

# Field Innovations to Policy for Climate Resilient and Sustainable Agriculture in Karnataka



Key Strategies for Sustainable | Climate-Smart Agriculture  
Resource Use | Livelihoods and Value Change



भाकृअनुप कृषि प्रौद्योगिकी अनुप्रयोग अनुसंधान संस्थान  
ICAR-Agricultural Technology Application Research Institute  
Zone-XI, Hebbal, Bengaluru - 560 024



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Indian Council of Agricultural Research, New Delhi

## FORWORD

Amid mounting pressures from climate variability, resource depletion, market vulnerability, labour shortages, and post-harvest losses, Indian agriculture faces both serious challenges and transformative opportunities that can be effectively realized only through policies grounded in field realities, scientific evidence, and proven grassroots innovations.

This policy document on “*Field Innovations to Policy for Climate-Resilient and Sustainable Agriculture in Karnataka*” brings together a diverse and compelling set of policy briefs that exemplify the principle of “*field evidence to policy action*.” The contributions span multiple subsectors of agriculture and allied activities—ranging from climate-resilient cropping systems, soil and water management, and sustainable aquaculture, to agri-waste valorization, plantation and horticultural value chains, sericulture innovations, drone-based services, farmer producer organizations, and community-led communication platforms. Collectively, they reflect a holistic vision of agricultural transformation that integrates productivity, profitability, sustainability, and resilience.

A key strength of this compilation is its firm grounding in on-farm experimentation, pilot demonstrations, institutional models, and livelihood interventions led by ICAR–Krishi Vigyan Kendras, State Agricultural Universities, Farmer Producer Organizations, and community institutions, with a strong focus on Karnataka. The documented innovations and policy analyses illustrate how local resources, knowledge, and enabling institutions can be effectively leveraged to build scalable, inclusive, and sustainable solutions for climate resilience, water security, income enhancement, and rural enterprise development.

It is hoped that the insights and policy options presented here will kindle deliberations, inspire adaptive policymaking, and contribute meaningfully to the national goals of farmer welfare, environmental stewardship, and resilient agri-food systems.

Date : 15 April 2026

(Rajbir Singh)





**ICAR-Agricultural Technology Application Research Institute, Zone XI**

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## **PREFACE**

Indian agriculture is at a pivotal crossroads. Escalating climate variability, degradation of natural resources, market instability, labour shortages, and post-harvest losses are placing growing pressure on the sustainability of farm livelihoods. Simultaneously, transformative opportunities are emerging through climate-smart technologies, circular economy models, digital innovations, farmer collectivization, and value-added agri-enterprises. Converting these opportunities into scalable, inclusive, and durable outcomes demands policies that are firmly anchored in field-level evidence.

This publication, ***Field Innovations to Policy for Climate-Resilient and Sustainable Agriculture in Karnataka***, presents a curated collection of policy briefs developed by scientists and practitioners from ICAR–Krishi Vigyan Kendras (KVKs), State Agricultural Universities, and allied institutions, with a primary focus on Karnataka. These contributions draw upon sustained field engagement, on-farm demonstrations, institutional innovations, and livelihood interventions across diverse agro-ecological regions.

The compilation spans a broad thematic spectrum, including climate-resilient farming systems, waste-to-wealth and circular economy approaches, crop diversification, water-efficient technologies, digital agriculture, Farmer Producer Organizations, women-led enterprises, and rural communication platforms. Together, the chapters illustrate how locally validated solutions—ranging from vegan areca leather derived from leaf sheath waste and banana flour from surplus produce to cocoon-based bio-crafts, direct seeded rice, millets, agricultural drones, and community radio—can meaningfully inform national policy frameworks when supported by enabling institutions and convergent public schemes.

A defining feature of this volume is its strong policy orientation. Each brief extends beyond problem identification to propose actionable pathways aligned with flagship Government of India initiatives such as the National Mission on Sustainable Agriculture, NICRA, PMFME, the Digital Agriculture Mission, the FPO Promotion Policy, Atmanirbhar Bharat, and the national circular economy agenda. Equal emphasis is placed on technological viability, institutional architecture, financing mechanisms, gender inclusion, and scalability.

Intended for policymakers, planners, researchers, development professionals, agri-entrepreneurs, and students of agricultural policy, this volume also stands as a testament to the critical role of ICAR–KVKs as bridges between grassroots innovation and policy formulation. It is hoped that this compilation will contribute to evidence-informed policymaking and foster deeper collaboration between field institutions

**(V. Venkatasubramanian)**

**Date : 15 April 2026**



## ACKNOWLEDGEMENTS

The successful compilation of this volume is the result of the collective efforts and intellectual contributions of many individuals and institutions. We sincerely acknowledge the valuable inputs provided by scientists, extension professionals, and practitioners from ICAR–Krishi Vigyan Kendras across Karnataka, State Agricultural Universities, and partner institutions, whose field-based research, innovations, and policy insights form the foundation of these policy briefs.

We also express our profound gratitude to **Dr. M. L. Jat**, Hon'ble Director General, Indian Council of Agricultural Research (ICAR) and Secretary, Department of Agricultural Research and Education (DARE), Government of India, for his visionary leadership and steadfast commitment to sustainability, resilience, and innovation in Indian agriculture. His emphasis on integrating science, policy, and extension has provided a strong intellectual foundation for this compendium and reinforced the importance of evidence-based policy instruments responsive to climate risks, resource constraints, and livelihood vulnerabilities.

