Madras Agric.J.,2026; https://doi.org/10.29321/MAJ.10.261269

RESEARCH ARTICLE

Potential Underexploited Vegetable Crops of Tamil Nadu with Emphasis on Nutritional and Medicinal Value

Ajay Raja. A[1*], Praneetha. S[1], Lokesh. R[2], and Dinesh. D[3]

[1]Department of Vegetable Science, Horticulture College and Research Institute, Tamil Nadu Agricultural University, Coimbatore -641003, India

[2]Department of Plant Pathology, Center for Plant Protection Studies, Tamil Nadu Agricultural University, Coimbatore -641003, India

[3]Department of Agricultural Economics, Tamil Nadu Agricultural University, Coimbatore -641003, India

Received: 11 Nov 2025

Revised: 27 Jan 2026

Accepted: 07 Mar 2026

ABSTRACT

Underutilized vegetable crops represent a vital yet often neglected segment of agro-biodiversity, offering considerable potential to enhance nutritional security, sustainable agriculture, and resilience to climate change. Tamil Nadu, with its varied agro-climatic zones spanning coastal plains, dry regions, and hilly terrains, supports a rich array of indigenous and lesser-known vegetables adapted to local conditions. This review critically explores the potential of underexploited vegetable crops in the region, focusing on their nutritional and medicinal attributes. It covers leguminous vegetables, cucurbits, tubers, leafy greens, and fruit vegetables, emphasizing their protein, essential mineral, vitamin, antioxidant, and bioactive compound content. These crops exhibit multiple health-promoting properties, including antidiabetic, antioxidant, anti-inflammatory, antimicrobial, and cardioprotective effects. Despite their demonstrated benefits, these vegetables remain marginal due to limited research, weak seed systems, low market integration, and poor consumer awareness. The review also highlights significant constraints and proposes strategies for conservation, crop improvement, value addition, and policy support. Enhancing their cultivation and utilization can strengthen dietary diversity, conserve genetic resources, and promote sustainable nutrition and livelihoods in Tamil Nadu.

Keywords: *Underutilized vegetables, Agro-biodiversity, Nutritional value, Medicinal properties, Climate resilience, Tamil Nadu*

INTRODUCTION

Vegetables are indispensable components of the human diet, serving as primary sources of essential vitamins, minerals, dietary fibre, and a wide range of bioactive compounds necessary for maintaining health and preventing malnutrition (Ramkumar *et al.,* 2025). Adequate intake of vegetables plays a crucial role in addressing micronutrient deficiencies, strengthening immune function, and reducing the risk of non-communicable diseases. In a populous country like India, where food demand continues to rise alongside persistent nutritional imbalances, vegetables contribute significantly to nutritional and food security by ensuring dietary diversity, affordability, and year-round availability (Harris *et al.,* 2022).

Despite India's remarkable progress in vegetable production, the benefits are primarily derived from

*Corresponding author mail: ajayraja03111999@gmail.com

a limited number of major commercial crops. A substantial proportion of edible plant diversity remains outside mainstream agriculture. These crops are commonly referred to as underutilized, neglected, minor, or orphan vegetables (Peduruhewa *et al.,* 2021). Underutilized or neglected vegetable crops are plant species with a history of traditional use for food and medicine but that are inadequately researched, poorly commercialized, and weakly integrated into formal seed systems, markets, and policy frameworks. Although they are often locally or regionally important, their potential remains untapped mainly at the national and global levels.

Underutilized vegetables are gaining renewed attention amid climate change and sustainable agriculture. Many of these crops possess inherent tolerance to drought, heat, poor soils, and biotic stresses, require fewer external inputs, and thrive under marginal conditions (Pandiyaraj *et al.,* 2024). Their cultivation can enhance agrobiodiversity, improve ecosystem stability, reduce reliance on a narrow crop base, and support climate-resilient, low-input farming systems, while simultaneously contributing to nutritional and livelihood security (Debbarma *et al.,* 2020).

Tamil Nadu represents a notable hotspot of agro-biodiversity in India, characterized by diverse agro-climatic zones ranging from coastal plains and dry tracts to hill ecosystems. This diversity supports a wide array of indigenous and lesser-known vegetable crops, including leafy greens, tubers, legumes, gourds, and perennial vegetables that are deeply embedded in local food cultures and traditional knowledge systems (Karthick *et al.,* 2024).

In this context, the present review aims to critically document the potential underexploited vegetable crops of Tamil Nadu, with particular emphasis on their nutritional composition and medicinal properties. The review highlights their ecological resilience, traditional relevance, and potential for conservation and broader use in strengthening sustainable agriculture and nutritional security.

Agro-Climatic Diversity of Tamil Nadu

Tamil Nadu exhibits considerable agro-climatic diversity, ranging from the humid coastal plains and fertile river basins to semi-arid interiors and cool hill ecosystems, which collectively favour the cultivation of a wide range of underutilized vegetable crops. Variations in rainfall (monsoonal dependence), temperature regimes, soil types, and altitude enable the successful growth of indigenous leafy vegetables, tubers, legumes, gourds, and perennial vegetables adapted to marginal and low-input conditions. This ecological heterogeneity supports rich vegetable diversity and provides opportunities to promote climate-resilient, nutritionally important underexploited crops across the state's different farming systems (Government of Tamil Nadu, 2020).

Criteria for categorizing vegetables as underutilized

To qualify as an underutilized vegetable crop, a plant generally exhibits the following characteristics (Thakur, 2014):

- Its edibility is well established through scientific studies or long-standing ethnobotanical knowledge.
- The crop has a history of cultivation, either historically or within restricted geographical regions rather than widespread commercial areas.
- Present-day cultivation and consumption levels are substantially lower when compared with commonly grown conventional vegetables.
- Organized systems for seed production, certification, and distribution are poorly developed or absent.
- The crop is closely associated with traditional, indigenous, or community-specific uses in certain localities.
- It has attracted minimal focus from agricultural research programs, extension networks, farmers, policy planners, and technology developers.
- Despite limited recognition, the crop often possesses superior nutritional value, medicinal or therapeutic benefits, and/or multiple functional uses, underscoring its untapped potential.

