



EXPORT POTENTIAL OF UNDERUTILISED EXOTIC VEGETABLES OF NORTH-EAST INDIA

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INTRODUCTION

India ranks second globally in fruit and vegetable production yet accounts for approximately one per cent of world horticultural trade. The national export basket remains concentrated in a narrow set of commodities, and the North-Eastern Region contributes almost nothing to it despite an agro-biodiversity endowment unmatched elsewhere in the country.

The NER which includes the states of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura occupies about eight per cent of India's geographical area and shares 5,182 km of international boundary with China, Myanmar, Nepal, Bhutan and Bangladesh, positioning it as the country's land gateway to ASEAN. Roughly two-thirds of the region is hilly, which precludes large-scale mechanised agriculture but confers a comparative advantage in horticulture. Because cultivation continues largely by traditional methods with negligible chemical inputs, producers of the region are, in effect, organic by default.

Within this system exists a large body of indigenous species such as bamboo shoot, tree bean, elephant apple, king chilli, tree tomato, roselle, perilla and others that are dietary staples locally but qualify as "exotic" in international trade.

EXPORT PERFORMANCE OF THE NORTH-EASTERN REGION

The region's current position must be understood before potential is assessed. Analysing APEDA-DGCIS data for 2010–11 to 2020–21 NER fruit exports grew at a compound annual rate of 19.9 per cent in quantity and 39.1 per cent in value, while vegetable exports grew at 48 per cent and 60 per cent respectively. These growth rates are impressive but deceptive: instability indices, computed using the Cuddy–Della Valle method,

stood at 76.93 and 54.98 per cent for fruit quantity and value, and at 91.37 and 97.07 per cent for vegetables, which is extreme volatility by any standard classification.

The region's average contribution over the period was 0.97 per cent of India's fruit export quantity and 0.27 per cent of value; for vegetables, both figures were approximately 0.02 per cent. Concentration analysis using the Gini–Herfindahl–Hirschman Index showed values of 1.0 for vegetables between 2010–11 and 2012–13, indicating that a single crop which is tomato constituted the entire vegetable export basket. Diversification has since improved modestly.

Aggregate agricultural export earnings from the region rose from USD 2.52 million to USD 17.2 million between 2016–17 and 2021–22, a growth of 85.34 per cent. Bangladesh and Bhutan remain the dominant destinations.

The implication is clear. The region has an export sector at a nascent stage, dominated by conventional crops in which it holds no particular advantage, while the crops in which its advantage is greatest remain untraded.

PRIORITY SPECIES

1. Bamboo shoot

Bamboo shoot represents the largest volume opportunity. India holds the world's largest bamboo area, with the North-East accounting for the bulk of the resource. Over eighty species are used by communities in the region, of which approximately fifteen have commercial importance and only eight to ten enter markets as food. Consumption is substantial: surveys across the North-Eastern Himalayan region covering 118 markets and 1,200 vendors estimated annual consumption of fermented, roasted and boiled shoots at approximately 680 tonnes, with Arunachal Pradesh alone accounting for 481

tonnes.

Nutritionally, juvenile shoots are rich in protein, carbohydrate, minerals and dietary fibre, low in fat and sugar, and contain phytosterols and bioactive phenolics that support classification as a functional food ingredient. The global bamboo shoot market is measured in billions of US dollars and continues to expand at approximately four per cent annually, driven by Asian cuisine, plant-based diets and high-fibre food demand. Canned and processed shoots dominate world trade; fresh shoots constitute a negligible share owing to rapid post-harvest lignification.

The reclassification of bamboo grown on non-forest land as a grass, effected through amendment of the Indian Forest Act, removed the transit-permit barrier that had constrained commercial cultivation, and the National Bamboo Mission has since supported processing capacity.

Constraint: shoots contain cyanogenic glycosides, principally taxiphyllin, which must be reduced by boiling, fermentation or other validated processing before consumption. Export-grade protocols and testing capacity are prerequisites, not refinements.

Recommended export form: canned shoot in brine, vacuum-packed boiled shoot, dried and fermented products, dietary-fibre ingredient fractions. Target markets: USA, UK, EU, Australia, Gulf states.

2. Tree bean (*Parkia timoriana* DC. Merr., syn. *P. roxburghii* G. Don)

The tree bean presents the clearest case of pre-existing, unserved overseas demand. Known as yongchak in Manipuri, zawngtah in Mizo, khorial in Assamese and urohi locally, it is congeneric with the Southeast Asian petai or stink bean (*P. speciosa*) and is sold as petai or pete in Indonesia, Malaysia and Singapore. Frozen and brined petai is a standard retail item across Southeast Asia and in Asian grocery chains in the United Kingdom, the Netherlands, Australia and the Gulf.

The species is a fast-growing leguminous tree of 10–20 m grown in home gardens, jhum fallows and marginal land across the region, with pods available from approximately October to March. Flowers, tender pods and seeds are all edible and are nutritionally superior in protein, minerals and vitamins to several conventional legumes. Processing method materially affects composition;

Recommended export form: frozen shelled

beans, brined beans, pickled and dried pods, freeze-dried powder for the ingredient trade. Target markets: Malaysia, Singapore, Thailand, UK, Netherlands, UAE, Australia.