We gratefully acknowledge **Dr. Rajbir Singh**, Deputy Director General (Agricultural Extension), ICAR, for his strategic guidance and constant encouragement. His insights into extension reforms, pluralistic partnerships, and farmer-centric knowledge systems have significantly shaped the orientation of the policy briefs, ensuring alignment with national priorities while remaining responsive to local contexts.

We sincere thanks are extended to **Dr. R. R. Burman** and **Dr. Ranjay Kumar Singh**, Assistant Directors General (Agricultural Extension), ICAR, for their scholarly inputs and thoughtful guidance. Their focus on social inclusion, institutional strengthening, and innovation dissemination has added depth and rigor to the policy recommendations, anchoring the compendium in a balanced integration of technology, institutions, and human dimensions.

The cooperation extended by line departments, Farmer Producer Organizations, community institutions, entrepreneurs, and progressive farmers during field implementation and documentation is also duly acknowledged.

Support from various national programmes and schemes that enabled on-ground experimentation and scaling of innovations is deeply appreciated. The editorial and technical teams involved in review, compilation, and publication deserve special thanks for ensuring quality, coherence, and policy relevance.

Above all, We acknowledge with our salutations to the farming communities of Karnataka, whose experiences, innovations, and resilience continue to inspire evidence-based policies for sustainable, climate-resilient, and inclusive agricultural development.

**Editors**



### Areca Leaf sheath Waste to Vegan Leather for Sustainable Livelihoods and Green Manufacturing

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#### Executive Summary

India's rapid expansion in arecanut cultivation, particularly in Karnataka, has enhanced farm incomes but also increased vulnerabilities related to monocropping, climate variability, pest outbreaks, and market volatility. Concurrently, arecanut plantations generate large volumes of leaf sheath biomass that remain underutilized.

This policy brief proposes Vegan Areca Leather, derived from areca palm leaf sheaths, as a scalable, sustainable, and cruelty-free material that aligns with national priorities on circular economy, waste-to-wealth, Atmanirbhar Bharat, startup promotion, women-led enterprises, and green manufacturing. Targeted convergence across NITI Aayog, DAC&FW, MSME, and PMFME can transform this agricultural waste into a high-value industrial input while strengthening farmer resilience and rural employment.

#### Context and Need for Policy Intervention

Arecanut (*Areca catechu*), a tropical palm species widely distributed across South East Asia, is popularly known as betel nut or *supari* in India. India is the world's largest producer and consumer of arecanut, accounting for about 54.07 per cent of global production as per FAO statistics. The crop is predominantly cultivated in Karnataka, Kerala, and Assam, with Karnataka alone contributing nearly 40 per cent of the national area and a substantial share of total production. Other producing states include Tamil Nadu, Meghalaya, and West Bengal. In recent years, there has been a significant expansion in arecanut cultivation, driven by higher economic returns compared to traditional crops such as paddy and ragi, along with improved access to irrigation facilities. In Karnataka, the area under arecanut increased dramatically from 218.01 thousand hectares in 2014–15 to 676.95 thousand hectares in 2023–24, registering a Compound Annual Growth Rate (CAGR) of 16.20 per cent. Correspondingly, national production rose from 457.56 thousand tonnes to 1,032.02 thousand tonnes during the same period, with a CAGR of 14.12 per cent. However, the faster growth in area compared to production indicates emerging concerns related to yield stagnation, marginal land expansion, pest and disease incidence, and climatic variability.

Arecanut cultivation in Karnataka is concentrated in high-rainfall districts such as Dakshina Kannada, Uttara Kannada, Udupi, Shivamogga, and Chikkamagaluru, where the crop plays a crucial role in the regional economy and farmer livelihoods. Shivamogga district alone accounts for about 1.37 lakh hectares under arecanut, with a production of 2.17 lakh metric tonnes (2023–24), although productivity has been declining at an annual rate of 0.15 per cent. Despite government interventions such as financial support for disease management, promotion of intercropping, and establishment of quality testing facilities, farmers continue to face challenges including price volatility, climate stress, pest and disease outbreaks, and inadequate post-harvest infrastructure. Given the long economic life of arecanut palms—often exceeding 80 years—and the substantial generation of by-products such as leaf sheaths and husk, there exists significant scope for income diversification through value addition. Each hectare produces thousands of leaf sheaths annually, which were traditionally used for mulching or left as waste but are now increasingly processed into biodegradable plates, bowls, and other products due to plastic bans. These areca leaf sheath products offer an environmentally sustainable alternative to plastic-based disposables, promote circular economy principles by utilizing agricultural waste, and generate employment through labour-intensive rural enterprises, thereby enhancing both environmental and economic sustainability.

#### Vegan Leather and the Future of Indian Leather Industry: A Sustainable Shift

The Indian leather industry, a major contributor to footwear, apparel, and lifestyle manufacturing, is undergoing a significant transition towards sustainable and ethical alternatives. Conventional leather production, which relies on animal hides and chemical-intensive tanning processes, raises serious environmental, health, and animal welfare concerns. These challenges, combined with shifting consumer preferences towards cruelty-free and eco-friendly products, have accelerated the adoption of vegan leather—plant-based materials that replicate the look and feel of traditional leather without animal-derived inputs. In India, the synthetic and vegan leather market was valued at ₹31,396



crore in 2024 and is projected to reach ₹45,349 crore by 2033, growing at a CAGR of 4.03 per cent. Innovations in bio-based materials such as areca leaf sheath leather, mushroom leather, apple leather, leaf leather, and Piñatex are driving this transformation, supported by start-ups and research-led enterprises responding to global sustainability trends.