Nutritional and Medicinal Properties of Diverse Underutilized Vegetables of Tamil Nadu

a) Underutilized Leguminous Vegetables

Underutilized leguminous vegetables represent a diverse group of nutrient-rich crops with high agronomic, nutritional, and medicinal potential that remain inadequately exploited in mainstream food and farming systems (Figure 1).

Figure 1. Underutilized Leguminous Vegetables

1. Faba bean. Faba bean (*Vicia faba* L.; Fabaceae), commonly referred to as broad bean, Windsor bean, winter bean, or bakla bean, is a minor legume vegetable cultivated mainly in the hilly regions of India. It is used for human consumption, animal feed, and as green manure, improving soil fertility through biological nitrogen fixation (Jensen *et al.,* 2010). In the Nilgiris district of Tamil Nadu, broad beans are consumed as fresh seeds, tender pods, or dried seeds, and despite being underutilised, they fetch reasonable market prices (Raja *et al.,* 2023; Raja *et al.,* 2025). Faba bean is nutritionally rich, with high protein (29.4%) and carbohydrates (51-68%) and low fat (1.5%); 100 g of seeds provides protein (4.5 g), carbohydrates (7.2 g), vitamin C (12.0 mg), calcium (50 mg), and iron (1.4 mg). At the same time, the green pods and leaves contain bioactive phytochemicals (Akgun and Canci, 2023). Faba bean contains flavonoids with antioxidant, antiviral, anticancer, anti-inflammatory, and anti-atherosclerotic effects, and L-DOPA, a dopamine precursor used in Parkinson's disease therapy (Debnath *et al.,* 2025).

2. Winged bean. Winged bean (*Psophocarpus tetragonolobus* (L.) DC.; Fabaceae) is an underutilized, self-pollinated tropical legume of Southeast Asian or Papua New Guinea origin, valued for its climate adaptability, high nutritional quality, strong nitrogen fixation, multiple edible parts, and processing potential (Paliwal *et al.,* 2020). Winged bean is known as a "supermarket on a stalk" because all its plant parts are edible, and its soybean-like nutritional value earns it the nickname "soybean of the tropics" (Khan, 1976). Winged bean is a nutrient-dense legume with seeds high in protein (29–37%), oil (15–20%), amino acids, vitamins, and minerals, and protein-rich leaves and tubers (12–20%) comparable to those of soybean (Tribhuvan *et al.,* 2024). Winged bean has notable medicinal value, as its high niacin content helps lower cardiovascular risk and its bioactive compounds support traditional therapeutic and cosmetic uses.

3.Cluster bean. Cluster bean (*Cyamopsis tetragonoloba* (L.) Taub.; Fabaceae), a drought-tolerant multipurpose legume commonly known as guar, is native to India, the world's leading producer which accounts for about 75% of global production. The tender immature pods used as vegetables are nutrient rich, containing moisture (81%), energy (16 kcal), carbohydrates (10.8 g), protein (3.2 g), fat (1.4 g), vitamin C (49 mg), vitamin A (65.3 IU), calcium (57 mg), and iron (4.5 mg) per 100 g of fresh edible portion (Manivannan *et al.,* 2016). Cluster bean possesses substantial medicinal value due to its guar gum–rich soluble fibre and bioactive compounds, which exhibit cholesterol-lowering, anti-diabetic, anti-inflammatory, antioxidant, digestive, and chemo-preventive properties (Hussain and Mahajan, 2025).

4. Dolichos bean. Dolichos bean (*Lablab purpureus* L.; Fabaceae), also known as hyacinth bean, is a versatile, climate-smart legume cultivated across continents, valued for its adaptability, protein richness, and diverse uses in farming systems and cuisines. *Dolichos lablab* leaves contain up to 28% protein, 150–157 mg iron, and 25–35 mg zinc per 100 g. It shows antidiabetic, antioxidant (DPPH IC_{50}: 430-853 µg/mL), antimicrobial,

and anti-inflammatory activities due to flavonoids and polyphenols (Chetia *et al.,* 2025).

5. Clove bean. Clove bean (*Ipomoea muricata* (L.) Jacq.; Convolvulaceae) is an underexploited vegetable cultivated for its fruits and thickened pedicels, widely adapted from sea level to about 1700 m altitude. Clove bean is nutritionally rich, providing dietary fibre, protein (1.00–1.50 g/100 g), calcium (200–220 mg/100 g), phosphorus (120–150 mg/100 g), iron (0.13–0.19 mg/100 g), ascorbic acid (30–40 mg/100 g), and crude fibre (0.67–3.33%). Clove bean has medicinal importance, as indolizidine alkaloids present in its seeds, leaves, and stems impart analgesic, antiseptic, and wound-healing properties (James and Girija, 2025).

6. Yard-long bean. Yard long bean (*Vigna unguiculata* subsp. *Sesquipedalis*; Fabaceae) is an underutilized, nutritionally rich cowpea type, characterized by cleistogamous self-pollination, and very long pods (0.5–1 m) bearing 8–12 mm seeds. It is also called asparagus bean, snake bean, Chinese long bean, or pea-bean, and is cultivated mainly for its crisp, tender pods, which are consumed fresh or cooked. Tender pods are called the "poor man's meat," providing 24–27% low-fat protein along with calcium (72 mg), phosphorus (59 mg), iron (2.5 mg), carotene (564 µg), thiamine (0.07 mg), riboflavin (0.09 mg), and vitamin C (24 mg) per 100 g (Jayasinghe *et al.,* 2015).

7. Sword bean. Sword bean (*Canavalia gladiata* Jacq.; Fabaceae) is a warm-season, self-pollinated, climbing legume with long, fleshy, sword-like pods, widely grown in South and Southeast Asia. The seeds are low in fat, high in protein, rich in antioxidant phenolics, and used in traditional medicine for cough, kidney pain, and other ailments (Qian *et al.,* 2025).

