September 2025 volume 27 no.3

# LEISA INDIA

Magazine on Low External Input Sustainable Agriculture

# Sustainable vegetable farming

LEISA INDIA

*September 2025 Volume 27 no. 3*

LEISA India is published quarterly by AME Foundation

Address : AME Foundation
No. 204, 100 Feet Ring Road, 3rd Phase,
Banashankari 2nd Block, 3rd Stage,
Bangalore - 560 085, India
Tel: +91-080- 8035845528
E-mail: leisaindia@yahoo.co.in

**LEISA India**

Chief Editor : T.M. Radha
Consultant Editor : K.V.S Prasad
Assistant Editor : Lalitha Sakthivel

***WEB COORDINATION***

G.G. Rukmini

***ADMINISTRATION***

B R Anjana

***DESIGN AND LAYOUT***

S Jayaraj

***COVER PHOTO***

*Kitchen gardens served as a boon to families facing food shortages due to crop loss, in Channapur village in Dharwad taluk.*
*(Photo: AME Foundation)*

**LEISA India Editions**

English
Hindi
Kannada
Tamil
Telugu
Punjabi
Marathi

http://www.leisaindia.org
https://hindi.leisaindia.org/
https://kannada.leisaindia.org/
https://tamil.leisaindia.org/
https://telugu.leisaindia.org/
https://punjabi.leisaindia.org/
https://marathi.leisaindia.org/



# Dear Readers

Vegetables constitute a significant component, offering both diversity and balanced nutrition. In general too, most of us do not eat enough fruit and vegetables. The World Health Organization (WHO) recommends consuming at least 400 g each day to reap their health and nutrition benefits. According to WHO, in 2017, some 3.9 million deaths worldwide were attributable to not eating enough fruit and vegetables. With rapid urbanisation and peri urban areas nearer to towns/cities moving away from farming, vegetable production areas are rapidly shrinking.

At farmer's household level too, with drastic shifts towards commercial crop cultivation, food and nutritional security of farm families is threatened. Invariably, it is farm women in the family who are more concerned about health and well being of the farm family – therefore, constantly innovating to produce safe, tasty and healthy foods for the young and old. The available spaces and resources considered waste are used creatively to grow kitchen gardens with less costs. Also, vegetable cultivation provides additional incomes too. Articles in this issue reflect this reality.

We, in LEISA India team have been striving our level best to reach out to people like you interested in practical eco-friendly field evidences through the magazine. We have just begun to explore reaching out through social media. We are all aware that there are lakhs of people who are extremely conscious for a safer and healthy planet. Please help us to reach out to them through Instagram, Facebook and other social media tools with eco-friendly farm alternatives.

**The Editors**

**LEISA** is about Low-External-Input and Sustainable Agriculture. It is about the technical and social options open to farmers who seek to improve productivity and income in an ecologically sound way. LEISA is about the optimal use of local resources and natural processes and, if necessary, the safe and efficient use of external inputs. It is about the empowerment of male and female farmers and the communities who seek to build their future on the bases of their own knowledge, skills, values, culture and institutions. LEISA is also about participatory methodologies to strengthen the capacity of farmers and other actors, to improve agriculture and adapt it to changing needs and conditions. LEISA seeks to combine indigenous and scientific knowledge and to influence policy formulation to create a conducive environment for its further development. LEISA is a concept, an approach and a political message.

**MISEREOR** founded in 1958 is the German Catholic Bishops' Organisation for Development Cooperation. For over 50 years MISEREOR has been committed to fighting poverty in Africa, Asia and Latin America. MISEREOR's support is available to any human being in need – regardless of their religion, ethnicity or gender. MISEREOR believes in supporting initiatives driven and owned by the poor and the disadvantaged. It prefers to work in partnership with its local partners. Together with the beneficiaries, the partners involved help shape local development processes and implement the projects. This is how MISEREOR, together with its partners, responds to constantly changing challenges. (www.misereor.de; www.misereor.org)

**AME Foundation** promotes sustainable livelihoods through combining indigenous knowledge and innovative technologies for Low-External-Input natural resource management. Towards this objective, AME Foundation works with small and marginal farmers in the Deccan Plateau region by generating farming alternatives, enriching the knowledge base, training, linking development agencies and sharing experience.

**AMEF** is working closely with interested groups of farmers in clusters of villages, to enable them to generate and adopt alternative farming practices. These locations with enhanced visibility are utilised as learning situations for practitioners and promoters of eco-farming systems, which includes NGOs and NGO networks. **www.amefound.org**

## 6 Sustainable vegetable farming

**Ashutosh Pal and Amar Kumar Gouda**

The Bhuban and Kankadahad model shows that climate resilience is possible through diverse, decentralized and ecologically sound farming systems. The success of low-input vegetable cultivation offers a replicable path for other rainfed and marginal areas.

## 12 Trellis vegetable Farming

### *Fostering income and hope for smallholder farmers*

**Yogesh G. Sawant, Sagar Jadhav, Kunjankumar Patel and Mahesh Patel**

Trellis-based vegetable production is a sustainable production system which leverages sunlight better, improves air circulation and facilitates multilayer cropping. Adopting this system, more than 10000 small and marginal farmers in several states in India have improved their food, nutritional and income security.

## 22 Monocropping to mixed vegetable farming

### *An inspiring journey*

**Siddharth Kumar Rout**

Pushpanjali's journey reflects a broader shift in vegetable farming, from chemical dependency to sustainability, from risk to resilience, and from subsistence to surplus. Her story stands as a living example of how smallholder farmers can overcome systemic challenges through knowledge, innovation, and collective support.

## 32 Vegetable promotion through entrepreneurship

**Rajesh Parida**

Many times, an improved practice is all it requires to bring about a change. A simple technique in nursery raising has made inroads in Banka district in Bihar resulting in increased vegetable cultivation in the region. Also by taking this as an enterprise and supporting vegetable production, many farm entrepreneurs are earning well to make a decent living.

# CONTENTS

Vol. 27 no. 3, September 2025



# Sustainable vegetable farming

Majority of the farmers owning small landholdings, depend almost entirely on the monsoon for raising crops. Erratic weather patterns caused by climate change are making their risky livelihoods even more precarious. Unpredictable crop production under these changing climatic conditions is enabling farmers to shift to short duration vegetable crops, which yield multiple times in an year. For small farmers who are less resourceful, vegetable farming is a boon for several reasons. It meets food and nutrition needs while there are food shortages owing to crop losses. Enables better resource management. It is estimated that while one cubic metre of water is needed to produce 330 grams of grains, the same quantity of water is sufficient to grow 18 kg of vegetables. Ecological and economic considerations that support this transition is resulting in small farmers expanding their areas under vegetable cultivation, both on the main farm as well as in their backyards.

Sustainable agricultural practices aligning with local ecosystems combined with traditional wisdom results in building resilience in vegetable farming. Sustainable farming practices like water-smart practices to use water efficiently and sustainably; mulching to retain soil moisture; rainwater harvesting and farm ponds to store water; scheduling irrigation based on crop needs and weather; use of drought-tolerant crop varieties, have resulted in 50% improvement in water-use efficiency. (Pal and Gowda, p.6). Adoption of organic manures, cover cropping, and mulching, along with the use of farm pond irrigation, has led to improved soil fertility, greater biodiversity, and increased pollinator activity, while ensuring water conservation. Similarly, around 25 women farmers in Hubballi taluk in Karnataka, raised nutrition qardens in their backyards using locally prepared organic inputs. Each household produced vegetables worth Rs.3000-4000 in a season. (AMEF, p.24).

Unlike monocultures, crop diversification reduces the risks of crop production and provides cash income. This leads to reduced seasonal migration and improve diet and health outcomes of the community. For instance, shifting from single-crop dependency to cultivating 4-5 types of vegetables in a year, Pushpanjali from Pehelaju Takera, in the Nayagarh district of Odisha, enjoys multiple harvests, meets her household's dietary needs, and contributes to the local market's supply of fresh produce.(Siddarth Kumar Rout, p.22)

Farmer-led demonstrations are a powerful tool for peer learning, generating greater trust, community engagement, and sustainability compared to top-down dissemination methods. For example, East-West Seed Knowledge Transfer Foundation (EWS-KT) began to work with smallholder farmers in Mayurbhanj and Keonjhar, by setting up vegetable production demonstration plots with local farmers. These demo plots with raised beds, proper spacing, appropriate fertilization, and integrated pest management (IPM) methods led to higher and better-quality yields for farmers (p.19).

Many times, an improved practice or a simple technology is all it requires to bring about a change. A simple technique in nursery raising has made inroads in Banka district in Bihar resulting in increased vegetable cultivation in the region. Unlike conventional methods where seedlings are grown in soil beds, this technique utilizes specialized trays with cocopeat medium, resulting in healthier plants with greater disease resistance. (Pal and Gowda, p.6).

Similarly, trellis-based vegetable production is a sustainable technology which leverages sunlight better, improves air circulation and facilitates multilayer cropping. Adopting this system, more than 10000 small and marginal farmers in several states in India have improved their food, nutritional and income security.

The practicing farmers have realized significant farm returns and also access to diverse and rich nutritional sources.(Yogesh G Sawant et.al., p.12)

Diverse, decentralized and ecologically sound farming systems can help build climate resilience. In addition, simple devices and digital tools that help in climate monitoring facilitate decision making for appropriate action. Adopting these, over 150 hectares in Bhuban and Kankadahad model have been brought under resilient vegetable farming. Automatic Weather Stations (AWS) and a lightening detection device provided real-time weather data guiding farmers on irrigation scheduling, disease-pest management, and crop planning, leading to upto 15% increase in yields, reduced input costs and better crop health. Crop health and pest incidence were monitored using digital tools. Crop losses due to weather anomalies have been significantly reduced (Pal and Gowda, p.6).

Backyard gardens, primarily managed by women, ensure year-round access to fresh vegetables. Women manage these gardens, using organic methods and recycling resources like kitchen waste. They are not only successful in meeting the nutrition needs of the household, but also supplement family incomes from sale of surpluses. Beyond supplemental incomes, some women have also taken this to an enterprise level, making farm based business model a success. In Inravaran village of Katoria block in Banka district. Muniya Murmu pioneered a transformative agricultural business model in 2022 when she established a tray nursery. Her enterprise strengthens local economic ecosystems. *"We created this so that village money stays within the village,"* she explains, highlighting how her business integrates with local women producer groups and the other entrepreneurs. (Rajesh Parida, p.32).

Community organisations like SHGs and FPOs play a key role in strengthening the enterprise. Collective procurement of inputs and group-based marketing facilitated through SHG and FPO, reduces exploitation by middlemen, thus giving small holder farmers better bargaining power. (Pal and Gowda, p.6).

Women's engagement through Self-Help Groups (SHGs) plays a pivotal role in scaling up adoption of kitchen gardens at the household level, strengthening nutrition, income, and collective decision-making. For example, Pushpanjali of Anantakhola Mahila SHG in Odisha, inspired 10 other women members from her SHG — to adopt mixed vegetable farming. Beyond inspiration, she provides training and handholding support to these women, enabling them to follow her footsteps. Her SHG received ₹10,000 in seed capital from the block agriculture department, which was instrumental in accessing improved seeds, farm tools, and transport facilities.(Siddarth Kumar Rout, p.22).

