

Underexploited vegetables of Eastern and North-Eastern India: A treasure of nutritional compounds

Underutilized vegetable crops are those that are not widely cultivated compared to major vegetable crops. Many of these crops are region-specific, particularly in the Eastern and Northeastern states of India. The term “underutilized” is relative: a vegetable that is common in one area may be considered underutilized in another. Various parts of these vegetables are rich in essential minerals, vitamins, phytopigments, and antioxidants, which can help prevent lifestyle-related chronic diseases. Increasing awareness about the edible parts and nutritional properties of these vegetables can aid in their popularization and conservation, contributing to nutritional security and enhancing farm profitability through crop diversification.

Keywords: Biodiversity conservation, Eastern and North-Eastern India, Food and nutritional security, Underutilized vegetables, Nutritional compounds

VEGETABLES are plant parts consumed fresh, cooked, or as salads. They may be vegetative, such as roots, stems, leaves, bulbs, or tubers, or reproductive, like flowers and fruits. Vegetables are rich in nutrients, including vitamins and minerals, which are essential for the proper functioning of the body and mind. Due to their high nutritional value, they are often regarded as 'health capsules or protective foods'. The Indian Council of Medical Research (ICMR) recommends consuming 125 g of green leafy vegetables, 100 g of roots and tubers, and 75 g of other vegetables per capita per day.

India's vast and growing population often faces critical shortages of nutritious food, and inadequate dietary intake of essential nutrients leads to malnutrition, especially among infants and children under five years of age. Underutilized vegetable crops often play a crucial role in subsistence farming for economically vulnerable populations, as they are easy to cultivate, require low input costs, and can help combat hunger and malnutrition.

These crops are not only rich in carbohydrates, proteins, vitamins, and minerals but also contain valuable phytonutrients, secondary metabolites, and pigments essential for overall human health. Many of these vegetables remain unfamiliar to consumers and are not widely known. Enhancing the nutritional quality of diets can be achieved by developing resilient varieties of underutilized crops that can withstand the challenges of climate change. Promoting their cultivation and consumption, along with raising awareness of their nutritional benefits among farmers and consumers, will contribute to sustainable agricultural practices and

improved food and nutrition security.

Overview of underutilized vegetables

Underutilized vegetables (also referred to as Ancient, minor, orphan, local, unexploited, neglected, wild, or underdeveloped crops) are those that are localized to specific regions, cultural practices, religious beliefs, health traditions, or social exchanges, and are not widely cultivated commercially. Despite their limited cultivation, these crops have immense potential for expansion beyond their current areas of growth and consumption. They are often termed 'minor vegetables' due to their smaller area under cultivation compared to mainstream crops.

The Indian subcontinent, recognized by N.I. Vavilov as one of the most diversified centers of origin, is home to over 1,800 plant species, including 160 domesticated species of economic importance and 920 wild species, with many still undocumented. Several underutilized vegetables continue to be grown traditionally in their centers of origin using conventional methods.

In India, the Eastern states (Bihar, Jharkhand, West Bengal, Odisha, Chhattisgarh) and the North-Eastern 'Seven sister' states (Assam, Arunachal Pradesh, Meghalaya, Nagaland, Manipur, Mizoram, Tripura) offer varied agro-climatic conditions, making them biodiversity hotspots for underexploited vegetables. Most farmers in these regions are smallholders with limited purchasing power, and these crops are commonly grown in homestead or kitchen gardens, making them inexpensive and readily accessible. Consequently, these vegetables are integral to the culture and diets of diverse ethnic communities.

Significant genetic diversity exists among several crops in these regions, including:

