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Underutilized Vegetables: Hidden Treasures for Nutrition, Health and Sustainable Agriculture

*S Sumithra and Abinaya C

Assistant Professor (Horticulture), Department of Horticulture, College of Agricultural Technology, Theni, Tamil Nadu, India

*Corresponding Author's email: sumithrahortz@gmail.com

Underutilized vegetables are locally adapted crops that remain outside the mainstream vegetable economy despite their nutritional, cultural, ecological and economic value. Many of these crops are rich in vitamins, minerals, dietary fibre, proteins and bioactive phytochemicals, while several also possess useful tolerance to drought, heat, poor soils or other environmental stresses. Examples include amaranth, drumstick leaves, Malabar spinach, winged bean, taro, elephant foot yam, agathi and purslane. This article reviews their importance for dietary diversification, nutritional security, climate-resilient horticulture, biodiversity conservation and livelihood improvement. Greater attention to crop improvement, quality planting material, agronomic packages, post-harvest management, value addition, consumer awareness and organized marketing can help move these crops from local niche foods into commercially relevant vegetables. Mainstreaming underutilized vegetables should complement—not replace—major vegetable crops and should be supported by evidence-based nutrition and food-safety evaluation.

Keywords: underutilized vegetables; neglected crops; nutritional security; agrobiodiversity; climate resilience; value addition; sustainable horticulture.

Introduction

Vegetable production systems are increasingly expected to provide more than calories: they must supply micronutrients, diversify diets, create income and remain productive under changing climatic conditions. Yet vegetable markets tend to concentrate on a relatively small number of widely traded crops. This concentration can reduce on-farm diversity and overlook locally adapted species. Underutilized vegetables offer an opportunity to broaden the crop portfolio because many are traditionally grown and consumed in specific regions but have received comparatively less research, breeding and market development. Recent reviews describe neglected and underutilized crops as important resources for dietary diversity, agricultural resilience and sustainable food systems, particularly in South Asia. ICAR has also highlighted underexploited vegetables as resources with nutritional, medicinal, economic and climate-resilience potential.

What are Underutilized Vegetables?

The term underutilized vegetables generally refers to vegetable species or types that are locally important but have limited cultivation, research investment, formal seed systems, processing infrastructure or market demand compared with major commercial vegetables. They may be indigenous, traditional, wild-derived or introduced crops that have become confined to particular communities or seasons. Underutilization should not be interpreted as poor quality. In many cases, these crops have distinctive flavours, nutrient profiles, traditional uses and adaptation traits. However, their potential varies widely among species and cultivars, and claims about health effects should be supported by crop-specific evidence rather than generalized assumptions.

Nutritional and Health Potential

Underutilized leafy vegetables can contribute vitamins, minerals, fibre and phytochemicals to diets. Reviews of lesser-known leafy vegetables report useful amounts of nutrients such as β -carotene, ascorbic acid, riboflavin, folate, iron, calcium and phosphorus, although concentrations vary substantially with species, plant part, maturity and environment. Selected underutilized vegetables have also attracted research interest for their phytochemical diversity. A review covering underutilized vegetables and other crops reported nutritional and phytochemical potential in examples including Moringa and nightshade, with opportunities for incorporation into functional foods. Nutrition should nevertheless be considered in the context of preparation. Some crops contain antinutritional compounds or naturally occurring substances that can be reduced through appropriate cooking, soaking, fermentation or other validated processing methods. For example, taro leaves require proper cooking because raw leaves contain calcium oxalate and other compounds that can limit safe palatability and nutrient utilization.

Selected Underutilized Vegetables

Amaranth

Vegetable amaranths are fast-growing leafy crops valued for their micronutrients, fibre and phytochemicals. Their broad adaptation and tolerance to several abiotic stresses make them attractive for diversified production. Amaranth has been described as a nutrient-dense, climate-smart crop with useful drought-tolerance traits.

Drumstick leaves (Moringa)

Moringa leaves are widely used in South Asian food traditions and provide protein, minerals, vitamins and bioactive compounds. Leaves can be consumed fresh or processed into powders and other value-added foods. Nutritional composition depends on leaf age, environment and processing.

Malabar spinach

Basella is a succulent leafy vegetable suited to warm conditions. Young leaves and tender shoots are used in curries, soups and stir-fries. Its mucilaginous texture provides opportunities for traditional and innovative culinary products.

Winged bean

Winged bean is notable because several plant parts—including immature pods, leaves and seeds—can be used as food. Its protein-rich seeds and nitrogen-fixing ability give it potential in diversified, resource-efficient farming systems.