8. Jack bean. Jack bean (*Canavalia ensiformis*; Fabaceae) is a tropical legume tolerant of acidic and dry soils, highly drought-resistant, with deep roots that support its cultivation. It is the richest source of protein (23–34%) and carbohydrates (55%). This legume contains nutrients that offer health benefits, including protection against cancer, heart disease, and diabetes, as well as support for healthy aging (Shevkani *et al.,* 2022).

b) Underutilized Cucurbitous Vegetables

Underutilized cucurbitous vegetables are lesser-known climbing or trailing members of the Cucurbitaceae family, typically grown as warm-season crops, valued for their nutritional and medicinal properties, yet remain under-cultivated with limited commercial presence in Tamil Nadu (Figure 2).

1. Momordica sp. Vegetables. *Momordica* includes 59 species, primarily annual and perennial climbing or herbaceous plants, with a few small shrubs; they are distributed worldwide, with 47 species in Africa and 12 in Australia and Asia (Heneidak and Khalik, 2015).

2. Ivy gourd. Ivy gourd (*Coccinia grandis*), also called kundru or tindori, is a highly nutritious vegetable

Table 1. Nutritional and Therapeutic Attributes of underutilized *Momordica sp.*

S. No.	Momordica *sp.*	Nutritional and Medicinal Value	Reference
1.	Sweet gourd (*Momordica cochinchinensis*) - Oblong, smooth, tender fruits.	Their young green fruits are cooked as vegetables and are the richest source of vitamins and minerals. Unripe fruits act as an appetizer and astringent, while root juice is stimulant, astringent, and antiseptic, used to control bleeding piles and treat expectorant, urinary, and bowel disorders.	Bora *et al.* (2025)
2	Spine gourd (*Momordica dioica*) - Small, oval, spiny, edible fruits.		
3.	Mithipagal (*Momordica charantia* var. *muricata*.) - Small, disc-shaped fruits characterized by numerous surface tubercles.	Mithipagal contains higher levels of protein, fat, carbohydrates, and minerals (iron, calcium, and vitamin C) than large-fruited types. It shows antidiabetic, antioxidant, anti-inflammatory, antimicrobial, anti-HIV, anti-ulcer, anti-leukemic, and antitumor activities.	Agalya *et al.* (2023)
4.	Athalakkai (*Momordica cymbalaria*)- Pyriform fruits; small size; 20–25 mm length.	Rich in K (505.9 mg), Ca (73.6 mg), Na (41.6 mg), Fe (1.71 mg), vitamin C (299.1 mg), carotenoids (2.81 mg), and lycopene (1.86 mg) per 100 g. Traditionally used for diabetes, rheumatism, ulcers, skin diseases, and diarrhoea, with antioxidant and anticancer properties.	Chinthan *et al.* (2021)

(Moisture 94%, Dietary fibre 1.6 g, Protein 1-2 g, Fat 0.4 g, Carbohydrates 3.1 g, Carotene 156 µg, Vitamin A 260 IU, Vitamin C 28 mg, Iron 14 mg, Energy 18 kcal per 100 g). Daily intake of 100 g helps lower blood sugar, supports bone and immune health, and its tendrils provide essential minerals. Leaf extracts show antimicrobial activity against pathogenic bacteria (Tak *et al.,* 2021).

3. Pointed gourd. Pointed gourd (*Trichosanthes dioica*), known as Parwal or Pravar and often called "green potato" in India, is valued for its edible fruits and nutritious leaves. The crop is a good source of carbohydrates (4.2g/100g), vitamins A (255 IU/100g) and C (2.5 mg/100g), and essential minerals, and its juice is traditionally used as a tonic for hair loss and mild liver enlargement (Sharma *et al.,* 2023).

4. Chayote. Chayote (*Sechium edule*) is a perennial climbing cucurbit in which all plant parts are utilized: fruits, tuberous roots, tender leaves, and shoots are consumed as vegetables, and the leaves and peel are traditionally valued for their diuretic properties. It is rich in dietary fibre, vitamin C, potassium, folate (vitamin B9), and antioxidants while being low in calories and fat. Additionally, its high content of polyphenols, flavonoids, and other bioactive compounds contributes to multiple health-promoting effects, including antihypertensive, antimicrobial, antioxidant, anticancer, antihyperglycemic, and neuropharmacological activities (Verma *et al.,* 2017).

5. Round melon. Round melon (*Praecitrullus fistulosus*), also called tinda, Indian round gourd, apple gourd, or Indian squash, is a cucurbit vegetable with light-green, hairy, spherical fruits (5–8 cm, 45–60 g); tender fruits are eaten as vegetables, and the seeds are roasted. The fruit is rich in proteins and carbohydrates. It possesses cooling, digestive, diuretic, and anti-inflammatory properties and is traditionally used to support digestion, urinary health, and overall metabolic balance (Tyagi *et al.,* 2017).

c) Underutilized Tuber Crops

Tamil Nadu harbors several underutilized tuber crops that are nutritionally rich and climate-resilient. These crops have potential for improvement, improving food security, nutrition, and income generation in marginal farming systems (Figure 3).

1. Yams. Yams (*Dioscorea* spp.; Dioscoreaceae) are tuberous, perennial crops (≈600 species worldwide), with Greater, Lesser, and White yams being the most cultivated for food and medicinal uses. The key nutritional components and bioactive properties of these widely cultivated yam species are summarized in Table 2.