Within this emerging landscape, areca vegan leather, derived from fallen areca palm leaf sheaths, represents a promising waste-to-wealth innovation, particularly for arecanut-growing regions such as Shivamogga district in Karnataka. This biodegradable and compostable material offers a sustainable alternative to both animal leather and petroleum-based synthetics, requiring minimal and chemical-free processing while reducing plastic waste and carbon footprint. Beyond environmental benefits, areca vegan leather creates significant socio-economic value by generating rural employment, supporting SHG- and FPO-led enterprises, and providing stable supplementary incomes to farming communities. Rising consumer awareness, supportive government policies, and growing demand from the fashion and lifestyle sectors further strengthen its market potential. However, challenges related to initial production costs, consumer perception regarding durability, and distribution infrastructure must be addressed through targeted policy support, research and development, and market awareness initiatives to enable large-scale adoption and integration into India's sustainable manufacturing ecosystem.

### Problem Statement

1. Increasing monocropping risk in arecanut-growing regions.
2. Limited value addition and post-harvest utilization of arecanut by-products.
3. Environmental and ethical concerns associated with conventional leather and synthetic alternatives.
4. Inadequate rural agro-processing enterprises linked to plantation crops.

**Policy Gap:** Existing horticulture support largely focuses on production and disease management, with limited emphasis on structured utilization of by-products for income diversification

### Policy Objectives (Outcome-Oriented)

- Diversify income sources for arecanut farmers and plantation-dependent households.
- Promote sustainable, plant-based alternatives in the Indian leather and lifestyle sector.
- Strengthen rural agro-processing and micro-enterprises.
- Reduce environmental footprint of leather and plastic-based products.
- Enable women, SHGs, FPOs, and rural youth to participate in green value chains.

### Proposed Intervention: Vegan Areca Leather Value Chain

**Raw Material:** Naturally fallen areca palm leaf sheaths (agricultural waste)

**Processing:** Cleaning, fermentation/softening, pressing, drying, and finishing using low-energy, chemical-free processes. **Products:** Footwear components, bags, wallets, belts, accessories, upholstery, lifestyle products.

### Implementation Model:

- SHG/FPO-led primary processing units at cluster level
- MSME/private sector participation for finishing, branding, and marketing
- Technical backstopping by ICAR-KVKs and State Agricultural Universities

### Alignment with National Schemes and Ministries

#### a) NITI Aayog

- Circular Economy Action Plan
- SDGs: SDG 8 (Decent Work), SDG 12 (Responsible Consumption), SDG 13 (Climate Action)
- Aspirational Districts and Local Value Chain Development

#### b) Department of Agriculture & Farmers' Welfare (DAC&FW)

- National Mission on Sustainable Agriculture (NMSA)
- Horticulture Mission support for value addition
- Farmer income diversification and risk mitigation

### c) Ministry of MSME

- MSME cluster development in arecanut-growing belts
- Technology upgradation and credit-linked subsidy schemes
- Startup India and entrepreneurship promotion

### d) PMFME Scheme

- Support for micro food and agro-based enterprises
- SHG/FPO-led processing and branding
- One District One Product (ODOP) linkage for arecanut regions

### Expected Outcomes and Impact Indicators

#### Economic

- Additional income from by-products previously treated as waste
- Creation of rural micro-enterprises and local jobs

#### Environmental

- Reduction in plastic and synthetic leather usage
- Lower carbon and water footprint compared to conventional leather

#### Social

- Women and youth-led enterprises
- Safer working conditions due to chemical-free processing

### Role of Krishi Vigyan Kendras (KVKs)

Krishi Vigyan Kendras (KVKs), including KVK–Shivamogga, play a critical role in promoting agricultural innovations, technology transfer, and rural entrepreneurship, and can serve as key implementing agencies for advancing sustainable industries such as areca vegan leather. Although direct KVK involvement in vegan leather initiatives is currently limited, their institutional mandate positions them well to support this emerging sector. KVK–Shivamogga can facilitate technology dissemination by creating awareness on eco-friendly materials and sustainable processing methods for areca-based vegan leather. Through skill development and capacity-building programmes, KVKs can train rural youth, women, SHGs, and entrepreneurs in value addition, processing, and enterprise management. They can also undertake on-farm and off-farm trials to validate suitable plant-based raw materials and processing techniques, while promoting efficient waste management practices to convert agricultural residues into value-added products. Additionally, KVKs can play a catalytic role in strengthening market linkages by connecting farmers, processors, MSMEs, and buyers, thereby fostering entrepreneurship, local value chains, and sustainable livelihood opportunities in arecanut-growing regions.