Taro and elephant foot yam

Taro and elephant foot yam are important traditional tuber crops. They supply carbohydrates and fibre and can be processed into cooked foods, chips, flour and other products. Proper processing is important for palatability and reduction of antinutritional factors.

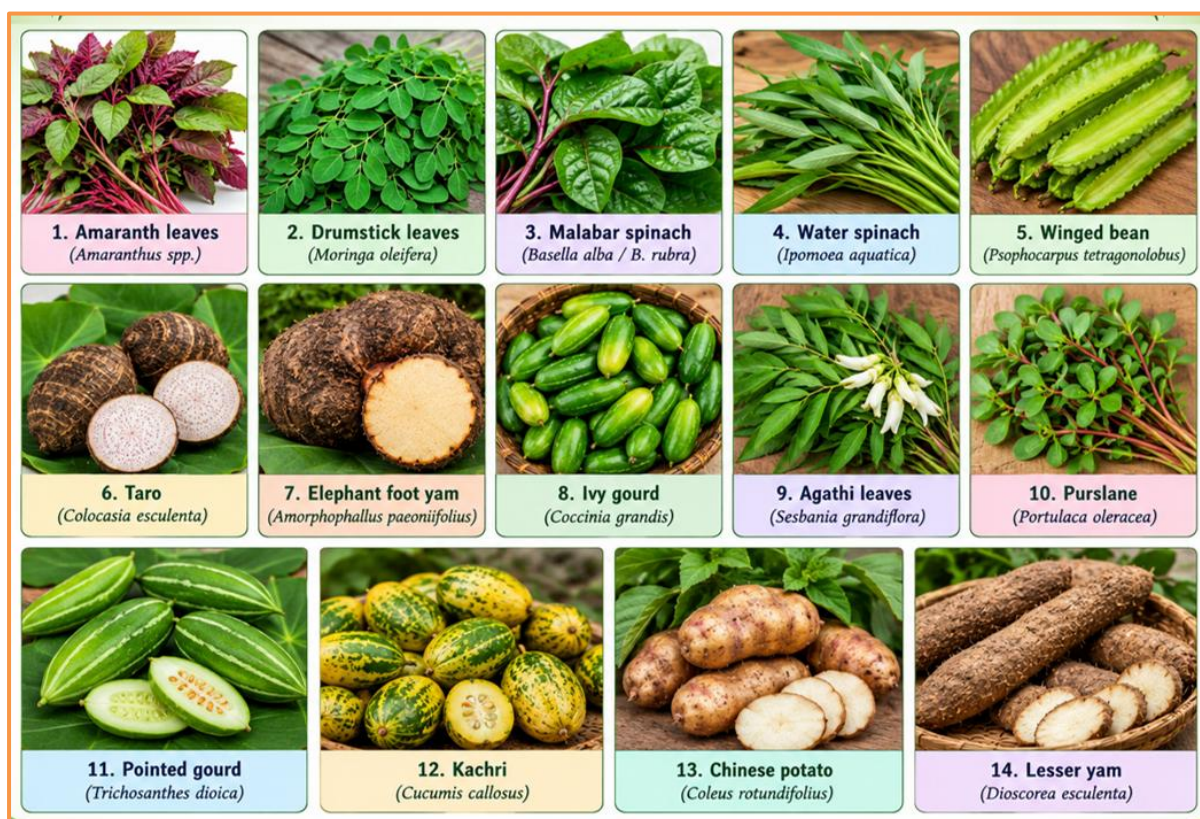
Agathi and purslane

Agathi leaves and purslane are examples of locally consumed greens that can diversify diets. Their edible leaves can be used in cooked dishes, soups, chutneys and other traditional preparations. Nutrient composition should be assessed for specific accessions and production environments.

Table 1. Nutritional highlights and potential food applications of selected underutilized vegetables. Values and nutrient emphasis are qualitative because composition varies among species, cultivars, plant parts and production conditions.

Vegetable	Scientific name	Nutritional highlights	Potential uses
Amaranth leaves	<i>Amaranthus spp.</i>	Iron, calcium, potassium, vitamins A/C, fibre, antioxidants	Curries, soups, puree, dried powder, fortified foods
Drumstick leaves	<i>Moringa oleifera</i>	Protein, calcium, iron, vitamins and bioactive compounds	Curry, soup, chutney, leaf powder, functional foods