While the support from external agencies is needed for promoting vegetable cultivation, we can find a number of innovative farmers who serve as inspiration to many. One such farmer from  Pamaladinni in Karnataka Sri Sannayamanappa, who is an inspiring example of how determination, innovation and traditional wisdom can transform small-scale farming into a viable, profitable and sustainable livelihood. His ability to blend vegetable cultivation with dairy, poultry and recreational components like bird rearing and farm tourism has not only improved his income but created a model worth replicating. (Channal and Desai, p.26)

# Sustainable vegetable farming

Ashutosh Pal and Amar Kumar Gouda

**The Bhuban and Kankadahad model shows that climate resilience is possible through diverse, decentralized and ecologically sound farming systems. The success of low-input vegetable cultivation offers a replicable path for other rainfed and marginal areas.**

Bhuban and Kankadahad blocks in Dhenkanal district, Odisha, are part of the East Coast Plains & Ghats Region and face challenges like increasing risks due to climate variability (eg. unpredictable rainfall ranging from 1000–1600 mm annually, hot summers and moderate winters). The area comprises of a high percentage of small and marginal farmers, primarily dependant on agriculture as their primary livelihood,

*Women grew vegetables round the year integrating LEISA practices with traditional knowledge*

supplemented by daily wage labor and livestock rearing. Women's participation in agriculture is significant, yet, their role largely unrecognized while making decisions. Intensive chemical agriculture practices have led to declining soil fertility, dependence on external chemical inputs, threatening both ecosystem health and farmer livelihoods.

Traditionally, vegetable cultivation  is taken up in both backyards and main farmland, depending on the household's landholding size and access to water. Backyard vegetable gardening is common among small and marginal farmers, especially women, for household consumption. Vegetables are usually grown year-round in small patches using kitchen wastewater and organic inputs.

Main farm vegetable cultivation is typically taken up by farmers with larger landholdings or access to irrigation. Vegetables are grown for both home use and commercial sale. On an average, vegetables are grown in 2 to 3 cycles per year depending on irrigation availability. During Kharif (monsoon), okra, gourds, and brinjals are grown. During Rabi (winter), availing residual moisture or shallow irrigation, vegetable crops like tomato, cauliflower are grown. During summer, often creepers and leafy vegetables are grown where irrigation is possible.

The challenges faced in vegetable cultivation include high input costs with diminishing returns from chemical-intensive practices; low water availability in non-monsoon months; high climate variability with erratic rainfall and prolonged dry spells affecting crop reliability; incidence of pests and diseases due to fluctuating humidity and temperature; weak institutional linkages and lack of extension support. Poor crop diversification, especially in the vegetable sector along with post-harvest losses, lack of market access for seeds, fertilizers and pesticides have lead to distress selling.

To build climate-resilient, resource-efficient and locally adaptable farming systems, *Organic vegetable farming model* was introduced. This approach emphasized on local resource use (compost, botanical extracts, cow-based bio-inputs); soil and water conservation; mixed cropping and crop rotation; farmer capacity building through participatory methods and women-led kitchen and nutrition gardens. The programme was started by Mahashakti Foundation under HDFC-FRDP project.

**The following vegetable varieties were promoted**

| Crop | Varieties Used | Type | Introduced/ New | Area Covered (avg) | Yield Before (q/ acre) | Yield After (q/acre) | Remarks |
|---|---|---|---|---|---|---|---|
| Brinjal | Utkal Tarini (OUAT) | Improved | Existing | 0.25–0.5 acre | 35–40 | 55–60 | Increased due to organic inputs, pest control |
| Tomato | Arka Rakshak (F1) | Hybrid | Existing | 0.2–0.4 acre | 30–35 | 50–55 | Mulching and staking improved productivity |
| Okra (Bhindi) | Arka Anamika | Improved | Existing | 0.1–0.3 acre | 25–30 | 40–45 | Better spacing and line sowing used |
| Pointed Gourd (Parwal) | Local runners | Traditional | Existing | 0.1 acre | 18–20 | 25–28 | Adopted trellis system to reduce pest attacks |
| Cucumber | Swarna Poorna | Improved | Newly introduced | 0.2 acre | – | 40–45 | Introduced in summer using drip irrigation |
| Leafy Greens | Local + improved composite seed | Mixed | Existing | 0.05–0.1 acre | 10–12 | 15–18 | Grown in backyard; high household nutrition value |
| Capsicum | California Wonder | F1 Hybrid | Newly introduced | 0.05 acre | – | 15–20 | Trial basis in low-cost poly tunnel nurseries |

## The initiative

Preparatory activities included conducting a baseline survey in 12 villages, where 180 small and marginal farmers participated. This was to understand the existing conditions and needs. Cluster identification was carried out based on the agro-ecological characteristics of the region in consultation with target farmers (mapping water source, crop pattern and risk exposure). Initial awareness and orientation sessions were organized to build community's understanding in preparing them for potential field activities.

In this initiative, over 500 small and marginal farmers are involved, with over 60% of them being from women-led households. Farmers were organized into 12 producer groups and 15 SHGs, ensuring inclusive participation and enhanced decision-making.

Training-cum-demonstration sessions on climate-resilient vegetable cultivation, organic input preparation, non-chemical disease-pest management and INM/IPM were conducted through 3 sessions per group as part of Farmer Field Schools (FFS). A total of 36 sessions were conducted on climate-resilient farming and organic practices. Farmers were taken on exposure visits and hands-on training was provided for practices such as composting and vermicomposting; preparation of bio-pesticides (e.g. Neemastra, Matka Khad, Jeevamrut); use of drip irrigation, mulching; and use of shade nets/ polyhouses for nursery raising and off-season production.

## Building climate resilience

Varieties suitable for local climate and agro-climatic zones were promoted. Ten farm youth were supported with low-cost shade nets to enable them to maintain timely nurseries for round-the-year vegetable production. Four farm ponds, 2 low-cost check dams and rainwater harvesting structures were developed to enhance water availability for 32 farmers. Adoption of micro-irrigation techniques like drip and sprinklers improved water-use efficiency for 24 farmers. Soil health was enhanced through use of compost, green manure, bio-fertilizers, and azolla tanks for nutrient cycling.

Water-smart practices to use water efficiently and sustainably, especially in areas facing water scarcity or erratic rainfall included drip and sprinkler irrigation to reduce water wastage; mulching to retain soil moisture; rainwater harvesting and farm ponds to store water; scheduling irrigation based on crop needs and weather; use of drought-tolerant crop varieties.

## Smart agriculture and digital integration

Seasonal vegetable kits were distributed twice during the year (like tomato, okra, brinjal, cucurbits, leafy greens). Training on Jeevamrut, Neemastra and mulching was organized through 12 demonstration plots (1 per village). Two Automatic Weather Stations (AWS) and a lightening detection device were installed and these instruments provided real-time weather

*Women's engagement through Self-Help Groups (SHGs) played a pivotal role in scaling up adoption*

> **Case 1: Sanjukta Mohanta – Small Farmer, Kankadahad Block**
>
> Sanjukta, a marginal farmer from Kharkhari village in Maruabili GP of Kankadahad block, used to grow vegetables only during the monsoon due to water scarcity. With support from Mahashakti Foundation, she adopted drip irrigation (subsidized by Government) and organic composting on her 0.5 acre plot. She now cultivates Brinjal and Okra across two seasons, reducing input costs and earning 30% higher income. Her farm now withstands dry spells better, showing improved resilience to erratic rainfall.
>
> **Case 2: Debasis Jethi – Youth Farmer, Bhuban Block**
>
> Debasis, a young farmer from Kumarsingha village in Baruan G.P. of Bhuban block, shifted from chemical-intensive farming to organic vegetable production on leased land. With training and support by Mahashakti Foundation through a Farmer Producer Group, he installed drip irrigation system (subsidized by Government). This reduced crop losses during heavy rains and helped him supply off-season vegetables to local markets, increasing his profit margin while minimizing climate-related risks.

data (temperature, humidity, rainfall, etc.) along with 24 hours forecasting on cloud. According to the data provided (online) through these AWSs, daily crop wise advisories were released. These AWS-based advisories guided farmers on irrigation scheduling, disease-pest management, and crop planning, leading to upto 15% increase in yields, reduced input costs and better crop health. Crop health and pest incidence were monitored using digital tools and field scouts providing timely response.

## Market and institutional linkages

Information on prices, demand, supply trends, and consumer preferences that help farmers decide what to grow, when to sell, and where to get better profits was made available. Seasonal crop planning was aligned with weather forecasts and market trends to maximize returns. To build better understanding, 2 exposure visits were organised to Kalahandi and Cuttack vegetable markets. Collective procurement of inputs and group-based marketing (of 18 quintals of produce per week) was facilitated through Farmer Producer Organizations (FPOs) and SHGs. Farmer Producer Organizations (FPOs) played a key role in strengthening small and marginal farmers by enabling collective action (i.e. collective procurement of inputs for ensuring quality and collective marketing for reduction of middlemen exploitation and giving smallholder farmers better bargaining power). Local market linkages were strengthened for effective sale of surplus produce.

**Table 1: Average Yield Increase (Before vs. After Intervention)**

| Crop | Before (quintal/acre) | After (quintal/acre) |
|---|---|---|
| Tomato | 48 | 72 |
| Brinjal | 40 | 60 |
| Chilli | 32 | 48 |
| Beans | 55 | 72 |
| Okra | 45 | 52 |

## Follow up, monitoring and evaluation

Monthly NGO staff visits to assist in crop and income tracking via digital tools (like field monitoring & logbook tracking) was done. Quarterly meetings and hands-on refreshers for all FFS members through *feedback and refresher sessions* were organised. Key performance indicators monitored included yield levels, water use, soil fertility and adoption rates, tracked on a monthly/ quarterly basis. Good practices and case studies are being documented for scaling up and policy advocacy. An independent third-party evaluation will be conducted at the end of the project to assess outcomes.

## Impact and Outcomes

Over 150 hectares have been brought under resilient vegetable farming. Farm income has increased by 30–40% with a 50% improvement in water-use efficiency. Crop losses due to weather anomalies have been significantly reduced. Convergence with government schemes further scaled up field-level implementation and impact. Significant improvement in average yields are recorded as presented in Table 1. While the incomes were around ₹35,000/season (pre project), they have been around ₹58,000/season (post project).

## Home consumption/Marketing

Vegetable cultivation serves both home consumption and marketing, depending on the scale and resources of the farmer. Backyard gardens are mainly for household use, ensuring year-round access to fresh vegetables and improving nutritional security. Women in particular manage these gardens, using organic methods and kitchen waste. Marketing (Commercial Purpose) is done at diverse venues – at local village markets (haats);

*Water-smart and adaptive cropping practices enabled to build climate resilience*

direct marketing by some progressive farmers and Farmer Producer Groups (FPGs) through collective sales and weekly vegetable vending in nearby towns in nearby town markets. These markets are primarily in Kankadahad, Bhuban, Kamakhyanagar and Dhenkanal district headquarters. Marketing is also done through middlemen or traders who supply to Cuttack and Bhubaneswar.

*Madan Munda, a farmer in Bramhanakantakol village with his organic vegetables harvest*

## Changes and Impact

Organic vegetable cultivation, led to a substantial reduction in chemical pesticide and fertilizer use. The cropping intensity has enabled year-round vegetable production. The promotion of local bio-inputs and on-farm seed saving has significantly reduced the cost of cultivation, while vegetable incomes have increased by 30–50% due to lower input expenses and improved market access.