### Policy Recommendations

#### a. Regulatory and Standards Framework

- Develop BIS/eco-certification standards for plant-based areca leather

#### b. Financial Incentives

- Capital subsidy and credit support under MSME and PMFME
- Tax incentives for eco-friendly materials

#### c. Research and Innovation

- Public funding for durability, scalability, and product standardization
- Industry–academia collaboration

#### d. Market Development

- Government procurement preference for sustainable materials
- Support participation in national and international trade fairs

#### e. Institutional Convergence

- Coordination between DAC&FW, MSME, MoFPI, and State Governments

### Conclusion

Vegan areca leather offers a strategic pathway to convert plantation waste into a high-value, sustainable product while addressing farmer income instability and environmental concerns. Explicit convergence of agricultural, MSME, and sustainability policies can position India as a global leader in plant-based leather alternatives and strengthen resilient rural livelihoods.

## Policy Brief 2

### Cocoon BioCraft: Sericulture Waste to Rural Wealth

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#### Executive Summary

Sericulture is a flagship agro-based rural enterprise in India, contributing significantly to employment generation, women's participation, and value-added manufacturing. However, nearly 75–80% of the cocoon biomass remains underutilized, particularly pierced, defective, and cut cocoons generated during grainage and reeling operations. These materials are often sold at negligible prices or discarded as waste.

Cocoon BioCraft, the systematic conversion of sericulture waste into decorative, utility, and eco-craft products, offers a low-cost, scalable, and inclusive livelihood model aligned with the Government of India's priorities on circular economy, waste-to-wealth, women-led development, and MSME promotion. With targeted policy support, Karnataka can serve as a national pilot for mainstreaming cocoon waste valorization across sericulture clusters.

#### Background and Rationale

India is the world's second-largest producer of silk, with Karnataka contributing a dominant share through districts such as Ramanagara, Chikballapur, Kolar, Mandya, and surrounding regions. While silk yarn extraction utilizes only a small fraction of cocoon weight, the remaining cocoon shell possesses excellent aesthetic, biodegradable, and craft-friendly properties.

At present:

- Cut and pierced cocoons generated in grainages are grossly undervalued.
- Rural women, specially-abled persons, and marginal groups face limited access to dignified, home-based livelihood options.
- Traditional sericulture extension focuses largely on production and reeling, with minimal emphasis on waste valorization and downstream entrepreneurship.

Cocoon BioCraft addresses these gaps by converting a neglected by-product into a high-value artisanal input, thereby strengthening the entire sericulture value chain.

#### Current Status and Institutional Initiatives

ICAR–Krishi Vigyan Kendra (KVK), Kolar, in collaboration with the Biocraft Unit, College of Sericulture, Chintamani, has demonstrated the technical and economic feasibility of cocoon craft interventions. Key achievements include:

- Skill development of over 250 rural women and individuals
- Production of garlands, bouquets, wall frames, flower pots, bead garlands, and decorative artifacts
- Demonstrated scope for home-based, low-investment enterprises

These pilots establish a strong foundation for scaling through policy and institutional convergence.

#### Opportunity Analysis: Cocoon BioCraft as a Rural Enterprise Model

Cocoon BioCraft offers multiple strategic advantages:

- **Minimal Capital Requirement:** Simple tools and locally available raw material
- **Inclusive Employment:** Ideal for women SHGs, specially-abled persons, senior citizens, and rural youth
- **Market Potential:** Growing domestic demand for eco-friendly crafts and export demand for sustainable décor
- **Environmental Gains:** Reduction in sericulture waste and promotion of biodegradable products

The model aligns strongly with India's transition towards a green, circular, and inclusive rural economy.

#### Alignment with Government of India and State Policy Priorities

Cocoon BioCraft is consistent with the following national and state initiatives:

- Swachh Bharat Mission (SBM) – Waste reduction and value addition
- Waste to Wealth Mission (NITI Aayog) – Resource efficiency and innovation

- **National Rural Livelihoods Mission (NRLM)** – Women-led SHG enterprises
- **MSME Development Framework** – Promotion of micro and village enterprises
- **Skill India Mission** – Artisan and vocational skill development
- **Karnataka Circular Economy Policy (under formulation)** – Sector-specific waste valorization
- **Karnataka Sericulture Budget 2025–26** – ₹250 crore allocation for hi-tech cocoon markets and reeler support

### Key Constraints and Implementation Gaps

Despite strong potential, scaling Cocoon BioCraft faces the following barriers:

#### a. Collection and Aggregation

- Absence of organized cocoon waste collection systems
- Inconsistent quality and supply volumes

#### b. Skill, Design, and Quality Capacity

- Limited exposure to contemporary designs and finishing techniques
- Inadequate packaging and quality assurance standards

#### c. Market Access and Branding

- Sales restricted largely to local exhibitions and melas
- Lack of branding, e-commerce integration, and export facilitation

#### d. Regulatory and Institutional Gaps

- No notified quality standards or certification mechanisms
- Limited recognition of cocoon crafts as a distinct eco-craft category

### Policy Recommendations

#### a. Strengthening Collection and Aggregation Infrastructure

- Establish Cocoon Waste Aggregation Centres co-located with grainages and cocoon markets
- Provide transport and sorting subsidies to ensure steady raw material flow to BioCraft clusters

#### b. Capacity Building and Skill Development

- Designate ICAR-KVKs (Kolar, Chikkaballapura), RUDSETIs, and Sericulture Institutes as Regional Cocoon BioCraft Training Hubs
- Integrate cocoon craft modules into sericulture extension and NRLM skill programs
- Emphasize design innovation, packaging, quality control, and entrepreneurship