Vegetable	Scientific name	Nutritional highlights	Potential uses
Malabar spinach	<i>Basella alba</i> / <i>B. rubra</i>	Vitamins A/C, minerals, fibre and antioxidant compounds	Curries, soups, stir-fries, pickles
Water spinach	<i>Ipomoea aquatica</i>	Iron, carotenoids, vitamin C and fibre	Stir-fry, curry, soup
Winged bean	<i>Psophocarpus tetragonolobus</i>	Protein, minerals; multiple edible plant parts	Pods, seeds, flour, protein-rich products
Taro	<i>Colocasia esculenta</i>	Starch, fibre and minerals	Boiled/steamed foods, flour, chips, curries
Elephant foot yam	<i>Amorphophallus paeoniifolius</i>	Carbohydrates, fibre and minerals	Curries, roast, chips, flour, pickles
Ivy gourd	<i>Coccinia grandis</i>	Fibre, vitamin C, carotenoids and phytochemicals	Curries, stir-fries, pickles
Agathi leaves	<i>Sesbania grandiflora</i>	Calcium, iron, protein and fibre	Cooked greens, curry, soup
Purslane	<i>Portulaca oleracea</i>	Omega-3 fatty acids, vitamins, minerals and antioxidants	Salads, curries, soups, chutneys
Pumpkin leaves	<i>Cucurbita spp.</i>	Provitamin A carotenoids, vitamin C, calcium, iron, fibre	Cooked greens, soups, dried powder
Pointed gourd	<i>Trichosanthes dioica</i>	Vitamins, minerals, fibre and phytochemicals	Curries, stuffing, pickles, processing



Role in Climate-Resilient Horticulture

Diversification with locally adapted crops can spread production risk and strengthen the resilience of farming systems. Some underutilized crops possess tolerance to heat, drought, marginal soils or seasonal variability, although resilience is crop- and genotype-specific.

Research on underutilized crops indicates that their physiological traits can contribute to adaptation under water stress and other climate uncertainties. In South Asian cropping systems, recent synthesis research identifies underutilized and neglected crops as potential contributors to dietary diversity, ecological sustainability and climate resilience. It also emphasizes the need for breeding, market development and supportive policy to unlock their potential.

Economic and Value-Addition Opportunities

Commercialization requires more than demonstrating nutrient content. Farmers need reliable planting material, production recommendations, predictable yields, post-harvest handling, aggregation and remunerative markets. Value addition can improve marketability by converting seasonal or perishable vegetables into powders, pickles, dehydrated products, chips, ready-to-cook foods, soups and functional ingredients. Small-scale processing enterprises can create opportunities for women and rural youth when linked with farmer groups, local institutions, food processors and digital marketing. Product development should prioritize sensory acceptance, shelf life, food safety, nutrient retention and realistic production costs.

Major Constraints

Limited availability of quality seed, planting material and elite cultivars.
Insufficient crop-specific agronomic, nutritional and post-harvest research.
Short or highly seasonal supply and weak market linkages.
Limited consumer awareness outside traditional production areas.
Variability in yield, appearance, shelf life and processing quality.
Insufficient standardized food-composition and safety information for many species.
Low investment in breeding, mechanization and value-added product development.

Strategies for Mainstreaming

Characterize and conserve local germplasm while identifying superior, nutrient-dense and market-preferred types.
Develop improved varieties and location-specific production packages.
Strengthen seed and planting-material systems and farmer training.
Promote nutrition education and culturally appropriate recipes.
Develop safe, convenient and affordable value-added products.
Build producer groups and short supply chains connecting farmers with retailers, institutions and processors.
Generate reliable evidence on nutrient composition, bioactive compounds, antinutrients, food safety and consumer acceptance.
Integrate underutilized vegetables into climate-smart and diversified horticultural systems where agronomically suitable.

Future Prospects

The future of underutilized vegetables lies in combining traditional knowledge with modern horticultural science. Genebank resources, participatory breeding, rapid nutritional screening, digital extension, protected cultivation, precision irrigation and low-cost processing technologies can accelerate their development. Recent ICAR initiatives emphasize mainstreaming traditional and underutilized crop resources as part of broader agrobiodiversity and climate-resilience efforts. Research should move toward whole-value-chain approaches: from germplasm and production to nutrition, processing, branding and markets. This can transform underutilized vegetables from locally confined foods into sustainable niche crops without eroding their traditional diversity.

Conclusion

Underutilized vegetables represent a valuable but underdeveloped component of diversified horticulture. Their contribution extends beyond food: they can support micronutrient-rich

diets, agrobiodiversity, farmer livelihoods and climate-resilient production. However, their promotion should be evidence-based, crop-specific and market-oriented. Coordinated efforts in breeding, production technology, nutrition research, food safety, value addition, consumer education and market development can unlock their potential. Recognizing these vegetables as strategic components of future food systems can help build horticulture that is more diverse, nutritious, resilient and economically inclusive.

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