- **Cucurbits:** *Cucurbita ficifolia* (fig-leaf gourd), *Cucumis callosus* (bitter cucumber/kachri), *Cucumis melo* var. *momordica* (snap melon/phoot), *Momordica dioica* (spine gourd), *Momordica cochinchinensis* (sweet gourd), *Sechium edule* (chow chow)
- **Solanaceae:** *Cyphomandra betacea* (tree tomato), *Solanum torvum* (turkey berry), *Solanum macrocarpon* (African eggplant), *Solanum khasianum* (medicinal solanum), *Solanum sisymbriifolium* (litchi tomato/sticky nightshade), *Solanum gilo* (scarlet eggplant/bitter brinjal)
- **Amaranths:** *Amaranthus viridis*, *Amaranthus spinosus*, *Amaranthus dubius*, *Amaranthus hypochondriacus*
- **Legumes:** *Sesbania grandiflora* (agathi), *Vigna umbellata* (rice bean), *Canavalia gladiata* (sword bean), *Canavalia ensiformis* (jack bean), *Psophocarpus tetragonolobus* (winged bean), *Vicia faba* (broad bean), *Parkia roxburghii* (tree bean)
- **Others:** *Allium tuberosum* (garlic chive)

These landraces require proper characterization, conservation, and deployment in resistance breeding programs to improve related major crops, enhance resistance to abiotic and biotic stresses, and ensure their continued use as nutritious vegetables.

Nutritional and medicinal properties

Underutilized vegetables offer a valuable opportunity to enhance agricultural resilience, address nutritional deficiencies, and support sustainable food systems. These crops are well-adapted to local environments, often thriving under adverse conditions, and possess inherent resistance to pests and pathogens, making their expanded cultivation both feasible and essential.

Key examples and benefits

- **Makhana (*Euryale ferox*)** : Seeds are rich in calcium, iron, potassium, magnesium, bioavailable proteins, and fatty acids. High levels of gallic acid, ellagic acid, and epicatechin confer antioxidant properties, helping prevent gout, inflammatory bowel disease, and rheumatoid arthritis.
- **Winged bean (*Psophocarpus tetragonolobus*):** All plant parts are protein-rich, with vitamins A,

B1–B3, B6, B9, C, and E, and minerals like iron, calcium, phosphorus, potassium, zinc, and copper. Polyphenols and flavonoids contribute antioxidant and antimicrobial properties. Traditionally used to treat gastric ulcers, smallpox, and inflammation.

- **Agathi (*Sesbania grandiflora*):** Nutritious leaves and flowers traditionally used for type-II diabetes, microbial infections, fever, inflammation, diarrhea, dyspepsia, and ulcers.
- **Longevity spinach (*Gynura procumbens*):** Contains flavonoids, terpenoids, and saponins. Used for viral infections, diabetes, hypertension, inflammation, and cancer prevention.
- **Bitter brinjal (*Solanum gilo*):** Rich in potassium, magnesium, dietary fiber, and vitamins B6 and K. Traditionally used for constipation, ulcers, and skin infections.
- **Tree tomato/Tamarillo (*Cyphomandra betacea*):** Fruits contain vitamins C and E with antioxidant, neuroprotective, anti-inflammatory, and anticancer properties. Supports metabolism, heart health, and cognitive function.
- **Poi/Indian spinach (*Basella spp.*):** Rich in vitamin A and dietary fiber. Used as a laxative, particularly for children and pregnant women, and for fever, skin diseases, and sexual weakness.
- **Bitter cucumber/Kachri (*Cucumis callosus*):** Fruits contain phenolic compounds with antioxidant and anticancer potential. Used in traditional medicine for kidney stones, urethral infections, diabetes, diarrhea, and gut health.
- **Yams (*Dioscorea spp.*) and *Solanum khasianum*:** Contain diosgenin and are used by tribal communities as a natural contraceptive alternative.
- **Other notable species:** *Moringa oleifera*, *Coleus forskohlii*, *Canna indica*, *Nelumbo nucifera*, among others, have traditional medicinal uses and remain largely underexplored, offering research opportunities.
- Advances in genetics, molecular biology, marker-assisted selection, and genome editing can enable precise trait improvement, supporting the development of biofortified varieties and expanding the nutritional and medicinal potential of these underutilized vegetables.