#### c. Market Access, Branding, and Promotion

- Develop a 'Cocoon BioCraft' national eco-craft brand
- Facilitate market access through: Khadi and Silk showrooms, Government procurement platforms (GeM), and Krishi Melas and state/national craft fairs
- Introduce micro-grants and buy-back arrangements for certified SHG producers

#### d. Regulatory and Fiscal Support

- Notify quality standards and certification protocols through the Department of Industries and Commerce in coordination with the Central Silk Board
- Extend GST exemptions, concessional credit, and marketing grants to cocoon value-addition enterprises, with priority to women-led and rural units

## Expected Outcomes and Impact (3-Year Horizon)

| Outcome Area               | Estimated Impact           |
|----------------------------|----------------------------|
| SHG-based artisan units    | 150–200 enterprises        |
| Cocoon waste reutilization | 30–40% reduction           |
| Employment generation      | ~2,500 persons             |
| New MSMEs                  | At least 10 BioCraft MSMEs |

## Implementation Pathway

A phased approach is recommended:

- Phase I: Pilot aggregation centres and training hubs in Karnataka sericulture districts
- Phase II: Market integration, branding, and certification rollout
- Phase III: Replication in other silk-producing states under a national Waste-to-Wealth framework



Coccon flower pots



Coccon flower pots



Coccon flower pots and garlands

Cocoon wall frame

Cocoon garlands

## Conclusion

Cocoon BioCraft offers a transformative pathway to turn sericulture waste into sustainable livelihoods while strengthening India's circular economy. With focused policy support and effective market integration, the initiative can generate dignified rural employment—particularly for women—and position Karnataka, and India more broadly, as leaders in eco-friendly silk-based crafts.

### Policies for Scaling Climate-Resilient Agriculture (CRA)

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#### Executive Summary

India's agriculture is increasingly exposed to climate risks—erratic monsoons, prolonged dry spells, extreme rainfall events, and rising temperatures. With over 50% of the workforce dependent on agriculture and nearly 60% of net sown area rainfed, climate variability poses systemic risks to food security, farm incomes, and ecological sustainability. Climate-Resilient Agriculture (CRA) provides a strategic pathway by integrating adaptation and mitigation with productivity and livelihood enhancement.

This policy brief synthesizes field-based evidence generated under the Technology Demonstration Component (TDC) of the National Innovations in Climate Resilient Agriculture (NICRA) project implemented by ICAR-KVK, Tumakuru, Karnataka (2010–2024). The evidence demonstrates that integrated interventions in natural resource management, crop diversification, agroforestry, digital advisories, and local institutions significantly enhance resilience at the village scale. The brief proposes actionable policy options for scaling CRA within the Government of India (GoI) framework through convergence of schemes, institutional strengthening, and innovative financing.

#### Context and Rationale

India is among the most climate-vulnerable countries, with agriculture bearing disproportionate impacts. Increased frequency of droughts, floods, heatwaves, and unseasonal rains has led to yield instability, rising input costs, and agrarian distress particularly among small and marginal farmers.

Tumakuru district (Karnataka) exemplifies these challenges, experiencing on average six dry spells (8–15 days) and three high-intensity rainfall events (>60 mm/day) annually over the last decade. Recognizing these risks, the NICRA-TDC intervention was initiated in D. Nagenahalli village (2010) with support from ICAR-CRIDA, Hyderabad and ICAR-ATARI, Bengaluru, focusing on four pillars:

- a. Natural Resource Management (NRM)
- b. Crop Production Systems
- c. Livestock and Fisheries
- d. Institutional Interventions

The dual rationale of CRA risk reduction and environmental sustainability underpins the policy relevance of NICRA outcomes.

#### Evidence from NICRA-KVK Tumakuru

##### a. Natural Resource Management

- Trench-cum-Bunding (TcB): Implemented on 134 ha, reducing runoff and soil erosion.
- Farm Ponds: 108 ponds created with a cumulative storage capacity of 30,950 m<sup>3</sup>, improving protective irrigation.
- Tank Desilting and Widening: Three village tanks renovated, conserving 3,68,040 m<sup>3</sup> of water during normal rainfall events.

Component of the NICRA TDC intervention in Tumakuru district, priority was accorded to in-situ and ex-situ water conservation measures to address recurrent dry spells, high runoff, and soil degradation. Trench-cum-Bunding (TcB) was implemented over 134 hectares, significantly reducing surface runoff, enhancing rainwater infiltration, and minimizing soil erosion on undulating rainfed lands. Complementing this, 108 farm ponds were constructed with a cumulative storage capacity of 30,950 m<sup>3</sup>, providing critical protective irrigation during prolonged dry spells and enabling timely lifesaving irrigation to standing crops. In addition, desilting and widening of three village tanks substantially enhanced their storage efficiency, enabling the conservation of approximately 3,68,040 m<sup>3</sup> of water during a normal rainfall event. Collectively, these interventions strengthened village-level water security, improved soil moisture availability, stabilized crop productivity under climate stress, and laid a durable foundation for climate-resilient farming systems in the NICRA village.