3. Elephant apple (*Dillenia indica* L.)

Botanically a fruit but used almost exclusively as a culinary vegetable in Assamese fish curries, dals, chutneys and pickles, elephant apple (ou tenga, chalta) is among the region's most abundant and most wasted resources. The species grows wild across South and Southeast Asia, including India, Bangladesh, Nepal, Myanmar, Thailand and Sri Lanka.

Fruit, leaves and bark are rich in protein, minerals, crude fibre, carbohydrate, vitamin C, tannins, malic acid and glucose, and documented an extensive phytochemical profile with antidiabetic, anti-inflammatory, antioxidant, antimicrobial and hepatoprotective activity. The authors specifically note that the species' commercial production remains under-utilised relative to its economic value.

The fresh fruit is bulky and fibrous, making direct export impractical. The realistic route is entirely through processing, which is also where value addition is greatest.

Recommended export form: pickles, jams, jellies, squash and ready-to-serve beverages, dehydrated slices, standardised extracts for the nutraceutical trade. Target markets: Bangladesh, Nepal, UK, Gulf (diaspora); ingredient buyers in EU and USA. Constraint: almost entirely wild-harvested, with no varietal standardisation or organised orchards.

4. Naga king chilli / Bhut Jolokia (*Capsicum chinense* Jacq.)

This is the most export-proven crop in the basket. In replicated trials at Las Cruces, New Mexico, Scoville heat units of 1,001,304 for Bhut Jolokia sourced from Assam, establishing it as the world's hottest known chilli at that time; molecular analysis using RAPD markers identified it as a *C. chinense* cultivar with probable introgression from *C. frutescens*. The Guinness World Records confirmation followed in 2007, and GI certification was granted.

The first commercial export of fresh king chilli occurred in July 2021, when APEDA, working with the Nagaland State Agricultural Marketing Board, air-freighted a 250 kg consignment sourced from Tening in Peren district, Nagaland, packed at an APEDA-assisted packhouse in Guwahati, to

London. Laboratory testing conducted in June and July 2021 confirmed that the produce was organically grown, and a phytosanitary certificate was issued by the Plant Quarantine Station, Guwahati.

The significance of this consignment lies less in its volume than in its demonstration effect: a highly perishable NER product cleared quarantine, obtained certification and reached a European buyer through regional infrastructure. Commercially, however, fresh chilli is the most difficult form to trade, and value resides downstream.

Recommended export form: dried whole and flakes, oleoresin and capsaicin extracts, hot sauces and pastes, pharmaceutical-grade capsaicin. Target markets: USA and UK specialty hot-sauce industry, EU extract buyers, pharmaceutical capsaicin buyers, Japan.

5. Bird's eye chilli / Mizo chilli (*Capsicum frutescens* L.)

GI-tagged and cultivated almost entirely organically on jhum land in Mizoram, bird's eye chilli benefits from being a globally recognised ingredient rather than a novelty, which materially simplifies market access. The Government of Mizoram announced the first consignment of 7.5 metric tonnes of organic bird's eye chilli for export to the United States following organic confirmation testing. Small fruit size gives a favourable dried-weight-to-freight ratio, an underrated advantage for a landlocked region.

6. Second-tier species

DEMAND-SIDE DRIVERS

Four convergent trends favour this basket.

Ethnic and diaspora retail: Southeast Asian and South Asian food retail is expanding faster than mainstream grocery in the UK, USA, Canada, Australia and the Gulf. Petai, bamboo shoot and bird's eye chilli are already established products in these channels; the requirement is supply, not demand creation.

Organic and clean-label premium: The low-input character of NER cultivation supports a credible organic claim, with Sikkim fully certified. In markets where maximum residue limits are the primary rejection risk, this converts into price premium rather than mere positioning.

The superhot chilli segment: Specialty hot-sauce and extract markets in North America and Europe actively seek authenticated high-capsaicin material, a segment in which a GI-tagged, organically grown chilli of over one million SHU has a defensible and non-replicable position.

INSTITUTIONAL AND INFRASTRUCTURAL ENABLERS

Policy support has strengthened considerably over the past decade.

Geographical Indications: Twenty-nine GIs from the NER are registered, of which approximately eighteen belong to the agri-horticultural sector, including Naga Chilli, Mizo Chilli, Naga Tree Tomato, Naga Sweet Cucumber, Kachai Lemon, Chak-Hao, Tripura Queen Pineapple, Karbi Anglong Ginger, Tezpur Litchi, Khasi Mandarin, Memang Narang and Sikkim Large