More than 350 farmers, of whom 60% are women, have been trained and mobilized into functional producer groups. These groups have established nutrition gardens, enhancing household food security, dietary diversity, and fostering collective decision-making among women SHG members. Adoption of organic manures, cover cropping, and mulching, along with the use of farm pond irrigation, has led to improved soil fertility, greater biodiversity, and increased pollinator activity, while ensuring water conservation.

The initiative has led to a revival of traditional knowledge related to pest management and seed conservation, enriching both agro-ecological resilience and cultural heritage. A noticeable shift in farmer perception has occurred—from subsistence-based farming to a model of self-reliant, market-oriented organic agriculture.

## Key drivers of success and field level learnings

The success of the initiative can be attributed to the following aspects.

- A participatory, community-driven approach ensuring relevance has instilled a strong sense of ownership.
- Experiential learning-based training, utilizing local materials and resources, enhanced practical knowledge and encouraged widespread adoption of practices.
- Women's engagement through Self-Help Groups (SHGs) played a pivotal role in scaling up adoption at the household level, strengthening nutrition, income, and collective decision-making.
- The use of localized weather-related information (like rainfall, temperature, humidity and seasonal forecasts) and market intelligence helped farmers plan better, adapt with confidence, and make more informed decisions regarding cropping patterns and resource use. Access to information help farmers plan sowing, irrigation, and protect crops from climate risks.
- LEISA (Low External Input Sustainable Agriculture) proved most effective when it was aligned with local ecological conditions and integrated with traditional knowledge systems, especially those preserved by women.
- Water-smart practices and adaptive cropping combined with localized weather forecasts enabled farmers to build climate resilience and reduce risks associated with erratic rainfall and seasonal changes.
- Farmer-led demonstrations emerged as a powerful tool for peer learning, generating greater trust, community engagement, and sustainability compared to top-down dissemination methods.

Sustainability of the initiative is planned through building capacities, institutionalizing market linkages, linking with government schemes, and developing local agri-entrepreneurs to continue service delivery. Other scaling up strategies include better Cold Storage infrastructure, advisory systems and digital marketing, to name a few.

## Conclusion

The Bhuban and Kankadahad model shows that climate resilience is possible through diverse, decentralized and ecologically sound farming systems. The success of low-input vegetable cultivation offers a replicable path for other rainfed and marginal areas. Mahashakti Foundation continues to support the upscaling of these models across Odisha, contributing to sustainable rural livelihoods and local food security. Also, planned are weather advisories and climate-smart crop calendars. The policy should integrate low cost vegetable farming under state agriculture missions and MGNREGA for resource support; promote decentralized bio-input units at village level with SHG/producer group ownership and incentivize organic produce marketing through rural haats and digital platforms.

**References**


1. LEISA India (2022). **Sustainable Farming for a Changing Climate**. AME Foundation.
2. Ministry of Agriculture & Farmers Welfare (2023). **Best Practices on Organic Vegetable Farming**. Government of India.
3. Mahashakti Foundation (2024). **Annual Report: Climate-Resilient Agriculture Initiatives in Dhenkanal**.



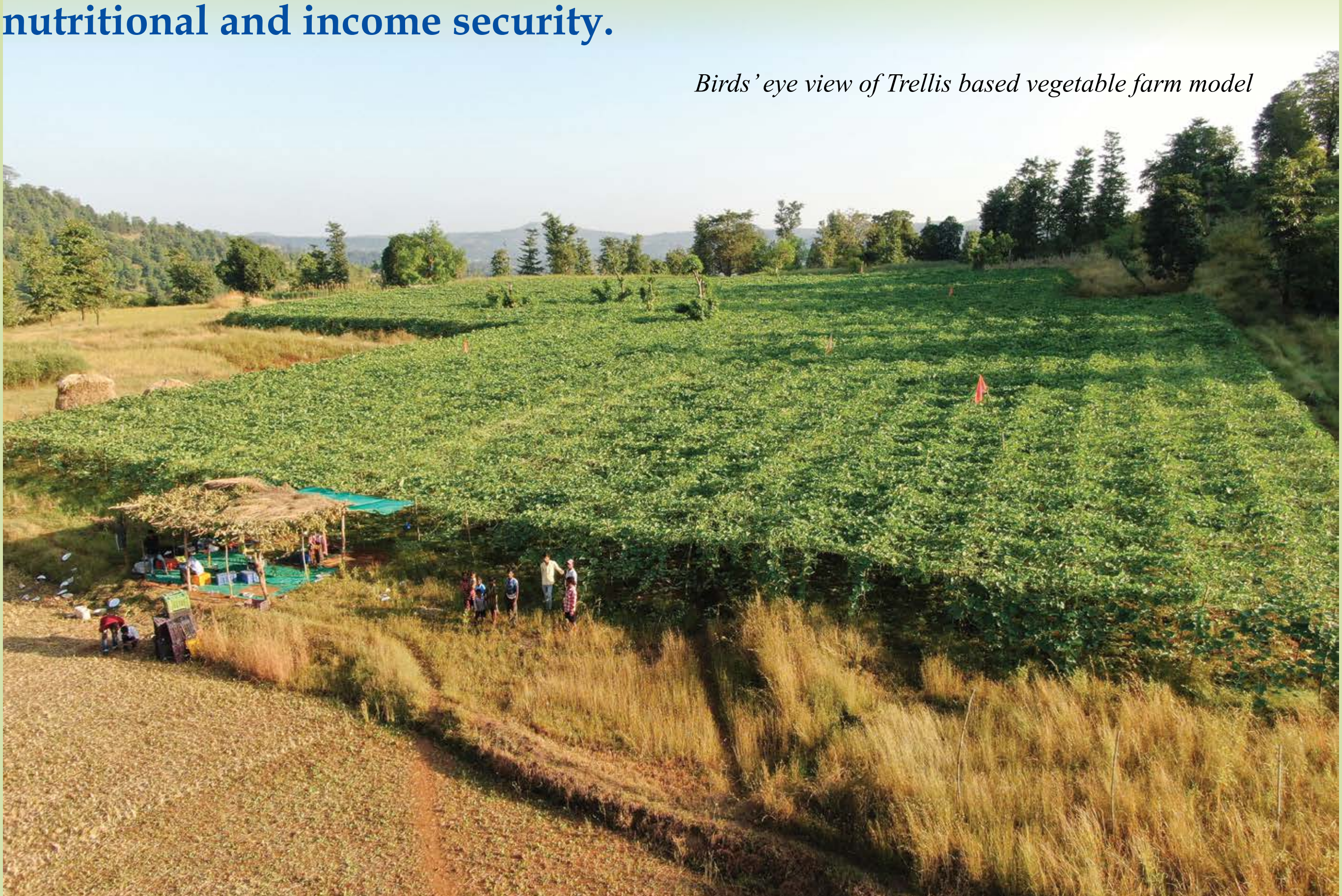
**Ashutosh Pal and Amar Kumar Gouda**
Mahashakti Foundation
Plot No.-05, HIG, Dharma Vihar, Khandagiri
Bhubaneswar, Odisha-751030
E-mail: ashutoshpal@mahashaktiindia.org

# Trellis vegetable farming

## *Fostering income and hope for smallholder farmers*

**Yogesh G. Sawant, Sagar Jadhav, Kunjankumar Patel and Mahesh Patel**

**Trellis-based vegetable production is a sustainable production system which leverages sunlight better, improves air circulation and facilitates multilayer cropping. Adopting this system, more than 10000 small and marginal farmers in several states in India have improved their food, nutritional and income security.**



*Birds' eye view of Trellis based vegetable farm model*

Majority of Indian farmers own small and fragmented landholdings, limiting their opportunities for increasing income from agriculture. According to the annual survey of marginal farmers, small and marginal farmers with less than two hectares of land account for 86% of all farmers in India, but own just about 47% of the crop area (10th agriculture census). The small landowner farmers who grow staple crops actually earn low to negative returns. Given a choice, many farmers would rather take up another occupation (Radhakrishnan committee Report on agriculture indebtedness). Limited cultivation season, depleting crop diversity, untimely and erratic rainfall, water scarcity, lack of awareness on improved cropping practices and high value cash crops and challenges of market access often result in low returns for small holder farmers. Low returns from agriculture usually lead to distress seasonal migration.

In this context, it is essential for small holder farmers to undertake diversified and high value crop cultivation and to enhance crop returns per unit area. This requires efficient use of both horizontal and vertical space, as well as sunlight. The natural resources like soil and water should also be managed sustainably.

The region where BAIF intervened in South Gujarat is characterised by hilly terrain and receives nearly 2700 mm rainfall. The soils are mostly red lateritic with nutrient and organic matter deficiency. Majority of the farmers belong to scheduled tribes. The average landholding is less than one hectare. Agriculture was mainly at subsistence level, with major crops cultivated being rice, finger millets and black gram. Cultivation was usually limited to the monsoon season only and the area under rice cultivation was increasing. After the harvest of the *Kharif* crop, majority of the farmers had to depend on seasonal migration for livelihoods.

To address these challenges, BAIF initiated Wadi (Agri.-Horti-Forestry) programme in South Gujarat, focussing primarily on integration of fruit and forestry trees into the farming system. In fact, the fruit and forestry trees serve as a sustainable and long term source of livelihoods source for the families. The tree species have a gestation before reaching peak returns. It was observed that farmers with very small landholding could not participate in the Wadi initiative. Thus, there was a need to improve incomes/ livelihoods of small and marginal landholdings families.

*Availability of vegetables improved household nutrition*

Taking advantage of demand from urban population, several high value cropping models in the form of floriculture and vegetable cultivation, were introduced on a pilot basis for addressing the challenges. While several different vegetable crops were introduced, the multilayer *Trellis-based vegetable cultivation* received greater acceptance from the community.

## Features of the trellis based multilayer vegetable cultivation

- Certain common crops cultivated are Cucumber, Bitter Gourd, Bottle Gourd, Ridge Gourd, Snake Gourd, Beans, Peas and Pumpkin.
- Supports appropriate growth of climbers and vines and multilayer cropping.
- Helps utilize vertical space, making it ideal for small gardens or limited land.
- Leaves and fruits get uniform sunlight, enhancing photosynthesis.
- Leads to improved yield and fruit quality.
- Better air flow around plants reduces humidity and disease risk.
- Reduces certain pests
- Crops are at an accessible height, making them easier to harvest, prune or inspect.

➢ Produce fetches better market price due to clean produce.

The advantage of the trellis-based vegetable production system is that this method offers a sustainable way to improve food and nutritional security, generate income, and create alternative livelihoods for small and marginal farmers. The trellis system leverages sunlight better, improves air circulation and facilitates multilayer cropping.

Initially, the trellis-based vegetable cultivation system was introduced in Amboshi village in the year 2005. Some farmers used to cultivate vegetables in their backyards with limited management practices. Initially farmers were hesitant for adopting vegetable cultivation for commercial purpose. In order to boost their confidence, in the year 2003, exposure visits were organised to the farms of commercial vegetable growing farmers as well as to the demonstration farms of state Agriculture Universities.