## b. Climate-Resilient Crop Systems

- **Drought-Tolerant Varieties:** Introduced on 262 ha covering 473 farmers (Finger millet ML-365, Pigeon pea BRG-2, Aerobic paddy MAS-26).
- **Crop Diversification & Intercropping:** Implemented on 423 ha (Finger millet + Pigeon pea; Maize + Pigeon pea; Groundnut + Pigeon pea; Finger millet + Field bean), reducing mono-cropping risks.
- **Agroforestry:** Tree-based farming expanded from 18.6 ha to 40.9 ha—a 120% increase, enhancing carbon sequestration and income diversification.

Under the Climate-Resilient Crop Systems component, the NICRA-TDC interventions in Tumakuru focused on enhancing crop adaptability, reducing production risk, and improving farm income stability under variable climatic conditions. Drought-tolerant and climate-resilient crop varieties were introduced over 262 hectares, benefiting 473 farmers, including finger millet (ML-365), pigeon pea (BRG-2), and aerobic paddy (MAS-26). These varieties demonstrated better tolerance to moisture stress and yield stability during prolonged dry spells. To further minimize climate risk and dependency on single crops, crop diversification through scientifically designed intercropping systems was promoted on 423 hectares, involving combinations such as finger millet + pigeon pea, maize + pigeon pea, groundnut + pigeon pea, and finger millet + field bean. These systems improved resource-use efficiency, enhanced soil fertility through legume inclusion, and provided assured returns even under partial crop failure. In parallel, agroforestry and tree-based farming systems were actively encouraged, leading to an expansion of area from 18.6 ha before NICRA to 40.9 ha after intervention, marking a 120% increase. This shift not only contributed to long-term income diversification and livelihood resilience but also strengthened ecosystem services through improved carbon sequestration, microclimate moderation, and soil health enhancement.





### c. Digital Climate Services

- **Soil and Land Use Planning:** Satellite-based imagery from ICAR–NBSS&LUP, Bengaluru supported micro-planning.
- **Weather Advisories:** Timely inputs from IMD improved preparedness for extreme weather events.

Under the Digital Climate Services component, the NICRA–TDC intervention leveraged geospatial tools and real-time weather information to strengthen climate-informed decision-making at the farm and village levels. Satellite-based soil and land use imagery developed by ICAR–NBSS&LUP, Bengaluru was utilized for micro-level resource characterization and planning, enabling precise identification of soil constraints, land capability classes, and suitability of crops and conservation measures. This scientific land-use planning supported targeted implementation of interventions such as crop selection, soil and water conservation structures, and agroforestry systems. In parallel, timely weather advisories and forecasts from the India Meteorological Department (IMD) were disseminated to farmers through KVK extension mechanisms, enhancing preparedness for extreme events such as dry spells, heavy rainfall, and unseasonal showers. These advisories facilitated informed decisions on sowing windows, irrigation scheduling, input application, and harvesting, thereby reducing weather-induced losses. Collectively, the integration of geospatial intelligence with localized weather services improved anticipatory capacity, reduced climate risk exposure, and strengthened the overall resilience of farming systems in the NICRA intervention village.

### d. Institutional Innovations

- **Village Climate Risk Management Committees (VCRMCs):** Enabled participatory planning and local ownership.
- **Farmer Producer Organization (FPO):** *Grama Chetana* FPO emerged as a key platform for sustaining and scaling CRA activities.

Under the Institutional Innovations component, the NICRA–TDC project emphasized strengthening local governance structures to ensure participatory planning, community ownership, and long-term sustainability of climate-resilient agriculture (CRA) interventions. Village Climate Risk Management Committees (VCRMCs) were constituted by involving progressive farmers, women representatives, Panchayati Raj Institution (PRI) members, and line department functionaries. These committees served as decentralized platforms for assessing climate risks, prioritizing interventions, and coordinating implementation at the village level, thereby enhancing transparency, inclusiveness, and accountability in decision-making. The action plans prepared through VCRMC meetings ensured that interventions were context-specific and aligned with local needs and resource endowments. Building on this institutional foundation, the Grama Chetana Farmer Producer Organization (FPO) emerged as a critical mechanism for sustaining and scaling CRA initiatives beyond the project period. The FPO facilitated collective input procurement, aggregation and marketing of produce, and dissemination of climate-resilient technologies, while also enabling better access to credit, schemes, and extension services. Together, VCRMCs and the FPO created a robust institutional ecosystem that enhanced social capital, strengthened adaptive capacity, and ensured continuity of climate-resilient practices at the grassroots level.

### Key Challenges Identified

- Fragmented implementation of climate advisories and conservation measures.
- Limited adoption of water-saving irrigation and climate-resilient inputs.
- Inadequate convergence of schemes at the village level.
- Financial and risk-management gaps for smallholders in climate-prone regions.

### Strategic Policy Options

#### Option 1: Mainstream CRA across Flagship Schemes

- Integrate CRA priorities into NMSA, PMKSY, RKVY, MGNREGA, and State Action Plans on Climate Change (SAPCCs).
- Mandate climate-risk screening for agricultural investments in rainfed and dryland regions.

#### Option 2: Strengthen Local Institutions

- Institutionalize VCRMCs under Panchayati Raj Institutions (PRIs) for village-level climate adaptation planning.
- Promote FPOs, SHGs, and NGOs as delivery platforms for CRA technologies and services.

### **Option 3: Scale Climate-Resilient Technologies**

- Prioritize drought and heat tolerant varieties, intercropping, agroforestry, and conservation agriculture.
- Ensure timely availability of contingency crop seeds and inputs through decentralized seed systems.