2. Elephant foot yam. Elephant foot yam (*Amorphophallus campanulatus*; Araceae) has dry, pungent corms with digestive, anthelmintic, and aphrodisiac properties, traditionally used to manage vata–kapha disorders, inflammatory conditions, gastrointestinal ailments, respiratory issues, anaemia, and general debility; fresh corms are also applied externally to relieve acute rheumatism. The corms are rich in minerals, notably iron (340.2), magnesium (119.2), potassium (38.1), copper

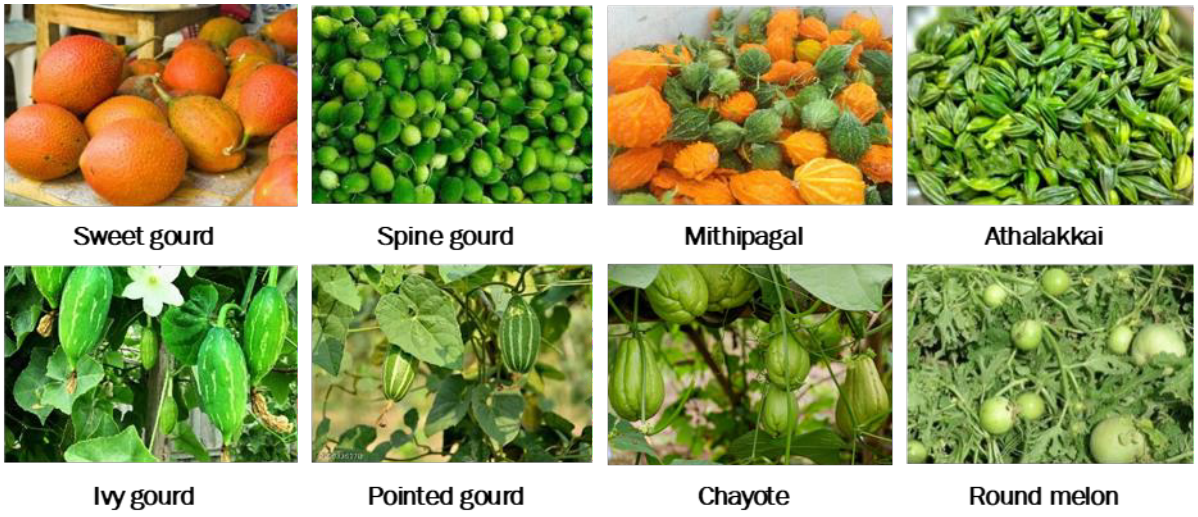

Figure 2. Underutilized Cucurbitaceous Vegetables

Table 2. Nutritional and medicinal attributes of major yam species

S. No.	Dioscorea sp.	Nutritional and Medicinal Value	Reference
1.	Greater yam (*D. alata*)	Rich in carbohydrates, protein (6–8 g protein/100g), potassium, magnesium, and iron; contains anthocyanins, β-carotene, diosgenin, and dioscorin; exhibits antioxidant, anticancer, anti-inflammatory, and immunomodulatory activities.	Tareen *et al.* (2025)
2.	Lesser yam (*D. esculenta*)	Contains carbohydrates, dietary fiber, protein (2.1 g protein/100g), calcium, potassium, and iron; diosgenin provides antioxidant, anti-inflammatory, and anti-diabetic effects; improves muscle quality and glycemic control.	Wang *et al.* (2025)
3.	White yam (*D. rotundata*)	High in carbohydrates, moderate protein (1.5 g/100g), iron, potassium; contains diosgenin, flavonoids, phenols; supports antioxidant, digestive, and metabolic health; staple tuber in West Africa.	Alinnor and Akalezi, (2010)

Figure 3. Underutilized Tuberous Vegetables

(32.6), zinc (23.1), and phosphorus (4.53) µg/gm (Srivastava *et al.,* 2014).

3. Taro. Taro (*Colocasia esculenta*; Araceae) is a perennial, herbaceous tuber crop cultivated worldwide for its starchy edible corms and leaves. It is rich in complex carbohydrates (~70–80% starch), dietary fiber, potassium, calcium, iron, and vitamins; it contains polyphenols and resistant starch with antioxidant, anti-inflammatory, prebiotic, and metabolic health benefits (Kaushal *et al.,* 2015).

4. Chinese potato. Chinese potato (*Coleus rotundifolius*; Lamiaceae) is a perennial herb native to tropical Africa, grown in India for its edible tubers. The tubers are nutritionally rich, containing reducing sugars (26 mg), protein (13.6–14.6 mg), fiber (1.6%), minerals such as calcium (29 mg) and phosphorus (36 mg), vitamins A (13.6 mg) and C (10.3 mg), B-complex vitamins, and antioxidants per 100 g. The tuber's aromatic flavour makes it highly desirable, and its flavonoids impart medicinal value by helping reduce blood cholesterol (Murugesan *et al.,* 2020).

d) Underutilized Leafy Vegetables

Underutilized leafy vegetables of Tamil Nadu represent a diverse group of indigenous greens (Figure 4) that are nutritionally rich and possess valuable bioactive compounds, yet remain largely neglected in mainstream agriculture and diets. Table 3 summarizes the nutritional composition and medicinal properties of selected species, highlighting their potential to improve nutrition, health, and sustainable food systems in the state.

Table 3. Nutritional composition and medicinal properties of selected underutilized leafy vegetables

Vegetables (Scientific name)	Medicinal properties	Protein (%)	Carbohydrate (%)	Fat (%)	Fiber (%)	Ash (%)	Vitamin A	Calcium (mg)	Iron (mg)	Reference
Agathi (Sesbania grandiflora)	Antioxidant, antimicrobial; traditionally used for digestive disorders, fever, and wound healing	8.25	6.30	–	2.90	3.15	89 µg RE	–	–	Arfan *et al.* (2016)
Asiatic pennywort (Centella asiatica)	Wound healing, cognitive enhancement, anti-inflammatory; widely used in traditional medicine	3.5	7.5	0.6	2.5	2.0	~350 µg RE	215	5.6	Nongrum *et al.* (2020)
Basella (Basella alba)	Cooling, laxative; supports digestion and iron absorption; rich in antioxidants	1.8	3.4	0.3	1.0	1.1	800–900 µg β-carotene	109	1.2	Kumar *et al.* (2015)
Ceylon spinach (Talinum triangulare)	Antioxidant, anti-inflammatory; traditionally used as a diuretic and for asthma	11.88	45.80	2.23	16.43	13.29	–	–	–	Musefiu and Yinka, (2022)
Chekurmanis (Sauropus androgynus)	"Multivitamin green" is used traditionally for anemia and eye health	22.0	–	–	34.0	–	9250 µg	–	4.5	Platel and Srinivasan, (2017)
Moringa leaves (Moringa oleifera)	Antioxidant, anti-inflammatory; supports immunity and glycemic control	6.7	12.5	1.7	0.9	–	1280 µg RE	440	0.85	Moyo *et al.* (2011)
Ponnanganni (Alternanthera sessilis)	Used for skin and eye ailments; wound healing; rich in micronutrients	4.0	0.29	0.012	0.356	0.51	50 µg RE	379	5.0	Bhavithra, *et al.* (2021)
Roselle leaves (Hibiscus sabdariffa)	Diuretic, laxative, antioxidant; rich in polyphenols and anthocyanins	3.3	9.2	0.3	10.0	1.0	200 µg RE	213	4.8	Islam *et al.* (2016)