Table 1. Additional NER species with export potential

Common name	Botanical name	Principal states	Status	Indicated export form
Naga tree tomato (tamarillo)	<i>Solanum betaceum</i> Cav.	Nagaland, Manipur	GI-tagged	Pulp, juice concentrate, chutney
Naga sweet cucumber	<i>Cucumis sativus</i> L.	Nagaland	GI-tagged	Fresh (regional), pickles
Sirarakhong hathei chilli	<i>Capsicum</i> spp.	Manipur	GI-tagged	Dried, powder, paste
Dalle khursani	<i>Capsicum</i> spp.	Sikkim	GI-tagged	Paste, sauce, pickle
Lakadong turmeric	<i>Curcuma longa</i> L.	Meghalaya	High curcumin	Powder, oleoresin
Roselle	<i>Hibiscus sabdariffa</i> L.	Assam, Mizoram	Non-GI	Dried calyces, herbal tea, jam
Perilla	<i>Perilla frutescens</i> (L.) Britton	Manipur, Nagaland	Non-GI	Seed, culinary oil, ingredient
Colocasia / taro	<i>Colocasia esculenta</i> (L.) Schott	Assam, Meghalaya	Trial-exported	Fresh, flour, chips
Wild yam	<i>Dioscorea</i> spp.	Assam, Meghalaya	Non-GI	Flour, resistant-starch ingredient
Sawtooth coriander	<i>Eryngium foetidum</i> L.	Region-wide	Non-GI	Fresh herb, dried, paste

Cardamom. Registration was driven substantially by NERAMAC with support from the North Eastern Council, and roughly 800 farmers have been authorised as GI users.

APEDA infrastructure: Packhouses have been established in Assam, Sikkim and Mizoram; direct agri-export clearance operates at Guwahati airport; and over 130 capacity-building programmes and 22 international buyer-seller meets have been organised across the region.

Air logistics: The Krishi UDAN 2.0 scheme, launched in October 2021 across 53 airports with explicit focus on North-Eastern and tribal regions, provides assistance for air movement of agricultural produce, critical where sea freight is unavailable.

CONSTRAINTS

Freight economics and perishability: The region is landlocked. Perishables must move by air at 8–10 times sea-freight cost, or overland to Kolkata with substantial transit loss. This single factor is the strongest argument for a processing-led export strategy.

Cold-chain deficit: The eight NER states together hold only 69 cold storage units with an aggregate capacity of approximately 2.56 lakh MT, of which Assam alone accounts for 39 units and 1.78 lakh MT; Manipur and Sikkim have two units each.

Wild harvest and supply irregularity: Tree bean, elephant apple and most bamboo shoot supply originate from wild or semi-wild stands. There are no released varieties for most species, no grading standards, and consequently no capacity to guarantee consistent volume and quality, the actual determinant of export contracts.

Regulatory novelty: The most underestimated barrier. Under Regulation (EU) 2015/2283, any food not consumed to a significant degree within the European Union before 15 May 1997 requires Novel Food authorisation through a dossier-based application. Several NER species, including tree bean and elephant apple, are likely to fall within scope. Establishing a history of consumption or initiating authorisation is a precondition for EU market entry.

Fragmentation and weak aggregation: Small holdings, thin farmer organisation and low FPO density prevent assembly of container-scale consignments. Export trade in the region remains largely unorganised and controlled by a small number of private traders operating on temporary

negotiations.

Statistical invisibility: Most of these crops lack dedicated HS codes, so their trade does not appear in official statistics which in turn weakens the evidentiary basis for policy support.

STRATEGIC FRAMEWORK

Prioritise processed over fresh forms. Freight economics and shelf life converge on this conclusion. Canned bamboo shoot, brined tree bean, dried chilli and elephant apple preserves are tradable; fresh produce largely is not.

Domesticate wild species. Varietal selection, nursery development and agronomic packages for *P. timoriana*, *D. indica* and priority edible bamboos should constitute the immediate research and extension agenda. Tree bean plantation on degraded jhum fallows achieves ecological restoration and export supply simultaneously.

Build crop-specific clusters around FPOs, aligned with the District as Export Hub framework, each linked to an anchor buyer, following the crop-specific organic cluster model.

Convert GI registration into a commercial instrument. A GI is presently a certificate; it must become a brand with authorised-user enforcement, packaging identity and traceability. GI combined with organic certification is the region's strongest differentiator.

Initiate regulatory work in parallel with production development, including EU Novel Food scoping, US FDA facility registration and importing-country residue compliance.

Sequence markets ASEAN-first. Thailand, Malaysia, Singapore and Vietnam already consume these foods, are geographically proximate, and impose fewer novelty barriers. Success there builds the volume and quality systems required for Western markets.

Locate value addition within the region. Oleoresin and capsaicin extraction, freeze-drying and controlled fermentation units sited in the NER retain margin with regional stakeholders rather than transferring it to processors elsewhere.

CONCLUSION

The exotic vegetables of North-East India are not a marginal curiosity. They constitute a set of crops with documented nutritional and bioactive properties, credible organic credentials, GI protection and in several cases, established overseas demand that India does not currently serve. The Bhut Jolokia consignment to London and the Mizo chilli shipment to the United States

demonstrate that the export pathway is operationally open.

What remains is the unglamorous institutional work: domesticating wild species, standardising processing, aggregating producers, resolving regulatory barriers and building brands around GI tags already granted. Executed effectively, this converts a subsistence resource into an income stream for some of India's most remote farming households and repositions the region's geographic isolation as what it in fact is India's doorstep to Southeast Asia.

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