### **Option 4: Expand Digital Climate Services**

- Strengthen IMD-ICAR convergence for localized early warning systems.
- Promote open-access platforms for soil, weather, and crop advisory data.

### **Option 5: Financing and Risk Management**

- Enhance public funding through NMSA, NABARD, and NAFCC.
- Leverage blended finance, green bonds, CSR, and international climate finance (e.g., GCF).
- Reform PMFBY for faster payouts, improved loss assessment, and wider coverage in rainfed areas.

### **Implementation Pathway**

- Convergence: Align central and state schemes at the district and village levels.
- Capacity Building: Continuous training of farmers, extension personnel, and PRIs.
- Phased Adoption: Early awareness on long-term benefits of agroforestry and water conservation.
- Resource Use Efficiency: Promote across-slope cultivation, drip and sprinkler irrigation over conservation alone.

### **Monitoring and Evaluation**

- Develop CRA indicators linked to productivity, resilience, income stability, and ecosystem services.
- Use remote sensing and digital dashboards for real-time monitoring.
- Encourage independent impact evaluations of CRA clusters.

### **Way Forward**

At the field level, effective convergence of central and state government programmes is essential to achieve the shared objective of developing climate-resilient farming systems. Active stakeholder participation at all stages of planning, implementation, and monitoring should be institutionalized to ensure relevance, ownership, and sustainability of interventions. Early-phase awareness creation on the long-term benefits of climate-resilient practices, such as tree-based farming systems and on-farm water harvesting through farm ponds, is critical for improving adoption rates. Timely availability of quality seeds and critical inputs for contingency cropping must be ensured to enable rapid response to aberrant weather conditions. Beyond conservation alone, emphasis should be placed on the judicious and efficient use of natural resources, particularly soil and water. Accordingly, context-specific interventions such as across the-slope cultivation, micro-irrigation systems (drip and sprinkler), and precision water management practices should be promoted through appropriate schemes and incentives.

At the policy level, a comprehensive shift is required to embed climate resilience as a central pillar of India's agricultural development strategy. Policy coherence must be strengthened through enhanced coordination among ministries and effective convergence of flagship schemes. Agricultural research and extension institutions should prioritize the development and dissemination of climate-resilient crop varieties, livestock systems, and adaptive farming practices. Investments in digital infrastructure, data integration, and information-sharing platforms should be scaled up to strengthen early warning systems and location-specific advisories. Financial instruments must be redesigned to address the differentiated needs of smallholders and women farmers, including access to credit and incentives for adopting resilient practices. Risk transfer mechanisms require further strengthening, with reforms to the Pradhan Mantri Fasal Bima Yojana (PMFBY) focusing on timely claim settlement, improved crop loss assessment, and expanded coverage in climate-vulnerable regions. Finally, the establishment of a National Climate-Resilient Agriculture Platform is recommended to consolidate data, innovations, best practices, and capacity-building efforts, thereby enabling systematic scaling of successful CRA models across the country.

### **Conclusion**

Climate-resilient agriculture is no longer optional but essential for India's agrarian future. Evidence from NICRA KVK Tumakuru demonstrates that integrated, participatory, and science-based interventions can substantially enhance resilience at scale. A coherent policy ecosystem grounded in equity, sustainability, and local institutions can transform Indian agriculture into a climate-resilient growth engine.

### Direct Seeded Rice as a Water-Smart Strategy for Climate-Resilient Agriculture

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#### Executive Summary

Rice is a critical food security crop in Karnataka, particularly in the Tungabhadra command and associated irrigated tracts of Ballari, Raichur, Koppal, and Vijayanagar districts. However, conventional puddled transplanted rice (PTR) cultivation is highly water-intensive, labour-demanding, and increasingly unsustainable under conditions of declining groundwater availability, rising labour costs, and climate variability.

Direct Seeded Rice (DSR) offers a viable and scalable alternative to PTR by enabling rice establishment through direct sowing of seed under aerobic or near-aerobic soil conditions. Evidence from Karnataka demonstrates that DSR can reduce irrigation water use by 35–40 per cent, lower production costs, advance crop maturity, and improve farm profitability while contributing to climate-smart agriculture. This policy brief outlines the rationale, benefits, constraints, and strategic policy actions required to mainstream DSR in Karnataka in alignment with Government of India (GoI) priorities on water conservation, doubling farmers' income, and sustainable agriculture.

#### Context and Rationale

Rice cultivation traditionally requires continuous flooding, consuming up to 4,000–5,000 litres of water per kilogram of rice produced. In water-stressed regions such as Ballari district, this practice places severe pressure on canal systems, groundwater resources, and energy inputs for irrigation.

Ballari district produced approximately 5.2 lakh tonnes of paddy during 2023–24, ranking second in the state after Raichur. However, state-level projections indicate a decline in paddy production during 2024–25 due to water scarcity, soil degradation, and climate-induced stresses. More than one lakh hectares across the “rice bowl” districts of Karnataka are affected by saline–alkaline soils, resulting in yield reductions of up to 20 per cent.

- **Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)** for water-use efficiency;
- **National Food Security Mission (NFSM–Rice)** for productivity enhancement;
- **National Mission on Sustainable Agriculture (NMSA)** for climate resilience; and
- **Sub-Mission on Agricultural Mechanization (SMAM)** for farm mechanization.

