yam bean, tuber cowpea, spine gourd, etc., are dicots, while