



**Nutritional Profiling,
Mass Multiplication and
Promotion of Scientific
Cultivation of
Indigenous Wild Edible
Fruits in Nagaland for
Nutritional Security and
Sustainable Income
Generation for
Farmers.**



Dr. M. MATHIYAZHAGAN

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1. Introduction to project:

- Nagaland, a biodiversity-rich state in Northeast India, harbors a wide range of **indigenous wild edible fruit species** that are deeply integrated into the diet and culture of local tribes.
- These fruits are rich in **vitamins, minerals, antioxidants, and phytochemicals**, offering immense potential for improving **nutritional security** and **health** in rural communities.
- However, most of these fruits remain **underutilized** due to limited scientific research, lack of organized cultivation practices, and insufficient market linkage.
- They are primarily collected from forests resources, making supply irregular and unsustainable.
- With increasing nutritional deficiencies and rural unemployment, promoting the **scientific cultivation and commercial utilization** of these fruits can address **both malnutrition and livelihood generation**.
- Scientific **nutritional profiling** and **mass multiplication** through modern propagation techniques (like tissue culture and grafting) can ensure consistent quality and availability.
- Therefore, present study aims to focus on the following wild indigenous fruits such as *Solanum betaceum* (**wild tomato**), *Citrus maxima* (**Pomelo**) and *Docynia indica* (**wild apple**).



2. Project Objectives:

1. **Germplasm exploration and Collection** - To conserve native genetic resources, biodiversity documentation and future programs on **nutritional profiling, mass multiplication, and scientific cultivation** for livelihood enhancement and sustainable use.
2. **Nutritional and Phytochemical Profiling** - To analyse the nutritional composition (macronutrients, micronutrients, vitamins, minerals) and bioactive compounds (antioxidants, phenolics, flavonoids) of selected fruits and to assess their potential contribution to dietary nutrition and health benefits.
3. **Mass Multiplication and Propagation Techniques**- To develop and standardize the efficient propagation protocols (cutting, grafting, tissue culture, etc.) and to establish nursery models for large-scale plant production.
4. **Scientific Cultivation and Agro-Techniques**- To improve location-specific agro-techniques for commercial cultivation and to assess growth performance under different agro-climatic conditions.
5. **Capacity Building and Farmer Training** - awareness and training programs for farmers and local youth on propagation and cultivation.
6. **Conservation and Sustainable Utilization** - To promote in situ and ex situ conservation of wild edible fruit species to integrate the traditional knowledge with modern conservation strategies for sustainable use.



3. Methodology and implementation approach (1):

Germplasm exploration and Collection –

- **Sampling site:** Kohima, Mokokchung, Wokha and Phek
- **Number of tress/plants per species:** Minimum of 10 matured healthy individuals per species from selected districts of Nagaland.

Nutritional and Phytochemical Profiling –

Sample collection and Pre – processing: Harvest 2–3 kg fruit per tree in sterile polythene bags, surface cleaning with Dis. water, peel and separate the edible pulp, homogenize the fresh pulp for assays. Fresh aliquots or dry sample.

Assays: Macronutrients – K, Na, Ca, Mg, P

Micronutrients- Fe, Zn, Mn, Cu, Se, etc.

Vitamin, Sugar, Fatty acid, Amino Acids

Phytochemical - Total phenolic content, Total flavonoid content, Tanins

Antioxidant assay- DPPH (2,2-diphenyl-1-picrylhydrazyl).

Instruments: Analytical balance, oven, muffle furnace, Kjeldahl apparatus, Soxhlet, centrifuge, HPLC, GC-MS, spectrophotometer, lyophilizer.

3. Methodology and implementation approach (2):

Mass Multiplication and Propagation Techniques

- Selection of elite mother plants (high yield, disease-free).
- Preparation of large-scale stem cuttings.
 - Tissue Culture –
 - **Explant Selection**-shoot tips, nodal segments, or apical meristems
 - **Surface Sterilization**- 70% ethanol, 0.1% HgCl₂ or 1–2% NaOCl (5–8 min).
 - **Culture Media** – MS (Murashige and Skoog)
 - shoot induction - (MS + **BAP (1.0–2.0 mg/L)** + **NAA (0.1 mg/L)**)
 - shoot multiplication (MS + **BAP (2–3 mg/L)** + **Kn (0.5–1 mg/L)**)
 - Rooting - MS + **IBA (0.5–1.0 mg/L)** or **NAA 0.5 mg/L**.
 - **Hardening & Acclimatization.**
 - **Field transplantation**

Scientific Cultivation and Agro-Techniques – location specific agrotechniques to assess growth performance.