Motivated by these visits, two farmers from Awadha village in Dharampur, Gujarat showed interest. They were provided support for piloting the cultivation of bitter gourd. These farmers were guided in the establishment of the trellis support system on 0.2 ha of land each. Seeds were provided and farmers were trained on cultivation practices. These farmers cultivated bitter gourd during the first season. During the initial cropping cycles, while optimum production could not be achieved, it could generate reasonably good earnings of around Rs. 35,000 which increased their confidence. Exposure visits for farmers of Amboshi village and adjoining villages were organized to the trellis-based vegetable cultivation field in Awadha village. Nearly 45 farmers joined the exposure visits in 2 batches. Some farmers were highly motivated as they observed that the returns were nearly twice their conventional crops. They showed keen interest in undertaking trellis based vegetable cultivation. During the next season, in 2004 the trellis based vegetable cultivation was piloted with 15 farmers and with 42 farmers during the subsequent years. However, certain initial challenges were observed for scaling-up the system. They are as follows.

➢ The production realized varied to a great extent from farmer to farmer. There was a need to standardize the package of practices.

### Box 1: Impact

A sample study was conducted in the year 2024, with 50 farmers in 2024 across 15 villages (Kunda, Dhamni, Chandvegan, Mohpada, Nilosi, Borpada, Kaprada, Veribhavada, Mani, Avdha, Hedri, Mandva, Tammachadi, Veribhavada and Sajnibarda) to assess the impact of trellis based vegetable cultivation, revealed the following learnings.

➢ Farmers realized significant increase in farm returns. With improving confidence, increased the area under trellis and other vegetable crops. Their farm incomes have increased over the years ranging from Rs. 80,000 to Rs. 3.5 lakhs per annum against the baseline farm income of around Rs. 25,000 per annum in the year 2022.

➢ The crop diversity has enhanced their resilience.

➢ The availability of vegetables and fruits for home consumption improved in turn providing better nutrition.

➢ Increased self-confidence improved their farming and cultivation practices, also strengthening collective action by the farmer producer organizations.

➢ The initial cost for establishment of the trellis support system using durable cement poles and for inputs (around Rs. 22000/-) was significantly high and not within the reach of the small holder farmers. The need was to bring down the costs so as to make it affordable for several other farmers to adopt the model.

➢ There was a need to reduce the use of agro-chemicals recommended in the conventional cropping system.

➢ When vegetable production increased, adequate market linkages were needed.

The above challenges were discussed in detail with diverse stakeholders, experts and farmers jointly. The following strategies were adopted.

- In order to reduce the costs, bamboo poles were utilized instead of cement poles. This helped reduce the initial costs.
- Standard Operating Practices (SOP) were finalised. The SOPs involved appropriate size of the trellis support system, spacing between each pole of the system (5 m), height (5–7 feet above ground), material to be used (bamboo/ wood sticks/ cement poles/ galvanized iron pipes) for supporting the trellis system. Plastic-coated steel wires, nylon

*Groups of farmers raised contributions for establishing trellis based farming.*

ropes, GI wires, or plastic mesh was used to create a support structure for the creepers and ensure trellis is stable against wind. Crop-based practices outlined in the SOPs included using seedlings aged 25–30 days, maintaining proper plant to plant spacing for bitter gourd (120cm × 45cm). Other practices followed included Integrated Nutrient and Pest Management, and harvesting at appropriate maturity stage.

- In order to reduce the use of agrochemicals, various organic and natural farming practices were integrated into the conventional crop cultivation practices. Emphasis was laid on recycling of the organic waste, production and use of compost as well as safe pest control measures including bio-pesticides, reducing dependence on purchased external inputs. The major sources of biomass for compost making included farm residues and forest litter collected from the adjoining areas.
- In order to reduce the costs of establishment of trellis system various alternatives were explored. During the earlier pilot phase, cement poles were introduced for establishment of the trellis system. This contributed significantly to the costs of the system, nearly 50% of the costs. Cement poles were replaced with bamboo poles. Also, it was observed that the bamboo poles were absorbing moisture and rotting in the region close to the soil. Later these poles were treated at the base before installation. This helped in improving the life of the bamboo poles. The quality of wires to be used were also finalized. These alternatives helped in reducing the initial cost of trellis establishment.

## Popularising trellis-based vegetable cultivation

- BAIF mobilised partial support for several farmers enabling them to initiate the activity. Support was provided to vulnerable and needy families. After the initial support they were expected to continue the activities by themselves.
- Other farmers interested in adopting trellis-based vegetable cultivation were mobilized to form pairs or small groups usually with adjacent farmers. These farmers/ groups of farmers raised the investment through contributions for initiating trellis based farming in groups. As they generated reasonable savings after a few cropping cycles, they started cultivating vegetables independently.

## Overcoming challenges

Initially, as the number of farmers involved in the cultivation of vegetables was less, selling of the produce in the local area was not difficult. However, as the number of farmers cultivating the vegetable crops increased, there was a need to tap external markets to ensure farmers receive appropriate price for their produce. Market linkages were necessary. Majority of the farmers involved in vegetable cultivation were members of the farmer producer organizations/ cooperatives. These

*Safe measures for prevention and management of pests were introduced*

cooperatives were primarily involved in aggregation and processing of fruits like mango and cashew produced in their Wadis. These cooperatives intervened into strengthening the value chain for vegetable crops and other farm produce. Further, they introduced the supply of fertilizers, seeds, etc., thereby ensuring timely availability and access to good quality inputs at a reasonable price.

Another challenge faced by the farmers was to transport the produce nearly twice or thrice a week to external markets. This was financially demanding as well as labour intensive for the small holder farmers. The cooperatives also conducted trader meets to address these challenges. As the volume of the produce increased the traders organized transport and pick-up facilities from the farms thereby allowing the farmers to focus on the farm-based activities.

## Upscaling

Owing to the appreciating returns fetched from small land holding, very soon trellis based vegetable cultivation was widely adopted by hundreds of farmers in the adjoining villages. Diversity in the types of vegetables cultivated was introduced with emphasis on sturdy crops and varieties. Multitier crop cultivation involving vegetables, fruits and forestry plants was introduced to enable farmers harvest multiple crops from their small land parcels. Scouting for pests was introduced through light and sticky traps. Safe measures for prevention and management of pests were introduced. Organic matter recycling, soil improvement and moisture conservation practices were promoted for boosting sustainability.

This approach has been scaled-up in various other regions of the country since 2014. Through BAIFs initiatives, trellis vegetable cultivation has been adopted by 11,700 farmers in Andhra Pradesh, Maharashtra, Gujarat, Odisha, Telangana, Jharkhand, Madhya Pradesh, Rajasthan, Uttarakhand, Karnataka and Uttar Pradesh during the year 2024-25. The trellis system has been adapted to the local conditions and market demands in other geographies. The practicing farmers have realized significant farm returns (See Box 1, p.14) and also access to diverse and rich nutritional sources. Thus, trellis-based vegetable cultivation is an important strategy to address the challenges faced by small holder farmers.

◆

**Yogesh Sawant**
Chief Thematic Programme Executive
(Farm Based Livelihoods and Climate Action)
BAIF Development Research Foundation
BAIF Bhavan, Dr. Manibhai Desai Nagar Warje
Pune – 411058
E-mail: ygsawant@baif.org.in

## India issues first national guidelines for animal blood banks to save livestock

The Government on Monday released the country's first comprehensive guidelines for veterinary blood transfusion services, addressing a critical gap in emergency animal healthcare.

The 'Guidelines and Standard Operating Procedures for Blood Transfusion and Blood Banks for Animals in India' establishes a scientific framework for animal blood donation, storage and transfusion procedures that were previously conducted without national standards, an official statement said.

Blood transfusion is recognized globally as essential for treating trauma, severe anemia, surgical blood loss, infectious diseases and bleeding disorders in animals. Most transfusions in India were performed in emergencies without standardised donor screening, blood typing or storage protocols.

*https://economictimes.indiatimes.com/news/economy/agriculture/india-issues-first-national-guidelines-for-animal-blood-banks-to-save-livestock/articleshow/123506969.cms*

## India, Japan sign MoC to boost low-carbon technologies under Paris Agreement

India and Japan have signed a Memorandum of Cooperation (MoC) to implement Joint Crediting Mechanism (JCM) under Article 6.2 of the Paris Agreement, Ministry of Environment, Forest and Climate Change (MoEFCC) announced on Friday (August 29, 2025).

The agreement, signed earlier this month, reinforces India's commitment to climate action and low-carbon development as the country works towards achieving Net Zero emissions by 2070.

Prime Minister Narendra Modi, during his ongoing visit to Japan, highlighted the partnership as part of the broader Indo-Japan cooperation agenda, "Green Energy Focus for a Better Future."

The initiative is expected to attract investments, facilitate advanced technology transfer, and provide capacity-building support for projects aimed at reducing greenhouse gas (GHG) emissions and promoting sustainable development.

JCM will encourage large-scale adoption of low-carbon technologies approved by India's National Designated Agency for Implementation of Article 6 of the Paris Agreement (NDAIAPA). These technologies are currently cost-intensive, requiring viability gap funding, and the collaboration is expected to address this challenge by providing financial and technical assistance.

Memorandum of Cooperation also paves the way for international trading of carbon credits generated from these projects with Japan and potentially other countries, while ensuring that India's Nationally Determined Contributions (NDCs) remain unaffected.

Union Cabinet has also authorised MoEFCC to finalise the Rules of Implementation (RoI) and sign similar agreements with other nations under Article 6.2, in consultation with relevant ministries and the Ministry of External Affairs (MEA).

*https://krishijagran.com/news/climate-action-india-japan-sign-moc-to-boost-low-carbon-technologies-under-paris-agreement*

## Andhra Pradesh CM launches ICAR-CIBA's innovative seaweed–shrimp integration model for coastal livelihood development

The Chief Minister of Andhra Pradesh, Shri Nara Chandrababu Naidu, launched the Innovative Seaweed–Shrimp Integration Model developed by the ICAR–Central Institute of Brackishwater Aquaculture, Chennai in partnership with the Society for Elimination of Rural Poverty (SERP), and Government of Andhra Pradesh. The initiative was formalized through the signing of a Memorandum of Understanding (MoU) under the Action Plan on Seaweed Culture Programme.

Addressing the gathering, Shri Naidu emphasized that integrating seaweed with shrimp farming will transform coastal aquaculture by improving water quality, enhancing nutrient recycling, and generating additional income, particularly for women Self-Help Groups (SHGs).

The MoU was signed by Smt. V. Karuna, IAS, CEO, SERP, and Dr. Kuldeep K. Lal, Director, ICAR-CIBA, in the presence of Shri Naidu.

Dr. Lal highlighted that ICAR-CIBA's research on integrating Gracilaria spp. seaweed with shrimp culture showed promising results, including a 3–8 fold increase in seaweed biomass and improved shrimp growth, providing farmers with additional revenue without extra inputs. This model, he stated, is both cost-effective and environmentally sustainable.

To operationalize the programme, the experts engaged 30 trained SHG women with technical support from ICAR-CIBA.

The Chief Minister interacted virtually with the women farmers, who shared their positive experiences and highlighted the new livelihood opportunities created through seaweed farming.

This public–private partnership aims to establish replicable, farmer-centric models of responsible aquaculture, supporting Andhra Pradesh's Blue Economy vision and positioning the state as a leader in sustainable coastal resource management.

*https://icar.org.in/en/andhra-pradesh-cm-launches-icar-cibas-innovative-seaweed-shrimp-integration-model-coastal*

## Karnataka women farmers' group among global winners of UNDP Equator Prize 2025

A women farmers' collective in Karnataka has been named among the ten global winners of the United Nations Development Programme's (UNDP) Equator Prize 2025, the world's leading community awards for protecting nature and tackling climate change.

