

Hidden Harvests: Unlocking the Potential of Neglected and Underutilized Vegetable Species (NUVS)

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Abstract

As the global population surges towards 9 billion, the dual challenges of climate change and "hidden hunger" (micronutrient malnutrition) loom large. Modern agriculture, with its over-reliance on a narrow basket of staple crops, has inadvertently marginalized a treasure trove of biodiversity (FAO, 2024). This article explores the untapped potential of Neglected and Underutilized Vegetable Species (NUVS). By synthesizing the agronomic superiority of these crops with the sociological insights of agricultural extension, we present a roadmap for mainstreaming India's forgotten superfoods.

Introduction: The Green Revolution's Unintended Shadow

The Green Revolution was an undisputed triumph of caloric security, ensuring that India produced enough wheat and rice to feed its millions. However, as we move through the 21st century, we face a second-generation challenge: the homogeneity of our diet. While our granaries are full, our nutritional security is compromised.

According to the FAO, of the 30,000 edible plant species known to humanity, only about 30 provide 95% of the world's food energy (FAO, 2024). This dietary simplification has led to the marginalization of thousands of Neglected and Underutilized Vegetable Species (NUVS). These are crops that have sustained civilizations for millennia, providing food, fiber, fodder, and medicine, but have been ignored by formal research, extension services, and policy frameworks.

2. Defining the Scope: What are NUVS?

- **Neglected:** Crops that are grown primarily by traditional farmers in their ecosystems (e.g., *Bathua* or *Chenopodium*). They are "neglected" because they lack formal seed supply systems and research attention.
- **Underutilized:** Crops with documented potential for broader economic value but are currently

limited by geography, lack of processing technology, or social stigma (e.g., *Winged Bean*).

In the context of the Indian subcontinent, these include wild leafy vegetables, roots, tubers, and specific legumes that are often harvested from the wild or maintained in small, informal kitchen gardens.

3. The Vegetable Science Perspective: Nutritional & Agronomic Superiority

From a botanical standpoint, the "weeds" of today are often the "superfoods" of tomorrow. Breeding programs for commercial crops like tomato and cauliflower have historically focused on yield, shelf-life, and visual uniformity, often effectively breeding out nutrient density. In contrast, wild vegetables retain their phytochemical richness.

3.1 The Nutrient Gap: A Comparative Analysis

Biochemical analysis reveals that NUVS are superior sources of critical micronutrients, particularly Iron, Calcium, and Vitamin A (Kumar and Singh, 2024).

Nutrient	Spinach (Commercial)	Stinging Needle (Indigenous)	<i>Chenopodium</i> (Bathua)	<i>Moringa</i> Leaves
Protein (g)	2.0	6.5	4.2	6.7
Iron (mg)	2.7	10.0	4.0	7.0
Calcium (mg)	73	481	150	440
Vitamin C (mg)	28	25	35	220
Fiber (g)	2.2	4.0	3.8	0.9
Beta Carotene (µg)	2800	5000+	1700	6700

[Data Source: Compilation of ICAR & NIN Nutrient Databases]

Table 1: Nutritional Comparison of Commercial vs. Indigenous Vegetables (Per 100g)

As shown in **Table 1**, species like Stinging Nettle (*Bichu Booti*) and *Moringa* provide vastly superior micronutrient profiles. For rural populations suffering from anaemia, these are not just vegetables; they are affordable nutraceuticals.

3.2 Climate Resilience: The Genetic Insurance Policy

Climate change is the greatest threat to modern horticulture. Rising temperatures and erratic rainfall devastate sensitive exotic crops like Broccoli and Capsicum. However, NUVS are inherently Climate-Smart:

- **C4 Photosynthesis:** Crops like *Amaranthus* possess the C4 pathway, allowing them to photosynthesize efficiently even in high heat and drought conditions where C3 crops (like rice or wheat) fail.

- **Hardiness:** Wild relatives of brinjal and okra found in forests carry genes for resistance against the Shoot and Fruit Borer and bacterial wilt. These genes are invaluable for modern breeding programs.
- **Low Input Requirement:** Most NUVS require little to no fertilizer or pesticide, making them ideal for organic and regenerative agriculture.

4. Profiles of Promising Candidates

The following are the three crops with immense potential in the Indian landscape, particularly in the Himalayan regions (Bhatia and Sharma, 2023).

A. Fiddlehead Fern (*Diplazium esculentum*) - The Himalayan Delicacy

Locally known as *Lingdu* or *Kasrod* in Himachal Pradesh and Northern India.

- **Botany:** It belongs to the *Athyriaceae* family. It is a non-cultivated fern that grows along water streams and damp forests.
- **Utilization:** The young, coiled fronds are harvested before they unfurl. They are rich in Omega-3 fatty acids and antioxidants.
- **Market Potential:** Currently sold in local markets at premium prices during the monsoon, but supply is erratic due to lack of domestication.