Key Nutritional values of underutilized vegetables of Eastern and North-Eastern India

Common Name(s)	Scientific name	Family	Edible part(s)	Nutritionally rich in
Sabungai/Longevity Spinach	<i>Gynura procumbens</i>	Asteraceae	Tender leaves	Antioxidants, flavonoids, phenolic acids, vitamins A, C, and K, dietary fiber
Paco Vegetable Fern/ Fiddlehead Fern/Dhekia Sag	<i>Diplazium esculentum</i>	Athyriaceae	Tender leaves	β-carotene, folic acids and minerals like calcium, iron and phosphorus
Chayote/Chow Chow	<i>Sechium edule</i>	Cucurbitaceae	Tender fruits, stems and leaves	Dietary fibre, vitamins C and B ₉ , quercetin, kaempferol
Michinga leaves/Sichuan	<i>Zanthoxylum rhetsa</i>	Rutaceae	Leaves	Flavonoids, terpenoids and coumarins
Fish mint/Fish leaf/ Rainbow plant	<i>Houttuynia cordata</i>	Saururaceae	Leaves	Amino acids, essential oils, carbohydrates, polyphenols, lipids, and flavonoids

Contd.

Common Name(s)	Scientific name	Family	Edible part(s)	Nutritionally rich in
Roselle	<i>Hibiscus sabdariffa</i>	Malvaceae	Foliage and flower buds	Citric, malic, and tartaric acids and β -carotene
Red amaranthus/Laal saag/ Chauli	<i>Amaranthus gangeticus</i>	Amaranthaceae	Red foliage and seeds	Folic acid, vitamins A, C and K, sodium and potassium, antioxidants
Jute mallow/Nalita jute/ Paat sag	<i>Corchorus olitorius</i>	Malvaceae	Tender leaves	Vitamin A, potassium, iron, copper, manganese and zinc
Cilantro/Pahadi dhaniya	<i>Eryngium foetidum</i>	Apiaceae	Tender leaves	Antioxidants, vitamins A, B ₉ , C and K
Taro/Elephant ear/ Kochhu saag	<i>Colocasia esculenta</i>	Araceae	Tubers, tender leaves and stems	Dietary fiber, vitamins A, B complex and C and minerals like calcium, potassium, iron, and magnesium
Chinese chive/ Oriental garlic	<i>Allium tuberosum</i>	Alliaceae	Leaves and bulbs	Vitamins A, C and K, potassium, calcium, iron, dietary fibre
Chinese basil/ East Indian mint	<i>Elsholtzia griffithii</i>	Lamiaceae	Leaves and flowers	Kaempferol, terpenoids, antioxidants and essential oils
Bitter brinjal	<i>Solanum gilo</i>	Solanaceae	Tender fruits	Dietary fibre, magnesium, potassium, vitamins B ₆ and K
Spiked ginger lily/Katuri/ Karpura kachari/Shati	<i>Hedychium spicatum</i>	Zingiberaceae	Rhizome	Essential oils like monoterpenes, sesquiterpenes, and 1,8-cineol, β -carotenoids and vitamin E
Oyik	<i>Gonostegia hirta</i>	Urticaceae	Leaves, young stems and roots	Potassium, calcium, organic and fatty acids, flavonoids and phenolics
Poi/basella/Indian spinach	<i>Basella</i> spp.	Basellaceae	Tender leaves	Calcium, iron, dietary fibre, antioxidants
Chinese cabbage/P-tsai/ Pak-choi	<i>Brassica</i> spp.	Brassicaceae	Fleshy leaves	Soluble fibers, vitamins C and K, folic acid and isothiocyanates
Bathua saag/Pigweed/ Lamb's quarters	<i>Chenopodium album</i>	Chenopodiaceae	Leaves/twigs	Vitamin A, carbohydrate, protein, calcium
Tree tomato/Tamarillo	<i>Cyphomandra betacea</i>	Solanaceae	Ripe fruits	β -carotene, vitamins C and E and different micronutrients
Dill/Sowa	<i>Anethum graveolens</i>	Apiaceae	Leaves and seeds	Carbohydrates, protein, vitamin C, calcium, potassium and dietary fiber
Winged bean	<i>Psophocarpus tetragonolobus</i>	Fabaceae	Whole plant	Protein, Vitamins A and C, dietary fibre, iron, copper, magnesium, zinc
Velvet bean	<i>Mucuna pruriens</i>	Fabaceae	Tender pods, seeds and leaves	Protein, minerals, antioxidants
Vegetable soybean/ Beer beans/Sweet beans	<i>Glycine max</i>	Fabaceae	Seeds and tender pods	Protein, dietary fibers, omega-3-fatty acids, phytoestrogen and minerals
Agathi	<i>Sesbania grandiflora</i>	Fabaceae	Leaves and flowers	Protein, lipids, calcium, iron, phosphorus, dietary fibers
Tree bean	<i>Parkia roxburgii</i>	Fabaceae	Tender pods	Carbohydrates, protein, lipids, and minerals
Yam bean/Kesaur/Sakalu	<i>Pachyrhizus erosus</i>	Fabaceae	Tuberous root	Carbohydrates and vitamin C
Water lily/Sapla phool	<i>Nymphaea nouchali</i>	Nymphaeaceae	Flowers and stems	Protein, iron, calcium, dietary fibre
Kachari	<i>Cucumis callosus</i>	Cucurbitaceae	Both unripe and ripe fruits	Antioxidants, anti-cancerous and anti-diabetic compounds
Lollipop climber/Striped Cucumber/Native bryony/ Shivalingi fruits	<i>Diplocyclos palmatus</i>	Cucurbitaceae	Leaves and fruits	Vitamins A, B ₁ , B ₂ , C; calcium and iron, alkaloids, flavonoids