Announced on the International Day of the World's Indigenous Peoples, the prize honours Indigenous peoples and local communities using nature-based solutions to improve livelihoods, protect the environment and build climate resilience.

This year's theme, 'Nature on climate action', focused on projects led by women and young people. Winners were selected from more than 700 nominations across 103 countries, with recipients from Argentina, Brazil, Ecuador, India, Indonesia, Kenya, Papua New Guinea, Peru and Tanzania. They were recognised for restoring ecosystems, safeguarding biodiversity and food sovereignty and creating inclusive, nature-based economies.

India's laureate, Bibi fathima Swa Sahaya Sangha SHG, is a women-led group working in 30 villages across Karnataka. Supporting more than 5,000 farmers, it promotes millet cultivation through mixed cropping, conserves traditional seeds and operates solar-powered processing machines. By combining age-old farming knowledge with sustainable innovations, the group has helped restore biodiversity, improve food security and generate jobs for women and young people.

*https://www.downtoearth.org.in/environment/karnataka-women-farmers-group-among-global-winners-of-undp-equator-prize-2025*

# Odisha, India: A new hub for pumpkin farming

Pumpkin fields as far as the eye can see. That's what you'll find in Karanjia block—a largely tribal area in the Mayurbhanj district, located in eastern Odisha state.

In the last growing season, farmers using improved agronomic techniques and disease-resistant seeds covered nearly 2,000 acres of Karanjia and neighboring Keonjhar district in pumpkin vines. This high-nutrition vegetable is bringing farmers an average net profit of US$830 to US$870 per acre, spurring tremendous economic growth.

Just a few years ago, the story was very different. Although the sandy loam soil and climate in this area is suitable for pumpkin cultivation, smallholder farmers using traditional growing methods and local pumpkin varieties struggled with low yields and poor marketability. The market demand is for larger pumpkins, and local varieties' susceptibility to viral diseases resulted in high pesticide use and poor fruit quality.

The situation started to change in 2021, when East-West Seed Knowledge Transfer Foundation (EWS-KT) began to work with smallholder farmers in Mayurbhanj and Keonjhar. EWS-KT set up vegetable production demonstration plots with local farmers and held training sessions on improved cultivation techniques. Raised beds, proper spacing, appropriate fertilization, and Integrated Pest Management (IPM) methods led to higher and better-quality yields for farmers. Still, the market challenges with local pumpkin varieties remained.

In 2022, EWS-KT established the Center of Excellence, a vegetable production learning hub in Keonjhar where farmers are exposed to sustainable farming practices to increase productivity and profitability. At the Center of Excellence, and in EWS-KT farmers' pumpkin demonstration plots, farmers saw larger pumpkins with

*Karanjia farmers have switched from low-yielding traditional pumpkin varieties to high-yielding varieties*

### Box 1: Improved pumpkin farming for better livelihoods

Raibari Behera is a young vegetable farmer from Sarangagad, a village in Karanjia block, located in the Mayurbhanj district of Odisha state. She farms on her own, with her husband alongside her, and she also grows crops as part of a women's self-help group called Maa Tarini.

In July 2023, Raibari cultivated pumpkins on an 800-square-meter demonstration plot, with the invaluable guidance of Sanu Kumar Behera, a Technical Field Officer with East-West Seed Knowledge Transfer Foundation. This experience taught her about improved farming techniques such as raised beds, quality seeds, and Integrated Pest Management (IPM), which prioritizes prevention and natural pest control methods. These approaches brought her significantly higher yields and an impressive ROI of 286%.

Raibari proudly shared, *"I have always believed that the right farming practices can make all the difference. Since adopting improved methods, I've seen a significant reduction in production costs, while improving the quality of my crops."*

Raibari owns 2 acres of land where she grows vegetables such as tomatoes, hot peppers, cauliflower, and bitter gourds. However, after witnessing the successful results of her pumpkin demonstration plot, she decided to cultivate pumpkins on a larger scale during the most recent kharif season (July to October 2024). She leased 30 acres of land, producing 5,481 tonnes of pumpkins and earning an excellent net profit of 1,819,800 rupees (US$21,700) from her 738,000-rupee (US$8,800) investment.

Raibari with EWS-KT Technical Field Officer Sanu Kumar Behera, who has been instrumental in Odisha's pumpkin expansion.

In addition to farming her own land, Raibari embarked on a collective pumpkin venture with the Maa Tarini self-help group. The women of the self-help group had attended EWS-KT's training sessions at Raibari's pumpkin demonstration plot, and some of them had shown an interest in cultivating pumpkins in order to develop their farming practices and improve their livelihoods.

Pumpkin is a particularly attractive crop for female farmers, as it has relatively low investment costs and low maintenance requirements. In August 2024, Raibari and four other members of the self-help group leased 30 acres of land to grow pumpkins, selecting a disease-resistant variety and implementing improved farming techniques.

For many women, the financial barriers to farming can be immense. Farming in a group can expand access to financial resources and help mitigate this challenge. To raise the money for their pumpkin farm, the women took loans from self-help groups, received a bank loan through a government program, and pooled their own funds, ultimately investing 738,000 rupees (US$8,800).

It was a profitable investment: their collective pumpkin farm returned a net profit of 1,750,200 rupees (US$20,800), which they divided equally among themselves. With the profits, Raibari and her group are prioritizing their children's education and further investing in their farming—including supplies and labor for the next season's crop.

Pumpkin is a crop that is better suited to the kharif season, so for the rabi season (November to April), Raibari plans to grow watermelons. She will be cultivating 8 acres of watermelon on leased land with her husband, and 10 acres with the self-help group.

Raibari has shown that with the right support and knowledge, women can lead the way in farming innovation.

*Source: https://www.ews-kt.com/improved-pumpkin-farming-for-better-livelihoods/ ort and knowledge, women can lead the way in farming innovation.*


*At harvest time, hundreds of trucks come from West Bengal to collect growers' high-quality pumpkins*

a uniform shape. They soon realized that this pumpkin variety, combined with the improved agronomic techniques they had learned, could finally enable them to meet market demand.

Growing these pumpkins, which have good disease resistance, also meant that farmers could rely on newly learned pest management techniques like pheromone traps, rather than spraying pesticides. The significant reduction in the use of pesticides—with most farmers using none at all on their pumpkin fields—saved farmers considerable time and money, as well as benefiting the environment and consumers.

Since most of the pumpkins produced in this area are sold to traders and shipped to Kolkata, West Bengal (about four hours away), farmers also saw market advantages in the new variety's long shelf life, ability to tolerate long-distance transport, and flat top and bottom, which make it easier to stack the pumpkins for travel.

Today, farmers in Karanjia and beyond have embraced high-quality seeds and better farming methods—and have scaled up pumpkin production like never before, leasing more and more land for pumpkin cultivation. At harvest time, hundreds of trucks come from West Bengal to collect growers' high-quality pumpkins for this previously untapped market, and farmers have doubled or tripled their profits.

EWS-KT's intervention has not only transformed the pumpkin marketplace but has created a new market for high-quality inputs, including pumpkin seeds, as farmers have switched from low-yielding traditional pumpkin varieties to high-yielding varieties. This is an exciting expansion opportunity for farmers, agro-input dealers, and others in the vegetable value chain.

EWS-KT Executive Director Stuart Morris recently visited the pumpkin fields of east Odisha. *"Where there's market and land available, the highly nutritious pumpkin is a wonder crop,"* he said. Reflecting on EWS-KT's Pumpkins in Africa project, he added, *"East-West Seed founder and World Food Prize laureate Simon Groot's vision for One million acres of pumpkin in Africa can take a lot of inspiration from these simple but highly profitable fields in Odisha, India."*

*Note: This article was originally published at https://www.ews-kt.com/odisha-india-a-new-hub-for-pumpkin-farming/*

# Monocropping to mixed vegetable farming

## *An inspiring journey*

**Siddharth Kumar Rout**

**Pushpanjali's journey reflects a broader shift in vegetable farming, from chemical dependency to sustainability, from risk to resilience, and from subsistence to surplus. Her story stands as a living example of how smallholder farmers can overcome systemic challenges through knowledge, innovation, and collective support.**

*Trelly technique was adopted to grow climber vegetables*

In the quiet village of Pehelaju Takera, nestled in the Nayagarh district of Odisha, a remarkable transformation has taken root led by Pushpanjali Mallik, a smallholder farmer.

Pushpanjali owns one acre of land, where she previously grew paddy and brinjal, primarily using chemical fertilizers. Like many other farmers in her community, she practiced monocropping, which offered minimal returns while slowly degrading soil health. Her family's nutritional needs remained

*Multiple harvests meets Pushpanjali's household's dietary needs*

unfulfilled and their annual household income hovered around ₹48,000, barely enough to sustain.

### Transition to mixed vegetable farming

The turning point came when NIRMAN, with sustained support and interventions, introduced capacity-building sessions for farmers. Pushpanjali actively participated in natural farming training, financial literacy workshops and group management training. She learned how mixed vegetable farming and natural methods could improve soil fertility, reduce pests and secure food year-round.

Motivated, she shifted from monocropping to cultivating a diverse range of crops. For example field crops like black gram, green gram, horse gram, indigenous paddy, maize etc; vegetables like brinjal, bitter gourd, cowpea, cucumber, ridge gourd, pumpkin, tomato, chilli etc; and fruit crops and perennials like papaya and drumstick. Also other enterprises included were goat rearing, desi chicken rearing and azolla cultivation.

Motivated by the newfound knowledge, Pushpanjali adopted natural farming methods and the trelly technique to grow climber vegetables like bitter gourd and beans. These simple innovations significantly boosted her yield per unit area. Shifting from single-crop dependency to cultivating 4-5 types of vegetables in a year, she now enjoys multiple harvests, meets her household's dietary needs, and contributes to the local market's supply of fresh produce. The results have been transformative.

Today, Pushpanjali produces 12–13 quintals annually across kharif and rabi seasons. Her household income has risen from ₹48,000 to about ₹64,000 per annum, marking a 20% increase. Her household now enjoys year-round nutritional diversity. Surplus vegetables are sold in local hats, through the FPO and to local aggregators. With these earnings, she is building a new house, a symbol of resilience and progress.

She candidly shares the challenges too:

- Lack of access to premium organic markets, which often forces her to sell produce at lower prices.
- Limited storage facilities, which compels immediate selling even when market prices are unfavourable.

### Moving beyond

Pushpanjali's transformation has not gone unnoticed. She has inspired 10 other women members from her SHG – Anantakhola Mahila SHG – to adopt mixed vegetable farming. Beyond inspiration, she provides training and handholding support to these women, enabling them to follow her footsteps. Her SHG received ₹10,000 in seed capital from the block agriculture department, which was instrumental in accessing improved seeds, farm tools, and transport facilities. This financial backing, combined with knowledge from NIRMAN's training, helped her shift from subsistence to surplus farming.