Capacity Building and Farmer Training – Awareness and training

Conservation and Sustainable Utilization – in situ & ex situ conservation

6.Social and nutrition impact pathway – Project outcomes/Impact:



•Outcomes-

- Increased household consumption of nutrient-rich indigenous fruits,
- Reduced micronutrient deficiencies,
- Improved dietary diversity in tribal households,
- Strengthening of tribal knowledge systems and cultural food heritage.
- Increased participation of **women and youth** in fruit cultivation and processing
- Reduced dependence on nursery and imported fruits.
- Increased farmer income from sale of fruits and planting materials.
- Expanded livelihood opportunities (nursery raising, processing, marketing).

•Impacts –

- Regular access to nutrient-rich indigenous fruits at household and community level.
- Long-term reduction in malnutrition, anemia, and vitamin deficiencies.
- Creation of local, climate-resilient food systems tailored to Nagaland's ecology.
- Increased annual income for tribal farmers through orcharding and value addition.
- Youth employment through agro-processing, nursery operations, and marketing.

Slide 6. Environmental and climate advantages

- Systematic cultivation reduces the threat of local extinction caused by overharvesting from wild forests.
- Germplasm conservation ensures long-term survival of the species
- Mass multiplication through scientific methods preserves elite, disease-resistant, and climate-resilient varieties.
- Restores species that are integral to Naga traditional diets and culture.
- Perennial fruit trees store carbon in biomass and soil.
- Helps mitigate climate change by acting as carbon sinks
- Restores degraded landscapes
- Increasing vegetation cover
- Enhancing soil fertility
- Perennial fruit crops produce income and nutrition year-round, encouraging sustainable land use.



7. Scaling, sustainability and cost efficiency:

Year 1- Survey, germplasm collection from farmer fields and wild habitats.

Nutritional profiling using biochemical and chromatographic methods.

Year 2 - Establishment of mother orchards at Department of Forestry, Nagaland University.

Mass multiplication of elite genotypes through invitro propagation and natural grafting and nursery techniques.

Year 3- Establishment of demonstration orchards in Department of Forestry and selected farms of Mukongchung District of Nagaland.

Farmer training and awareness programs.

Sustainability- Germplasm banks, seed orchards, and ex-situ conservation for genetic diversity.

- Encourage mixed orchards to maintain pollinators and ecosystem services.
- Women & youth engagement for nursery, processing, marketing.
- Traditional knowledge documentation & benefit sharing with tribal communities.

Cost efficiency – low-cost propagation: **vegetative methods (cuttings, grafting) + tissue culture** for elite, disease-free stock.

Decentralized nurseries at the village level to reduce the transportation risk

- Generate revenues early via sapling sales, demo plot produce, and scientific training on nursery cultivation.

8. Budget summary and risk and mitigation strategy:

ITEM	1st Year	2nd Year	3rd Year	Total (US\$)
A.RECURRING				
Project assistant (1) (Rs.25,000/month Consolidated)	3,424.70	3,424.70	3,424.70	10,274.1
Gardener (1) (Rs.12,000/month Consolidated)	1,643.87	1,643.87	1,643.87	4,931.61
(ii) Other cost (specify)				
Consumables (Chemicals & Glassware)	2,283.07	1,141.54	1,141.54	4,566.16
Travel	570.71	570.71	570.71	1,712.13
Contingency	570.71	570.71	570.71	1,712.13
Total - A	8,493.06	7,351.53	7,351.53	23,196.10
B.NON-RECURRING				
i) Machinery and equipment				
Autoclave (1)	1,712.19	-	-	1,712.19
Laminar Air Flow (1)	1,712.19	-	-	1,712.19
Hot air oven (1)	1,141.54	-	-	1,141.54
Electronic weighing balance (1)	1,141.54	-	-	1,141.54
Laboratory Refrigerator (1)	2,283.07	-	-	2,283.07
Air conditioners 2 nos.	1,712.19	-	-	1,712.19
Digital pH meter (1)	1,141.54	-	-	1,141.54
Shelves / racks (1)	1,141.54	-	-	1,141.54
(iii)Others (specify)				
Construction of hitech nursery (200 sq.ft)	9,139.69	-	-	9,139.69
Overhead charges (10%)	4,426.13	-	-	4,426.13
Total - B	25,674.89	-	-	25,674.89
Grand Total (A + B)	34,167.95	7,351.53	7,351.53	48,871.02



The project creates a **holistic pathway** where scientific knowledge (nutritional profiling + propagation technology) directly strengthens **indigenous fruit cultivation**, leading to improved **nutritional intake**, diversified livelihoods, **increased farmer income**, conservation of native biodiversity, and strengthened **tribal food culture** in Nagaland.



Thanks