Production constraints and way forward

Underutilized vegetable crops are crucial for ensuring nutritional security, supporting crop diversification, and enabling sustainable vegetable production, even under changing climatic conditions. However, several challenges limit their wider adoption:

Key constraints

- Lack of knowledge regarding commercial cultivation practices.
- Farmers' preference for mainstream vegetable crops, leaving minimal area for underutilized types.
- Restricted regional cultivation, often tied to traditional customs and cuisines, limiting awareness among the



Gynura procumbens: A popular leafy vegetable of North-Eastern India



Diplazium esculentum: A popular vegetable of humid parts of Eastern and North-Eastern India



Fruits of *Sechium edule*: Locally known as squash, a popular underexploited cucurbit vegetable



Zanthoxylum rhetsa: A popular leafy vegetable in Nagaland



Fruits of *Solanum gilo* commonly known as bitter brinjal



Basella sp. commonly known as poi: a popular leafy vegetable throughout the Eastern and North-Eastern India

- general population.
- Limited exploration of genetic diversity and nutritional potential.
- Population pressure threatening natural habitats of these crops.

Recommended measures:

Germplasm collection and characterization: Prioritize collection, characterization, and nutritional profiling of underutilized vegetables.

Documentation of traditional knowledge: Record indigenous practices regarding cultivation, consumption, and storage.

Demonstration and awareness programs: Conduct on-farm demonstrations, exhibitions at farmers' fairs, and awareness campaigns via radio, television, newspapers, and social media.

Capacity building: Train farmers in commercial production and processing technologies.

Integration into nutrition programs: Include underutilized vegetables in school mid-day meal schemes and ICDS programs.

Domestication of wild species: Promote homestead cultivation to reduce overexploitation of natural habitats.

Seed systems and standard practices: Develop standardized cultivation packages, ensure production and distribution of quality seeds/planting materials through Krishi Vigyan Kendras (KVKs).

Community involvement: Support community seed banks

and participatory varietal selection to maintain local genetic diversity.

Collaborative approaches: Foster partnerships among ICAR institutes, State Agricultural Universities, KVKs, State Departments, and NGOs to fully harness the nutritional and medicinal potential of these crops.

SUMMARY

The Indian subcontinent is blessed with the enormous genetic diversity of numerous vegetable crops. While the potential of some of these vegetables has been tapped, many other vegetables have been left behind, whose cultivation has been limited to only certain pockets by different ethnic groups. Eastern and North-Eastern India has numerous such vegetables with desirable food, nutritional and medicinal values. Collection, characterization, nutritional profiling and conservation of these vegetables are urgently needed alongside raising awareness among the farmers through large-scale demonstrations. Capacity building of the farmers with improved production and processing technology would lead to sustainable production and utilization of underexploited vegetables for ensuring food and nutritional security in India.

For further interaction, please write to:

¹MSc Student, ²Scientist; ICAR-Indian Agricultural Research Institute, Hazaribagh 825 405, Jharkhand *Corresponding email: saheb.pal@icar.org.in