*"The support from our SHG and the seed fund from the agriculture department gave us the confidence to try new techniques like the trelly method. I feel proud that I can now contribute more to my family and community" says Pushpanjali.*

◆

**Siddharth Kumar Rout**
State Program Coordinator
NIRMAN
Plot: S-2/15,
1st Floor, Niladri Vihar
Bhubaneswar, Odisha - 751021
E-mail: kksdfnirman@gmail.com

# Backyard nutrition gardens

## *For family nutrition and income*

AME Foundation

**In rainfed agriculture, where farm livelihoods are highly vulnerable to climate vagaries, alternative farm based enterprises go a long way in providing the necessary support for farmers to remain in farming. Backyard kitchen garden is one such enterprise which meets multiple needs like food, income and nutrition security, besides empowering women.**

Channapur and Chouragudda villages are located in Hubballi taluk, Dharwad district in Karnataka. Majority of the farmers own small landholdings and practice rain-fed agriculture, depending almost entirely on the yearly monsoon for irrigation. Poor soils and indiscriminate use of fertilizers and pesticides have not only resulted in increasing the production cost, but have also led to greater dependence on external inputs, low productivity, uncertain incomes and chemical laden food production. Erratic weather patterns caused by climate change are making their risky livelihoods even more precarious. Household food and nutrition security are at stake. With no serious guidance on eco-friendly farming from the mainstream institutions, farmers, especially youth are moving away from farming.

In this context, during 2023, AME Foundation in collaboration with Rotary Club Indiranagar implemented a project on promoting sustainable agriculture for improving the farmer livelihoods. The project was taken up to support dry land farming groups to undergo systematic and adopt alternative farming practices. Besides guiding farmers on sustainable agriculture practices in field crops like maize, soybean and sorghum, kitchen gardens were also promoted to enable households secure nutrition and also income.

### Backyard kitchen gardens

A key intervention was to help farm women raise kitchen gardens in their backyard. These kitchen gardens are meant to increase food diversity in the diets of the participating families and reduce reliance on the market for introduced vegetables. Each interested household was provided with a kitchen garden kit containing around 10-13 types of vegetable seeds. By raising kitchen gardens, women were able to harvest many types of seasonal vegetables.

During 2023-24, kitchen garden kits with 13 different varieties of vegetables were given to 70 group members. For those who had sown seeds early in the season, owing to excessive rains, the seeds didn't germinate. But around 40% of the women who took up late sowing, could harvest vegetables from the gardens. Women have done composting with kitchen waste, garden clippings, and dry leaves to create rich organic compost. This compost is used to fertilize the garden beds. They also prepared organic liquid fertilizers like *Panchagavya* and *Jeevamruta* to increase immunity and promote plant growth. To manage pest and diseases, they used neem oil spray as natural pesticides. Organic mulch, such as straw and dried leaves, were applied around plants to retain soil moisture, suppress weeds, and improve soil health. Each of the households produced vegetables like brinjal, bhendi, tomato, gourds, cucumber, radish and green vegetables. On an average each household produced vegetables worth Rs.2500-3500 in a season.

Again, 2024 has been a year of heavy rainfall for Dharwad district. Untimely rains caused havoc, damaging crops. Farmers had to face crop losses and in such a situation around 25 women farmers raised nutrition qardens in their backyard. Each household produced vegetables worth Rs.3000-4000 in a season. Kitchen gardens served as a boon to these families facing food shortages due to crop loss.

◆

**AME Foundation**
No. 204, 100 Feet Ring Road,
3rd Phase, Banashankari 2nd Block, 3rd Stage
Bangalore - 560 085, India
www.amefound.org
E-mail: leisaindia@yahoo.co.in

**Box 1: Case of Sainaza**

Smt. Sainaza M Shetasanadi lives with a family of 4 members in Channapur village, Hubballi taluk, Dharwad. Her family relies mostly on farming for livelihood. They have 2 acres of farmland. Having a small plot in her backyard, she desired to grow fresh, organic produce for her family and so adopted sustainable gardening practices. She was very keen to know how sustainable practices can transform small spaces into productive and eco-friendly gardens.

Sainaza is one of the women who was trained in kitchen gardening and was provided with a kitchen garden kit containing various vegetable seeds. She selected area in her home backyard that receives ample sunlight. Added homemade compost and organic manure. She planned the garden layout to include raised beds, vertical gardening structures, and containers to maximize the use of space.

She did composting with kitchen waste, garden clippings, and dry leaves to create rich organic compost. This compost is used to fertilize the garden beds. She used Panchagavya, Jeevamruta as Organic liquid fertilizers to increase immunity and promote plant growth. For natural pest control, she used neem oil, spray, water as natural pesticides. She applied organic mulch, such as straw and dried leaves, around plants to retain soil moisture, suppress weeds, and improve soil health.

Shainaza says that she used to spend about Rs.800-1000 every month for vegetables for the household and now she is able to produce them in her backyard. By producing on her own, she could harvest Rs.3800 worth vegetables.

Her approach not only provides fresh, healthy food for her family but also promotes environmental sustainability and community engagement. She actively shares her gardening knowledge with neighbours. By sharing her experiences and knowledge, she continues to inspire others to adopt sustainable gardening practices, contributing to a greener and healthier environment. Her successful kitchen garden has inspired several community members to start their own gardens, fostering a culture of sustainable living.

# Green enterprise in the fields of Pamaladinni

**Geeta Channal and Rajeshwari Desai**

**Sannayamanappa's journey is an inspiring example of how determination, innovation and traditional wisdom can transform small-scale farming into a viable, profitable and sustainable livelihood option.**

*Sannayamanappa's farm is a vibrant hub of vegetable cultivation and integrated farming*

In the quiet village of Pamaladinni, nestled in the Ghataprabha taluk of Belagavi district, Karnataka, lives a remarkable farmer whose story is a testament to determination, traditional knowledge, and entrepreneurial spirit. Sri Sannayamanappa, an illiterate yet visionary farmer, has turned his modest 3-acre land into a vibrant hub of vegetable cultivation and integrated farming. Alongside vegetable cultivation, he also manages dairy, poultry, rabbit rearing, and love birds.

## Vegetable cultivation

Sri Sannayamanappa's vegetable cultivation is highly efficient and well-organized, focusing primarily on four key leafy vegetables. He cultivates pudhina (mint), palak (spinach), basumati leaf, and pokala or lala bhaji (local leafy greens).

Mint is a star crop of Sannayamanappa's farm, known for its refreshing aroma and medicinal properties. It is cultivated extensively in one acre on his farm since three years. The mint beds are carefully nurtured with organic manure and regular irrigation. He uses cow dung and compost from his dairy unit to enhance soil fertility. He sells around 1,800 to 2,000 bundles per day at ₹3 per bundle, catering to local markets, street vendors, and nearby towns. *"Every bundle of mint carries the scent of the success",* says the farmer.

Palak is another mainstay of the farm, grown in well-prepared furrows of about thirty guntas with adequate sunlight and moisture. Its quick harvest cycle allows for continuous production throughout the year. Hand-weeding and minimal pesticide use make the crop clean and healthy. It fetches ₹5–6 per bundle, and he manages to sell hundreds of bundles every market day.

Basumati Leaf, a lesser-known yet locally valued green is grown in ten guntas. It is often used in traditional recipes and as fodder. With limited input cost and minimal care, it adds an additional stream of income and sold in bundles of 50 leaves for ₹1. It is mostly sold in bulk to local households and traders.

Locally called "lala bhaji," this reddish green leafy vegetable thrives in warm weather and is rich in iron. It is grown in patches between other crops in about thirty guntas and on the bunds of the farm too. It is popular for its flavor and health benefits. It is sold in small bunches, mainly during the early morning hours.

*Pokala leafy green vegetable is popular for its flavour and health benefits.*

## Optimal resource management and integrated farming

The bunds for the farm are also well utilized. Palm, mulberry and diancha are grown on the bunds. Mulberry and diancha are used as the cattle feed and about two quintals of palm is harvested every fifteen days.

The farm's irrigation system utilizes a combination of canal water, a well and two bore wells. His cultivation methods rely on traditional techniques passed down through generations, combined with careful observation and field knowledge rather than formal training.

Resource management is maintained as a closed loop system integrating various components, creating a sustainable and profitable integrated model farm. The model farm avails various components to improve fertility of the vegetable farm besides providing additional incomes.

In addition to vegetable farming, Sri Sannayamanappa has also diversified into several allied agricultural activities. With a small herd of livestock like thirty goats, two buffalos and two cows, the dairy unit not only provides milk for family use and sale but also supplies dung for composting. The slurry is used for biogas generation and also as a nutrient-rich input in his fields. This reduces dependency on chemical fertilizers.

The poultry shed houses around fifty desi chicken which are reared naturally. These birds are sold for meat and eggs in local markets. Poultry waste is used in vermicomposting, making his farm a closed-loop system

*Students visit the farm for hands-on learning*

Rabbits with their tiny paws are a big attraction of the farm, drawing curiosity and interest from visiting children and families. Rabbits are reared in bamboo cages and fed with vegetable scraps and green fodder. Their manure is used as organic compost.

A colorful attraction at his farm is the aviary of love birds. These are bred and sold to pet lovers. Their presence not only adds to income but enhances the aesthetic appeal of the farm.

The dung from dairy farm and manure from poultry and rabbit rearing keeps the farm fertile. Chemical fertilizers are rarely used,  may be only during the peak festive seasons to boost the growth of the crop.

## Family support and community involvement

His large family of  3 sons and 6 daughters support him and are engaged in various aspects of the farming activity. While the sons handle marketing and logistics, the daughters help with bundling greens, feeding livestock and managing accounts. Most of the work in the farm and market is taken care by the family members with assistance of two hired daily wage labour. The labour gets paid around Rs. 400 to 600 per day, while the family members are also paid for their service through direct deposit to their respective accounts.

## Serving as an agro-tourism model

Sri Sannayamanappa's farm feeds the soul, not just the stomach. Recognizing the growing interest in farm visits providing wholesomes rural experiences, the farmer has opened his farm to visitors. He charges a ₹50 entry fee. This small entry fee helps him to maintain the farm infrastructure and motivates the family to keep innovating. His farm draws visitors from nearby towns, not just for the fresh produce, but for the experience itself. Local school groups and agricultural students visit his farm for hands-on learning.

Sri Sannayamanappa's journey is an inspiring example of how determination, innovation and traditional wisdom can transform small-scale farming into a viable, profitable, and sustainable livelihood. His ability to blend vegetable cultivation with dairy, poultry and recreational components like bird rearing and farm tourism has not only improved his income but created a model worth replicating.

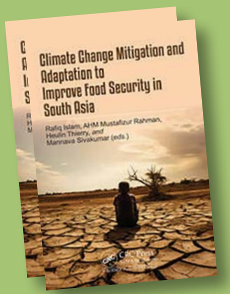
◆

**Geeta Channal**
Asso.Prof, Dept. of Extension Education and Communication Management,
College of Community Science
UAS, Dharwad
E-mail: geetrajpatil@yahoo.co.in

**Rajeshwari Desai**
Senior Scientist
AICRP-Women in Agriculture
UAS, Dharwad
E-mail: rajeshwarimanohardesai@gmail.com

# NEW BOOKS

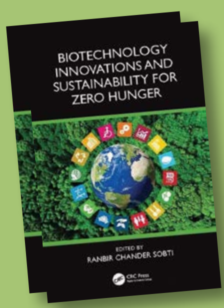
**Climate Change Mitigation and Adaptation to Improve Food Security in South Asia**




Rafiq Islam, AHM Mustafizur Rahman, Heulin Thierry, Mannava Sivakumar (Eds), *June 2025 , CRC Press,* 366 Pgs, ISBN: 9781032628493

Both food security and agriculture contribute to, and are affected by, global climate change. The Intergovernmental Panel on Climate Change reports that food production systems account for up to 37% of global greenhouse gas emissions. At the same time, these systems are increasingly vulnerable to climate change, with extreme weather events such as rising temperatures, flooding, drought, secondary salinity, and land degradation threatening food security in South Asia. Globally, more than 820 million people suffer from hunger, and by 2050, food production will need to double to meet global demands. This intensification of farming, combined with climate change, will lead to greater reliance on reactive chemicals, water, and energy inputs—potentially damaging agroecosystem services and becoming increasingly difficult to manage. South Asia, with its high population growth, is particularly vulnerable to climate impacts such as flooding, salinity, droughts, and solar dimming. Rising sea levels and coastal erosion could result in the loss of 17% of land surface and 30% of food production by 2050. This book, based on the outcomes of the 2022 International Conference on Climate Change and Food security in South Asia, held in Dhaka, Bangladesh, explores key challenges and innovative solutions for mitigating and adapting to the impact of climate change on food security.