Figure 4. Underutilized Leafy Vegetables

e) Underutilized Fruit Vegetables

Underutilized fruit and vegetables are nutritionally rich, bioactive compound–laden crops with significant potential for improving diet quality, health, and income in tropical and subtropical regions (Figure 5).

1. Drumstick. Drumstick (*Moringa oleifera*; Moringaceae) is a fast-growing, drought-tolerant perennial suited to semi-arid regions and intercropping systems. Its edible leaves, flowers, and pods are widely consumed, while extracts and powders exhibit antimicrobial, anti-inflammatory, hypoglycemic, hypocholesterolaemic, immune-stimulating, and anticancer properties. It is a potent nutritional plant used against malnutrition, providing about 7× more vitamin C than oranges, 10× more vitamin A than carrots, 17× more calcium than milk, 9× more protein than yoghurt, 15× more potassium than bananas, and 25× more iron than spinach (Rockwood *et al.,* 2013). Moringa contains phytosterols (stigmasterol, sitosterol, campesterol) that enhance oestrogen activity, promote lactation, help combat childhood malnutrition, and about six spoonfuls of leaf powder can meet daily iron and calcium needs during pregnancy (Islam *et al.,* 2021).

2. Turkey berry. Turkey berry (*Solanum torvum*; Solanaceae), locally known as Sundakkai, is a wild vegetable of northeast India bearing small (≈1 cm), green-to-yellow clustered fruits that are consumed stir-fried or boiled and form an essential part of the South Indian diet, particularly in Tamil Nadu, India. The fruits are nutritionally rich, providing calcium (221.5), iron (76.8), zinc (21.46), manganese (19.4), copper (2.6) mg/kg, along with vitamin A (0.078) and vitamin C (2.6) mg/100 g (Melila *et al.,* 2021). Preparations from *S. torvum* fruits, seeds, and vegetative parts are traditionally used to treat fever, cough, pain, wounds, liver and reproductive disorders, hypertension, and poisoning, and exhibit sedative, diuretic, haemopoietic, antimicrobial, and antioxidant properties (Sivapriya and Leela, 2007).

3. Bread fruit. Bread fruit (*Artocarpus altilis*; Moraceae) has over 120 cultivars and is a nutrient-rich, complex-carbohydrate–dense fruit with low fat and cholesterol. Immature fruits are also cooked by boiling, pickling, or marinating and have an artichoke-like flavour. It offers a well-balanced amino acid profile rich in essential amino acids and shows medicinal potential through its antioxidant, anti-inflammatory, antidiabetic, antimicrobial, and cardioprotective bioactive compounds (Liu *et al.,* 2015).

4. Tree tomato. Tree tomato or tamarillo (*Solanum betaceum*; Solanaceae) is an exotic, low-energy fruit valued for its rich supply of vitamins (A, C, B-complex), minerals (potassium, iron), fibre, and diverse bioactive compounds. Native to South America and widely cultivated, it demonstrates antioxidant, anti-inflammatory, antimicrobial, and antidiabetic activities, contributing to metabolic health, immunity, and reduced disease risk (Kumar *et al.,* 2024).

Constraints in Popularization

Underutilized vegetables, despite their nutritional and therapeutic potential, face several challenges that

Figure 5. Underutilized Fruit Vegetables

limit their wider adoption and cultivation (Kukreja and Sharma, 2023).

- ***Lack of improved varieties:*** Few high-yielding, stress-tolerant, or nutritionally enhanced cultivars are available.
- ***Poor market linkages***: Weak supply chains and limited infrastructure hinder commercialization and profitability.
- ***Limited consumer awareness:*** Low knowledge about nutritional benefits reduces demand and consumption.
- ***Inadequate research and extension support:*** Minimal scientific attention and insufficient farmer outreach restrict crop improvement and adoption.

Strategies for Promotion and Improvement

Effective promotion and improvement of underutilized vegetables require integrated strategies encompassing breeding, conservation, value addition, policy support, and urban cultivation.

1. ***Crop improvement and breeding***: Develop high-yielding, stress-tolerant, and nutrient-rich varieties using conventional and molecular breeding, including marker-assisted selection and genome editing.
2. ***Germplasm conservation:*** Preserve genetic diversity through in situ (on-farm) and ex situ (gene banks, seed banks) approaches (Bhardwaj *et al.,* 2020).
3. ***Value addition and processing:*** Enhance shelf-life and market potential via dehydration, pickling, powdering, and other post-harvest technologies.
4. ***Policy support and nutrition programs***: Integrate underutilized vegetables into national nutrition, food security, and agricultural diversification programs; provide subsidies and research funding (NAAS, 2025).
5. ***Urban farming and home gardens:*** Promote cultivation in urban and peri-urban areas to increase availability, awareness, and access to nutrient-dense vegetables.

Future Prospects and Research Gaps

Underutilized vegetables offer significant scope for climate-resilient production, given their tolerance to abiotic stresses and low input requirements. Their rich bioactive profiles highlight strong potential for the development of nutraceuticals and functional foods. However, limited molecular, biochemical, and genetic studies constrain targeted improvement. Integrating these crops into sustainable and diversified farming systems is essential to enhance nutrition, resilience, and livelihood security.