B. Winged Bean (*Psophocarpus tetragonolobus*) - The "Supermarket on a Stalk"

- **Botany:** A tropical legume where almost every part is edible.
- **Utilization:** The tender pods are eaten as vegetables; the leaves like spinach; the flowers in salads; and the tuberous roots are richer in protein (20%) than potatoes.
- **Market Potential:** An excellent candidate to replace soybean in protein-deficient regions.

C. Spine Gourd (*Momordica dioica*) - The Kartoli

- **Botany:** A dioecious cucurbit native to the Indian subcontinent.
- **Utilization:** Unlike the bitter gourd, it is not bitter. It is highly valued for its high protein content among gourds and its medicinal property of regulating blood sugar (anti-diabetic).

5. Socio-Economic Dimensions

While the biological potential is clear, the failure of these crops to take off is a sociological issue. Extension science provides the frameworks to diagnose these barriers and design adoption strategies (Mishra and Ray, 2025).

5.1 Constraints Analysis: The SWOT Grid

Strengths	Weaknesses
<ol style="list-style-type: none"> 1. High nutritional density 2. Zero input cost (often wild harvested) 3. Cultural acceptance in tribal belts 4. High tolerance to biotic/abiotic stress 	<ol style="list-style-type: none"> 1. Lack of quality seed material (Germplasm). 2. Poor shelf life (rapid wilting) 3. Presence of anti-nutritional factors (e.g., oxalates) requiring specific cooking knowledge 4. Erratic supply chain
Opportunities	Threats
<ol style="list-style-type: none"> 1. Growing urban demand for 'Organic' & "Exotic" foods. 2. Potential for Geographical Indication (GI) tagging. 3. Value addition (pickles, powders). 4. Integration into Mid-Day Meal schemes. 	<ol style="list-style-type: none"> 1. Habitat loss due to urbanization and deforestation. 2. Erosion of Indigenous Technical Knowledge (ITK). 3. 'Weed' perception by younger generations.

Table 2: SWOT Analysis of Promoting NUVS in Indian Markets

5.2 The "Stigma of Poverty"

A major psychological barrier observed in field extension work is the association of these foods with poverty. In many villages, serving Bathua or Nettle to a guest is considered disrespectful, whereas serving Paneer or Cauliflower is a sign of prosperity.

Extension Strategy: We need a "**re-branding**" campaign. Just as Millet was rebranded as "Shree Anna" (divine grain), NUVS need to be positioned as "*Himalayan Superfoods*" or "*Heritage Greens*" to appeal to the aspirational rural and urban youth.

5.3 Gender and Biodiversity

Women are the primary custodians of NUVS. In traditional agrarian structures, men manage the cash crops (wheat/apple), while women manage the kitchen gardens where these diverse species thrive.

Extension programs must specifically target women Self-Help Groups (SHGs). Empowering women with the technology to process and sell these vegetables ensures the knowledge is passed

down and the income goes directly to household nutrition (Singh and Thakur, 2022).

6. The Road Ahead: A Collaborative Strategic Framework

A multi-stakeholder strategy involving research, extension, and policy can be employed to mainstream these crops (Mishra and Ray, 2025).

6.1 Research & Breeding Interventions

- **Domestication:** Vegetable scientists must select superior genotypes from the wild. We need varieties of *Lingdu* that can be grown in fields rather than just foraged, and *Spine Gourd* varieties with higher fruit set.
- **Seed Technology:** Developing standardized seed production protocols is critical so farmers don't have to rely on wild foraging.

6.2 Extension & Marketing Interventions

- **Recipe Standardization:** KVKs (Krishi Vigyan Kendras) should document traditional recipes and modify them for modern palates (e.g., *Moringa Soup* or *Amaranth Granola Bars*).
- **Value Addition:** Since leafy vegetables wilt fast, simple technologies like *Solar Drying* and *Zero Energy Cool Chambers (ZECC)* must be introduced at the village level to extend shelf life.
- **Market Linkage:** Organizing farmers into *FPOs* (Farmer Producer Organizations) to aggregate produce. Connecting tribal farmers directly to urban organic stores helps bypass the middleman and secures a premium price.

6.3 Policy Interventions

Public Procurement: If the government mandates the inclusion of one local vegetable in the ICDS (Anganwadi) and Mid-Day Meal schemes per week, it would instantly create a massive, stable market demand.

7. Conclusion

The path to sustainable agriculture is not always about inventing something new; sometimes, it is about remembering what we have forgotten. Neglected and Underutilized Vegetable Species offer a robust solution to the triple burden of malnutrition, climate change, and rural poverty. By working together, we can turn these "weeds" into the "wealth" of the future.

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