**Biotechnology Innovations and Sustainability for Zero Hunger**




Edited By Ranbir Chander Sobti, *July 2025, CRC Press,* 394 Pgs, ISBN: 9781032678108

This reference book extensively examines the important role of biotechnology in tackling the global challenge of achieving zero hunger. The book delves into cutting-edge advancements and challenges in food biotechnology, crop improvement, genetic engineering, and the utilization of genetically modified organisms (GMOs) in sustainable agriculture. It provides a detailed examination of biotechnological interventions aimed at enhancing the nutritional content of crops, increasing agricultural productivity, and ensuring food security. Furthermore, the book explores the application of biotechnological techniques in improving animal-based foods, including advancements in animal breeding, genetics, and disease resistance. Additionally, the book introduces approaches for reduction of food waste through technological solutions, and the use of automation and robotics in food processing. This book is useful for researchers, academicians, and professionals of biotechnology, agriculture, food science, and sustainability.

**Optimizing Smart and Sustainable Agriculture for Sustainability**


Biswaranjan Acharya, Ankita Bansal, Abha Jain, Rachna Jain, Joel J. P. C. Rodrigues (Eds), *July 2025, CRC Press,* 284 Pgs, ISBN: 9781032657943

This reference text addresses the importance of smart crop management for increasing yield and presents a framework for smart monitoring and regulation of crop observation. This book presents meta-heuristic algorithms for optimization, economic crop planning, and use of effective water resource management. It discusses spatial decision support systems for crop productivity management, watershed management, and precision farming. Also it Illustrates swarm intelligence-based optimization techniques, data mining, and machine learning methods for aquaculture operations.

This book highlights artificial intelligence and machine learning-based harvesting algorithms for improving productivity and explains the use of green Internet of Things security solutions for agriculture, plant condition management, and greenhouse simulation.

# SOURCES


## Sustainable and Innovative Vegetable Production in times of Climate Change

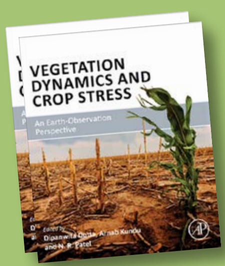
***Concepts of Olericulture***

Zafar Iqbal, Muhammad Akbar Anjum, Sezai Ercisli, Saeed Rauf (Eds), *Jun 2025, Springer Nature,* 547 pgs, ISBN: 9819662834, 9789819662838

This contributed book delves into the cutting-edge techniques and sustainable practices essential for vegetable production in times of climate change. It offers a comprehensive exploration of topics such as CRISPR-based gene tweaking, hydroponic systems, organic farming, edible landscaping, indoor vegetables' production techniques, vegetable grafting, protected olericulture, value addition and postharvest management.

The book covers insights into the nutritive and therapeutic value of vegetables, innovative nursery management, and the latest trends in fresh-cut vegetables. The chapters, contributed by world-renowned experts, address critical questions about food security, environmental sustainability, and advanced cultivation methods. This book is a must-read for anyone looking to enhance their understanding of modern vegetable production.

This book is an invaluable resource for agriculturists, horticulturists, food scientists, plant breeders, university scholars, and industry professionals. It provides knowledge on improving practices through eco-friendly techniques. Whether you are a researcher or an avid gardener, this book will equip you with the latest research and practical applications to thrive in the evolving field of olericulture.

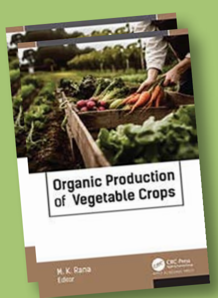



## Vegetation Dynamics and Crop Stress

***An Earth-Observation Perspective***

Dipanwita Dutta, Arnab Kundu, N.R. Patel (Eds), *July 2024, Academic Press*, 299 pgs, ISBN: 9780323956178

*Vegetation Dynamics and Crop Stress: An Earth-Observation Perspective* focuses on vegetation dynamics and crop stress at both the regional and country levels by using earth observation (EO) data sets. The book uniquely provides a better understanding of natural vegetation and crop failure through geo-spatial technologies. This book covers biophysical control of vegetation, deforestation, desertification, drought, and crop-water efficiency, as well as the application of satellite-derived measures from optical, thermal, and microwave domains for monitoring and modeling crop condition, agricultural drought, and crop health in contrasting monsoon/weather episodes.




## Organic Production of Vegetable Crops

M. K. Rana, PhD (Ed.), *July 2025, Apple Academic Press,* 764 pgs, ISBN: 9781003539049

OOrganic vegetable farming involves the use of biological resources and avoiding the use of synthetic substances for maintaining soil productivity and ecological balance, thereby minimizing wastage and environmental pollution. This new book provides a comprehensive introduction and covers a wide range of topics on successful production of organic vegetable crops.

The book introduces the concepts, importance, and scope of organic farming, highlighting best practices and the do's and don'ts. It then goes on to cover crucial topics on organic vegetable production, including methods for enhancing soil fertility, green manuring, role of biofertilizers, composting methods, agricultural waste, coir composting, biodynamic vegetable farming, botanical and biocontrol agents, and much more. The book also explores important subjects in organic farming such as the potential of zero-budget natural farming, nonconventional vermicomposting in organic farming, biodynamic vegetable farming, plant disease management, and processing and quality control for organic foods. In addition, the book discusses the export opportunities and challenges faced in organic farming.

# Farm diversity for successful farming

Basanagowda Rayanagowda Patil, a progressive farmer of Papanashi village in Gadag taluk, is 77 years old. However, he is full of enthusiasm, pursuing farming passionately and leading a healthy life.

While studying for his B.A. degree, he decided to make farming as his livelihood associating with the Mother Earth and lead a life of contentment and respect. He quit his B.A. degree halfway and started farming with his father, firmly aspiring to be a model progressive farmer. He has been continuously involved in agriculture, horticulture and forestry, from the time he was 21 years old. Being in farming since 55 years, he has gained immense knowledge in crop management. His younger son Praveenagouda Patil helps him in managing the plantation crops.

Basanagowda is a 40-acre landowner. There are about 80 types of agricultural/horticultural/forest crops in his farm. Seasonal crops such as sugarcane, wheat, jowar, chickpea, fenugreek, peanut and cowpea are cultivated. He is enthusiastic in growing crops including pulses based on discussions with scientists. The farm has flower crops such as rose, jasmine, aster. Vegetable crops such as beetroot, cabbage, cauliflower, golden tuber, brinjal, and tomato are grown in half an acre each.

Three years ago, as a new experiment, he brought 400 areca saplings from Banavasi and planted them in one acre. The crop is doing good. They have two acres of chrysanthemum, one acre of banana, and half an acre of curry leaves. Trees on the farm include, tamarind, coconut, custard apple, ram fruit, water chestnut, guava and lemon. Forest plants such as jatropha, neem, bamboo, *honge*, teak, sandalwood are found in Gowda's garden. There are medicinal plants like aloe vera, Japanese mint, basil, *amrita balli*, and jackfruit. Home remedies made from these are given free of cost to neighbors in need.

Equipments like tractor, seed drill, plough, rotovator, harrow, special harrow, rain gun, sprinkler irrigation unit, drip irrigation unit etc., are used for managing the farm. There is an open well in Gowda's garden. This is scientifically filled without wasting water during the rainy season leading to good recharge of tubewells. For soil and water conservation, he has implemented techniques like field bunds while planting fodder grass on the bunds. Eight years ago, he has built a 21-meter-wide farm pond pit in his garden in Lakkundi with support from Dept. of Agriculture's Krishi Bhagya scheme.

Not only maintaining a model diverse farm, he is keen on teaching and motivating others to be self reliant and progressive. He is thus truly a role model helping all those aspiring to be successful in farming.

Recognizing Gowda's achievements, he has been awarded the District Level Best Farmer Award by the Agriculture Department for the year 2023-24.

He visited several places including China, Delhi, Maharashtra, Haryana, Rajasthan, Kerala, Tamil Nadu. By interacting with farmers there, he has been able to adopt various technologies on his farm. Through visits and regular contact with Department, has been maintaining about 80 types of plants/trees/trees that can be seen on a single farm.

Overall, Basanagowda is always keen to do something new. He believes farming has made him self-sufficient, giving him immense satisfaction economically too. He strongly feels that young farmers should not hesitate to adopt integrated agriculture to make farming successful. He expressed that after deducting all the farm and family expenses, an estimated net income of four to six lakhs is obtained. His house which is located on the farm welcomes all those young farmers willing to learn something new from him.

Basanagowda may be contacted on his mobile number 9845876143.

*Note: This write up has been compiled by Ms. Hema Moraba, a journalist at Gadag. She can be contacted on 9844615364.*

# Vegetable promotion through entrepreneurship

**Rajesh Parida**

**Many times, an improved practice is all it requires to bring about a change. A simple technique in nursery raising has made inroads in Banka district in Bihar resulting in increased vegetable cultivation in the region. Also by taking this as an enterprise and supporting vegetable production, many farm entrepreneurs are earning well to make a decent living.**

*Women getting trained to raise seedlings in Pro-Tray Net House Nursery*

Banka district is one of Bihar's backward districts, lying in the eastern Bihar. Agriculture, is at subsistence level. It is primarily based on food crops, in spite of having a unique advantage of diversifying crop choices. With low productivity from small land holdings, the tribal farming families hardly manage to get a return of Rs 50000 in an year, in case there are no severe weather fluctuations.

Vegetable cultivation during the monsoon season remains low in many regions in spite of receiving substantial rainfall (around 700 mm from June to September). Farmers hesitation is owing to lack of technical knowledge and absence of reliable nursery infrastructure. Vegetable nurseries are initiated late missing out early harvest opportunities and better market prices. The available homestead and upland plots, ideal for early-season vegetable cultivation, are typically allocated to low-return crops like maize. One of the key deterrents has been farmers' past experiences with poor-quality saplings sourced from local markets, resulting in high mortality, low productivity, and economic losses.

The success of vegetable farming depends heavily on the quality of seedlings and the care taken during nursery raising. Critical steps like seed treatment, soil sterilization, root zone management, and timely application of bio-inputs and nutrients are often skipped due to lack of awareness or support, leading to stunted growth, pest infestation, or plant loss, thus affecting overall productivity at both the household and cluster levels. Traditional soil-bed nurseries faced low germination rates and were prone to soil-borne diseases such as wilt, leading to reduced productivity. The irregular rainfall in South Bihar often delayed land preparation, affecting timely crop establishment. All this called for an improved practice like Pro-Tray Net House Nursery, in raising seedlings.