CONCLUSION

Underutilized vegetable crops of Tamil Nadu constitute a vital yet largely untapped resource for enhancing nutritional quality, dietary diversity, and agro-ecosystem resilience. Rich in essential nutrients and medicinal compounds, these indigenous vegetables hold immense promise in addressing hidden hunger and sustaining traditional food systems. However, their potential remains constrained by inadequate research, weak seed systems, limited market linkages, and insufficient policy attention. Strategic investment in systematic research, conservation, crop improvement, and supportive policy frameworks is imperative. Mainstreaming underutilized vegetables can significantly contribute to nutritional security, climate-resilient agriculture, and sustainable livelihood opportunities for farming and tribal communities across Tamil Nadu.

Funding acknowledgement

This review was conducted without any external financial support.

Ethics Statement

No human or animal subjects were involved in this research, and therefore no specific permits were required.

Originality and plagiarism

We confirm that this manuscript is entirely original, and any use of others' work or words has been appropriately cited.

Consent for publication

All authors have approved the manuscript for publication.

Competing interest

The author declares that there are no conflicts of interest associated with the publication of this content.

Data availability

All data supporting this manuscript are included within the MS. No external data sources are required, and any additional information can be obtained by contacting the corresponding author via official email: ajayraja03111999@gmail.com

Author contribution

Ajay Raja A. conceived the idea and prepared the original draft; Praneetha S. provided guidance and supervision; Lokesh R. and Dinesh D. contributed to the review and editing of the manuscript.

REFERENCES

Agalya, P., Vethamoni, P. I., Pazhanivelan, S., Praneetha, S. and S. Haripriya. 2023. Studies on genetic variability and correlation analysis in mithipagal (*Momordica charantia* var. *muricata*) genotypes. *Int. J. Environ. Clim. Change.*, **13**: 2080–2087. https://doi.org/10.9734/IJECC/2023/v13i102869

Akgun, D. and H. Canci. 2023. Selection of faba bean (*Vicia faba* L.) genotypes for high yield, essential amino acids and low anti-nutritional factors. *Agriculture.*, **13**: 932. https://doi.org/10.3390/agriculture13050932

Alinnor, I. J. and C. O. Akalezi. 2010. Proximate and mineral compositions of *Dioscorea rotundata* (white yam) and *Colocasia esculenta* (white cocoyam). *Pak. J. Nutr.*, **9**: 998–1001. https://doi.org/10.3923/pjn.2010.998.1001

Arfan, N., Julie, A., Mohiuddin, A., Khan, S. and Z. Labu. 2016. Medicinal properties of the Sesbania grandiflora leaves. Ibnosina J. Med. Biomed. Sci., 8: 271–277. https://doi.org/10.4103/1947-489X.210243

Bhardwaj, D. R., Gautam, K. K., Dubey, R. K., Chaubey, T., Pandey, S. and A. K. Singh. 2020. Diversity and conservation of indigenous and minor vegetables. *Indian Hortic.*, **65**: 3. https://epubs.icar.org.in/index.php/IndHort/article/view/105382

Bhavithra, P., Balakumbahan, R., Kannan, P. and V. Sivakumar. 2021. Underutilized leafy vegetables in Western Ghats region for nutritional security. *Plant Arch.*, **21**: 1–5. https://doi.org/10.51470/PLANTARCHIVES.2021.v21.no1.005

Bora, G. C., Basumatary, P., Saikia, J. and S. Gogoi. 2025. Evaluation of spine gourd (*Momordica dioica* Roxb.) genotypes for yield, quality traits and adaptability in Assam, India. *J. Exp. Agric. Int.*, **47**: 678–691. https://doi.org/10.9734/jeai/2025/v47i83710

Chetia, S., Kumari, T., Nickhil, C. and S. C. Deka. 2025. A comprehensive review on the nutritional, medicinal and functional potential of *Dolichos lablab*. *Discover Food.*, **5**: 383. https://doi.org/10.1007/s44187-025-00500-9

Chinthan, K. N., Manjunathagowda, D. C., Rathod, V., Devan, S. R. and M. Anjanappa. 2021. Karchikai (*Momordica cymbalaria* Hook f.): an untapped cucurbit indigenous to India. *Genet. Resour. Crop Evol.*, **68**: 3427–3433. https://doi.org/10.1007/s10722-021-01247-9

Debbarma, S., Jamatia, J. and T. C. Singh. 2020. Underutilized vegetables, importance and its utilization by the tribal community of Tripura, North-East India. *Indian J. Pure Appl. Biosci.*, **8**: 471–483. http://dx.doi.org/10.18782/2582-2845.7665

Debnath, S., Rai, M., Tyagi, W., Majumder, S. and N. T. Meetei. 2025. Lower vicine content reduces the reproductive yield performance in faba bean (*Vicia faba* L.). *Sci. Rep.*, **15**: 311. https://doi.org/10.1038/s41598-024-83488-z

Government of Tamil Nadu, Department of Agriculture. 2020. Agro-climatic zones and agricultural profile of Tamil Nadu. Chennai, India. Retrieved from https://www.tn.gov.in

Harris, J., Tan, W., Raneri, J. E., Schreinemachers, P. and A. Herforth. 2022. Vegetables for healthy diets in low- and middle-income countries: a scoping review of the food systems literature. *Food Nutr. Bull.*, **43**: 232–248. https://doi.org/10.1177/03795721211068652

Heneidak, S. and K. A. Khalik. 2015. Seed coat diversity in some tribes of Cucurbitaceae: implications for taxonomy and species identification. *Acta Bot. Bras.*, **29**: 129–142. https://doi.org/10.1590/0102-33062014abb3705

Hussain, Z. and M. Mahajan. 2025. Hidden potential of cluster bean: an unexploited legume crop for food and nutritional security. *Vegetos.*, **38**: 1–8. https://doi.org/10.1007/s42535-025-01333-8

Islam, A. A., Jamini, T. S., Islam, A. M. and S. Yeasmin. 2016. Roselle: a functional food with high nutritional and medicinal values. *Fundam. Appl. Agric.*, **1**: 44–49. https://doi.org/10.5455/faa.302644242

Islam, Z., Islam, S. R., Hossen, F., Mahtab-ul-Islam, K., Hasan, M. R. and R. Karim. 2021. *Moringa oleifera* is a prominent source of nutrients with potential health benefits. *Int. J. Food Sci.*, **2021**: 6627265. https://doi.org/10.1155/2021/6627265

James, J. and K. Girija. 2025. Antioxidant effectiveness and phytochemical composition of *Ipomoea muricata* (I. turbinata): a focus on phenolic and flavonoids for pharmaceutical prospects. *J. Pharm. Bioallied Sci.*, 17: S516–S518. https://doi.org/10.4103/jpbs.jpbs_580_25

Jayasinghe, R. C., Premachandra, W. D. and R. Neilson. 2015. A study on *Maruca vitrata* infestation of yard-long beans (*Vigna unguiculata* subsp. *sesquipedalis*). *Heliyon.*, **1**: e00014. https://doi.org/10.1016/j.heliyon.2015.e00014

Jensen, E. S., Peoples, M. B. and H. Hauggaard-Nielsen. 2010. Faba bean in cropping systems. *Field Crops Res.*, **115**: 203–216. https://doi.org/10.1016/j.fcr.2009.10.008

Karthick, R., Arulmani, K. and K. Ravi. 2024. Impact of climate change assessments on horticultural crop dynamics in Tamil Nadu, India. *Int. J. Environ. Clim. Change.*, **14**: 114–125. https://doi.org/10.9734/IJECC/2024/v14i34024

Kaushal, P., Kumar, V. and H. K. Sharma. 2015. Utilization of taro (*Colocasia esculenta*): a review. *J. Food Sci. Technol.*, **52**: 27–40. https://doi.org/10.1007/s13197-013-0933-y

Khan, T. N. 1976. Papua New Guinea: a centre of genetic diversity in winged bean (*Psophocarpus tetragonolobus* (L.) DC.). *Euphytica.*, **25**: 693–705. https://doi.org/10.1007/BF00041608

Kukreja, N. and P. Sharma. 2023. Exploring the potential and prospects of underutilized vegetables – a review. *Curr. Agric. Res. J.*, **11**: 1–10. http://dx.doi.org/10.12944/CARJ.11.3.02

Kumar, S. S., Manoj, P. and P. Giridhar. 2015. Nutrition facts and functional attributes of foliage of *Basella* spp. *LWT–Food Sci. Technol.*, **64**: 468–474. https://doi.org/10.1016/j.lwt.2015.05.017

Kumar, S., Shree, B., Sharma, S. and A. Sharma. 2024. Tree tomato: underutilized vegetable for sustainable nutritional and economic security. *Sci. Hortic.*, **327**: 112867. https://doi.org/10.1016/j.scienta.2024.112867

Liu, Y., Ragone, D. and S. J. Murch. 2015. Breadfruit (*Artocarpus altilis*): a source of high-quality protein for food security and novel food products. *Amino Acids.*, **47**: 847–856. https://doi.org/10.1007/s00726-015-1914-4

Manivannan, A., Anandakumar, C. R., Ushakumari, R. and G. S. Dahiya. 2016. Characterization of Indian clusterbean (*Cyamopsis tetragonoloba* (L.) Taub.) genotypes using qualitative morphological traits. *Genet. Resour. Crop Evol.*, **63**: 483–493. https://doi.org/10.1007/s10722-015-0266-y

Melila, M., Dossou, B. R., Etse, K. D. and S. Firmin. 2021. Biochemical study and evaluation of the nutritional value of Solanum torvum (Swartz) fruits used as fruiting vegetables in Togo. J. Food Nutr. Res., 9: 579–584. https://doi.org/10.12691/jfnr-9-11-4

Moyo, B., Masika, P. J., Hugo, A. and V. Muchenje. 2011. Nutritional characterization of moringa (*Moringa oleifera* Lam.) leaves. *Afr. J. Biotechnol.*, **10**: 12925–12933. https://doi.org/10.5897/AJB10.1599

Murugesan, P., Koundinya, A. V. V. and K. I. Asha. 2020. Evaluation of genetic resource of Chinese potato (*Plectranthus rotundifolius*) for abiotic stress management – a review. *Curr. Hortic.*, **8**: 7–11. http://dx.doi.org/10.5958/2455-7560.2020.00002.3

Musefiu, T. A. and O. D. Yinka. 2022. *Talinum triangulare* (water leaf): what a wonderful plant?. *J. Biotechnol. Res.*, **8**: 26–31. https://doi.org/10.32861/jbr.82.26.31

NAAS. 2025. Underutilized fruits and vegetables for nutritional and health security. Policy Paper No. 140. National Academy of Agricultural Sciences, New Delhi. 8 pp. Retrieved from https://naas.org.in/Policy%20Papers/Policy%20140.pdf

Nongrum, Y., Prasad, R., Gupta, A. and M. Tiwari. 2020. Development and nutritional characterization of noodles enriched with *Centella asiatica* powder. *Int. J. Chem. Stud.*, **8**: 2183–2186. https://doi.org/10.22271/chemi.2020.v8.i2ag.9074

Paliwal, R., Abberton, M., Faloye, B. and O. Olaniyi. 2020. Developing the role of legumes in West Africa under climate change. *Curr. Opin. Plant Biol.*, **56**: 242–258. https://doi.org/10.1016/j.pbi.2020.05.002

Pandiyaraj, P., Sanmaya, A. M., Vinisha, V., Gopika, B., Kalai Chezhiyan, K., Prithiviraj, M. R., Antany Stanis Willson, M. and U. Udhayavanan. 2024. Underutilized vegetable crops: potential sources of nutrition and livelihood security. *Eur. J. Nutr. Food Saf.*, **16**: 248–254. https://doi.org/10.9734/ejnfs/2024/v16i71473