## Pro-Tray Net house Nursery Enterprises

The process of raising nurseries through this technique is as follows.

### a) Tray selection

Selection of pro-trays and the number of cells depends upon the requirement of the land and demand for the seedlings. The size of the cell is significant since it determines the quantity of media needed as well as the ability to store water. Choose trays as per crop requirement (98/50 cells) - 98-cell trays (for crops like tomato, brinjal, chillies etc) and 50-cell trays (for crops needing bigger root space like bitter gourd, bottle gourd, watermelon).

**Table 1: Number of seeds per packet for each type of vegetable**

| Sl no. | Crop name | No of seeds per 10 gm packet |
|---|---|---|
| 1. | Cauliflower | 2000-2200 seeds |
| 2. | Chilli | 2000-2200 seeds |
| 3. | Brinjal | 2000-2200 seeds |
| 4. | Tomato | 3000 seeds |
| 5. | Bitter gourd/ Bottle gourd | 50-55 seeds |
| 6. | Cucumber | 80 seeds |

### b) Preparation of growing media

Media selection is an important aspect for nursery raising. This should be done based on the type of seedlings to be raised. Physical and chemical properties of the media affect the germination and establishment of the seedlings. The important physical media components are water, air and nutrient retaining capacity of the media for optimum root growth. The pH of the medium also affects the germination. The media selection should be done in a such a way that it should retain optimum moisture- neither more nor less.

The media generally used for production of seedlings in nursery is cocopeat. The 5 kg cocopeat brick need to be soaked overnight in 25 litres of water. Later, cocopeat is washed 5 to 6 times using mosquito net to drain out excess of salt in cocopeat, maintaining a neutral pH of 7 for healthy growth. Then the cocopeat is dried to remove excess water. The most reliable and simple method to check moisture levels in cocopeat is by conducting *Hand Squeeze Test*. To perform this, take a handful of cocopeat from the tray or growing media and squeeze it tightly in your fist. If water drips out while squeezing, it indicates

**Box 1: Nursery Cycle**

| S.No | Month | Crop |
|---|---|---|
| Batch 1 | June-July | Cucumber, Bitter gourd etc. |
| Batch 2 | Aug-Sep | Cabbage, Cauliflower, Tomato, Chillies, Brinjal |
| Batch 3 | Dec-Jan | Watermelon, Bitter gourd etc. |

*Stacking trays after sowing seeds creates an ideal germination environment*

that the cocopeat is holding excess water and is too wet, which can lead to poor aeration and root rot. If no water drips out but your hand feels moist and the cocopeat holds together like a soft clump, the moisture level is ideal for seedling growth. However, if the cocopeat feels dry, loose, and crumbles, it means the media is too dry, needing immediate watering. Maintaining proper moisture balance is crucial for healthy root development and seedling survival.

To enrich cocopeat with nutrients and protective bio-agents, a balanced mixture of compost and biological additives should be used. For every 5 kg of cocopeat, add 5 kg of Brown Gold compost to improve nutrient content and organic matter. To this mix, incorporate 100 grams of Trichoderma and 100 grams of Pseudomonas fluorescens. These bio-agents help in preventing fungal and bacterial diseases at the root zone and improve overall plant health. Mix all components thoroughly to ensure uniform distribution. Once prepared, allow the mixture to rest for a few hours under shade before filling it into pro-trays. This combination provides a nutrient-rich, disease-suppressive nursery media for healthy seedling development

**c) Germination and transplanting**

Fill each cell of the tray with prepared media loosely and gently tap the tray to settle the media slightly. To create an ideal germination environment in a protray nursery, a simple and effective method is to stack the trays one over another after sowing the seeds. Once stacked, cover the pile of trays with a moist jute sack (jute bora) to maintain warmth and humidity – conditions that promote faster and uniform germination. Spray water over the jute sack daily to keep it moist, which helps in retaining humidity within the trays.

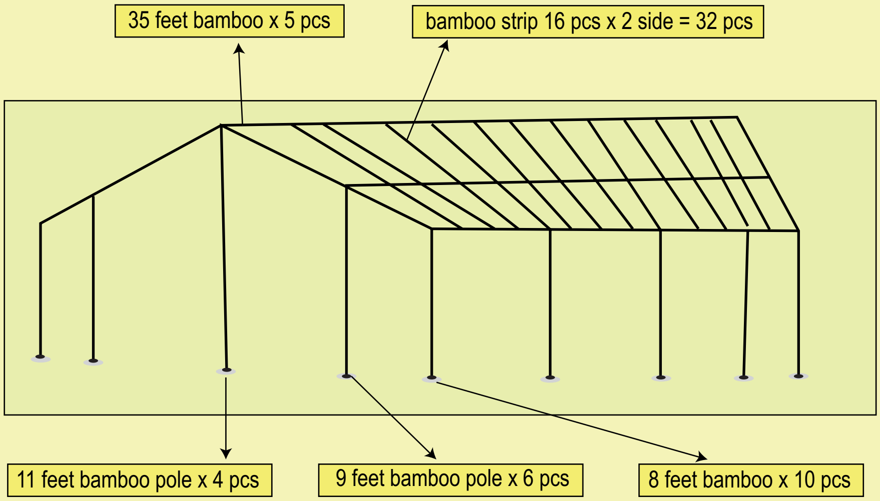
For most vegetables like chilli, tomato, and cauliflower, seeds typically begin to germinate within 3–4 days under optimal conditions. However, bitter gourd seeds are naturally hard and may take 6–7 days to germinate. It is important to check the trays daily for signs of seed sprouting. As soon as sprouting is observed in a

*Maintaining proper moisture balance is crucial for healthy root development and seedling survival* tray, remove it from the stack and spread it out under a shade net or net house, where the seedlings can receive filtered light and proper ventilation. This practice helps in preventing fungal infections and ensures healthy growth post-germination.

Spray NPK 19:19:19 @ 2-3gm / litre of water depending of growth and uniformity in growth.

Transplant seedlings at 21–30 days age, depending on the crop. Transplant during early morning or late evening to reduce transplantation shock.

**Fig 1: Bamboo structure of 35 feet x 30 feet**




## Nursery cycle – Business Model

This technique can be adopted using two types of structures. A 1200 sq.ft poly house with permanent structure which could last for 6 years, would cost around Rs.156000. A low cost alternative model is made of bamboo structure. This model lasts for 2 years.

The total cost of establishing the bamboo nursery is Rs.17830.

**Table 2: Expenditure and returns from a 6-cycle production of nursery saplings**

| S. No. | Material | Per cycle | Per unit price | For 6 cycles | Price |
|---|---|---|---|---|---|
| 1. | Tray | 250 tray 98 hole and 50 trays 50 hole | 98 holes -Rs.18.50 and 50 holes-Rs.22 | 250 tray 98 hole and 50 trays 50 hole | 5725 |
| 2. | Cocopeat | 60 kg | Rs 40 | 360 kg | 14400 |
| 3. | Brown gold | 60 kg | Rs 28 | 360 kg | 10080 |
| 4. | Trichoderma | 1.2 kg | Rs130 | 10 kg | 1300 |
| 5. | Pseudomonas fluorescens | 1.2 kg | Rs 140 | 10 kg | 1400 |
| 6. | NPK 19:19:19 | 1.2 kg | Rs 120 | 10 kg | 1200 |
| 7. | Medicine | lumpsum | Rs 100 | lumpsum | 1000 |
| 8. | Cauliflower/chilli/bringal/ tomato 10 gm | 12 packet | Rs 500 | 72 packet | 36000 |
| 9. | Bitter gourd/Bottle Gourd 10 gm | 50 packet | Rs 150 | 300 packet | 45000 |
| | | | | **Total** | **116105** |
| | | **Total expenditure over 6 cycles in polyhouse nursery per year** | | | **140690** |
| | | **Total expenditure over 6 cycles in net house nursery per year** | | | **123605** |
| | **No. of saplings grown in 6 cycles (98 holes x 250 trays x6 cycles) = 1,47,000** | | | | |
| | **No. of saplings grown in 6 cycles (50 Holes x 50 trays x 6 cycles)= 15000** | | | | |
| | **Net Returns = Rs. 81310 (polyhouse nursery); 98395 (net house nursery)** | | | | |
| | **Total Returns** | **147000 xRs1 + 15000 x Rs .5 = Rs.2,22,000/-** | | | |

**Box 2: Redefining woman's role: A case study of Muniya Murmu**

In Inravaran village of Katoria block in Banka district. Muniya Murmu pioneered a transformative agricultural business model in 2022 when she established a tray nursery with support from PRADAN and HDFC Bank Parivartan. Unlike conventional methods where seedlings are grown in soil beds, Muniya's technique utilizes specialized trays with cocopeat medium, resulting in healthier plants with greater disease resistance. This innovative approach not only addressed a market gap but positioned Muniya at the forefront of agricultural innovation in a region where women's technical expertise is rarely acknowledged.

Her journey wasn't without obstacles. When she first started selling seedlings at one rupee each, village elders dismissed her enterprise. *"People were saying who would buy plants for one rupee each, it's too expensive. They said we would face losses,"* Muniya remembers. Even within her home, skepticism prevailed. "My family also said I was starting something useless, wondering whether it would succeed", says Muniya.

Despite initial failures—including losing 5,000 seedlings due to inexperience with germination techniques, Muniya persevered. Her determination paid off. From a rented plot, she now owns eight kathas of land purchased entirely from her nursery earnings. The economic impact has been remarkable. *'In the first year, I earned ninety thousand rupees. In the second year, my earnings increased to one lakh eighty thousand,"* she states proudly. Currently, she's on track to earn over two lakh rupees this year. Her nursery produces an impressive variety of seedlings—1.5 lakh chilli plants, 1 lakh cabbage plants, and thousands of bitter gourd, cucumber, tomato, and eggplant seedlings.

Beyond personal gains, Muniya's enterprise strengthens local economic ecosystems. *''We created this so that village money stays within the village,"* she explains, highlighting how her business integrates with local women producer groups and the other entrepreneurs.

Perhaps most significantly, her success has transformed family dynamics. Her husband, who previously migrated for work, now collaborates with her in the nursery. Through her enterprise, Muniya has become an economic decision-maker and community resource person, dismantling gender stereotypes with each seedling she nurtures.

As other women from her village express interest in starting similar ventures. Muniya's journey illustrates how agricultural entrepreneurship can redefine women's roles in rural economies, turning gender constraints into opportunities for empowerment and community development.

## Impact

A total of 30 entrepreneurs have adopted this nursery technology. Each Entrepreneur is supported with a Nethouse Nursery structure which costs around Rs.20,000.00. They are providing disease-free saplings at reasonable prices to fellow farmers as a sustainable service model. This technology has already benefitted around 3000 farmers across Katoria and Chandan blocks of Banka district.

Through this intervention, farmers are now able to raise nurseries 20–30 days before the onset of rains. Once land is prepared, they can transplant 20–30-day-old healthy saplings, resulting in early crop production (20–30 days in advance); improved yields and disease-free crops, better market price realization due to early arrival of produce in the market, thus enhancing overall profitability.

**Rajesh Parida**
Project Executive,
PRADAN Katoria
Banka, Bihar-813106
E-mail: rajeshparida@pradan.net