Peduruhewa, P. S., Jayathunge, K. G. L. R. and R. Liyanage. 2021. Potential of underutilized wild edible plants as the food for the future – a review. *J. Food Secur.*, **9**: 136–147. http://dx.doi.org/10.12691/jfs-9-4-1

Platel, K. and K. Srinivasan. 2017. Nutritional profile of chekurmanis (*Sauropus androgynus*), a less explored green leafy vegetable. *Indian J. Nutr. Diet.*, **54**: 243. https://doi.org/10.21048/ijnd.2017.54.3.15765

Qian, H., Meng, D., Yue, L., Xu, H., Feng, K. and J. Wang. 2025. Ethnobotanical use, phytochemistry, pharmacology and toxicity of *Canavalia gladiata*. *Drug Des. Dev. Ther.*, **19**: 3779–3803. https://doi.org/10.2147/DDDT.S519102

Raja, A. A., Karthikeyan, S., Geethanjali, S., Raja, P. and S. P. Thamaraiselvi. 2023. Morphological evaluation of the local genotypes of broad bean (*Vicia faba* L.) for yield attributes under the Nilgiris condition. *Int. J. Environ. Clim. Change.*, **13**: 1916–1924. https://doi.org/0.9734/IJECC/2023/v13i102849

Raja, A. A., Karthikeyan, S., Geethanjali, S., Raja, P. and S. P. Thamaraiselvi. 2025. Unveiling genetic richness: profiling broad bean diversity in the Nilgiri Hills through morphological, biochemical and SSR markers. *Plant Sci. Today.*, **12**: 3. https://doi.org/10.14719/pst.6069

Ramkumar, M., Meyase, M., Wakulkar, K. D., Kumar, V., Nishad, U., Keval, R., Rajput, R. and A. Kumar. 2025. Vegetables for ensuring nutritional requirement. *Int. J. Adv. Biochem. Res.*, **9**: 1046–1051. https://doi.org/10.33545/26174693.2025.v9.i1Sn.3678

Rockwood, J. L., Anderson, B. G. and D. A. Casamatta. 2013. Potential uses of *Moringa oleifera* and an examination of antibiotic efficacy conferred by *M. oleifera* seed and leaf extracts using crude extraction techniques available to underserved indigenous populations. *Int. J. Phytother. Res.*, **3**: 61–71. https://doi.org/10.1016/j.fshw.2016.04.001

Sharma, S., Sinha, R., Singh, A. K., Meena, Y., Pongener, A., Sharma, R., Behera, T. K. and K. Barman. 2023. An umbrella review on ethnomedicinal, pharmacological and phytochemical profile of pointed gourd (*Trichosanthes dioica* Roxb.): a bioactive healthy vegetable of Indian subcontinent. *Food Chem. Adv.*, **3**: 100433. https://doi.org/10.1016/j.focha.2023.100433

Shevkani, K., Singh, N., Patil, C., Awasthi, A. and M. Paul. 2022. Antioxidative and antimicrobial properties of pulse proteins and their applications in gluten-free foods and sports nutrition. *Int. J. Food Sci. Technol.*, **57**: 5571–5584. https://doi.org/10.1111/ijfs.15666

Sivapriya, M. and S. Leela. 2007. Isolation and purification of a novel antioxidant protein from the water extract of sundakai (*Solanum torvum*) seeds. *Food Chem.*, **104**: 510–517. https://doi.org/10.1016/j.foodchem.2006.11.060

Srivastava, S., Verma, D., Srivastava, A., Tiwari, S. S., Dixit, B., Singh, R. S. and A. K. S. Rawat. 2014. Phytochemical and nutritional evaluation of *Amorphophallus campanulatus* (Roxb.) Blume corm. *J. Nutr. Food Sci.*, **4**: 1. http://dx.doi.org/10.4172/2155-9600.1000274

Tak, J. K., Pilania, S., Dashora, A., Lakhawat, S. S. and S. Dadheech. 2021. Genetic divergence analysis in ivy gourd (*Coccinia grandis*). *Int. J. Curr. Microbiol. Appl. Sci.*, **10**: 1336–1341. https://doi.org/10.20546/ijcmas.2021.1001.159

Tareen, M. B. K., Saeed, N., Sultan, M., Chen, X., Li, J. and S. Yan. 2025. Yam as functional food: bioactive properties, health benefits and applications. *Food Nutr. Health.*, **2**: 1–29. https://doi.org/10.1007/s44403-025-00022-3

Thakur, M. 2014. Underutilized food crops: treasure for the future India. *Food Sci. Res. J.*, **5**: 174–183. https://doi.org/10.15740/HAS/FSRJ/5.2/174-183

Tribhuvan, K. U., Mishra, T., Dilip, S., Pandey, A., Kumar, S., Mahato, J. L., Raiger, H. L., Pattanayak, A. and B. K. Singh. 2024. Genic-SSR-based genetic

diversity and population structure analysis in a global germplasm collection highlights the African origin of winged bean (*Psophocarpus tetragonolobus* L.). *Genet. Resour. Crop Evol.*, **71**: 309–329. https://doi.org/10.1007/s10722-023-01624-6

Tyagi, N., Sharma, G. N. and B. Shrivastava. 2017. Phytochemical and pharmacological profile of *Praecitrullus fistulosus*: an overview. *Int. J. Indig. Herb. Drugs.*, **2**: 29–35. https://doi.org/10.9790/2402-1009032328

Verma, V. K., Pandey, A., Jha, A. K. and S. V. Ngachan. 2017. Genetic characterization of chayote [*Sechium edule* (Jacq.) Swartz.] landraces of North Eastern Hills of India and conservation measure. *Physiol. Mol. Biol. Plants.*, **23**: 911–924. https://doi.org/10.1007/s12298-017-0478-z

Wang, P., Wang, Y., Liu, S., Wang, K., Yao, Y., Liu, W., Li, D., Wang, W., Li, B. and Y. Yang. 2025. Bioactive metabolites of *Dioscorea* species and their potential applications in functional food development. *Foods.*, **14**: 2537. https://doi.org/10.3390/foods14142537