#### The Direct Seeded Rice (DSR) Approach

Direct Seeded Rice involves sowing pre-germinated or dry rice seed directly into the main field using seed drills, drum seeders, or broadcasting under well-levelled conditions. Unlike PTR, DSR eliminates nursery raising, puddling, and transplanting operations.

In Karnataka, dry DSR under irrigated command areas has shown particular promise due to reduced tillage, lower water demand, and improved timeliness of operations.

#### Key Benefits of DSR

##### a. Water Conservation

- Reduces irrigation water requirement by 35–40 per cent compared to PTR.
- Enhances water productivity, with up to 46 per cent lower irrigation use reported in Raichur dry zone conditions.

### **b. Economic Advantages**

- Eliminates costs associated with nursery raising and transplanting.
- Reduces labour demand significantly, addressing rural labour shortages.
- Increases net farm income by 15–22 per cent as observed in Dharwad and Udupi districts.
- Improves benefit–cost (B:C) ratio due to lower input costs and comparable or higher yields.

### **c. Agronomic and Environmental Gains**

- Crop matures 10–15 days earlier, facilitating timely sowing of subsequent crops.
- Improves soil physical condition by avoiding repeated puddling.
- Reduces methane emissions due to absence of prolonged flooding, contributing to climate mitigation goals.

## **Major Constraints in DSR Adoption**

Despite its advantages, large-scale adoption of DSR faces several challenges:

### **a. Weed Management**

- Absence of standing water leads to severe weed infestation.
- Requires timely application of pre and post-emergence herbicides and mechanical weeding

### **b. Water and Nutrient Management**

- Precise irrigation scheduling is essential to avoid moisture stress during critical growth stages.
- Higher nitrogen losses under aerobic soil conditions necessitate split and site-specific nutrient management.
- Increased incidence of micronutrient deficiencies, particularly zinc.

### **c. Crop Establishment Risks**

- Uneven germination due to poor seed–soil contact, soil crusting or erratic rainfall.
- Seed damage from birds, rodents, and snails during early stages.

### **d. Machinery and Institutional Constraints**

- Limited availability of DSR-specific machinery such as seed drills, drum seeders, and laser land levellers.
- Small and marginal farmers face access and affordability constraints.
- Farmer reluctance due to familiarity with PTR and perceived yield risks.

## **Role of ICAR–Krishi Vigyan Kendra (KVK), Ballari**

ICAR–KVK Ballari plays a pivotal role in accelerating DSR adoption through:

- Capacity Building: Training programmes for farmers, extension personnel, and input dealers on DSR agronomy, weed management, and nutrient scheduling.
- Technology Demonstration: Front Line Demonstrations (FLDs) and on-farm trials showcasing yield, water, and cost advantages of DSR.
- Advisory Services: Real-time advisories through SMS, WhatsApp, community radio, and KVK mobile applications.
- Soil and Input Management: Soil testing services and site-specific fertilizer recommendations.
- Mechanization Support: Demonstration of drum seeders, zero-till seed drills, and laser levellers, and facilitation of custom hiring centres through SHGs, FPOs, and farmer groups.



### Policy Interventions Required

#### a. Strengthening Mechanization and Custom Hiring

- Expand Custom Hiring Service Centres (CHSCs) with DSR-specific equipment.
- Provide targeted subsidies under SMAM for DSR machinery and laser land levelling.

#### b. Incentives for Adoption

- Introduce financial incentives for DSR adoption in water-stressed command areas.
- Promote cluster-based DSR implementation to reduce individual farmer risk.

#### c. Training and Extension

- Integrate DSR modules into NFSM and state extension programmes.
- Support continuous capacity building through KVKs and agricultural universities.

#### d. Water and Nutrient Management Support

- Promote micro-irrigation and precision water management practices under PMKSY.
- Encourage balanced and split fertilizer application through soil health card-based advisories.

#### e. Market and Procurement Assurance

- Ensure Minimum Support Price (MSP) coverage and procurement for DSR-grown paddy.
- Strengthen market linkages and value chain integration for rice farmers.

#### f. Climate-Smart Agriculture Integration

- Include DSR as a core intervention under climate-resilient agriculture and adaptation programmes.
- Pilot and scale successful DSR models in vulnerable districts.

#### g. Institutional Coordination

- Establish a Karnataka DSR Task Force involving state departments, ICAR institutions, universities, private sector, and farmer organizations.
- Promote public-private partnerships for input supply, mechanization, and advisory services.

### Conclusion

Direct Seeded Rice represents a transformative shift in rice cultivation systems, offering substantial water savings, reduced labour dependence, improved profitability, and environmental benefits. While challenges related to weeds, nutrient management, and mechanization remain, these can be effectively addressed through targeted policy support, institutional coordination, and robust extension mechanisms.

Mainstreaming DSR in Karnataka will contribute significantly to sustainable water management, climate-smart agriculture, and enhanced farmer incomes, in line with the Government of India's vision for resilient and resource-efficient agricultural growth.

### Climate-Smart Soil and Water Management for Sustainable Agriculture

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#### Executive Summary

The Northern Dry Zone of Karnataka is characterized by low and erratic rainfall, frequent droughts, soil degradation, and declining water availability. Sustainable soil and moisture conservation is essential to enhance agricultural productivity, ensure livelihood security, and build climate resilience. This policy brief outlines evidence-based soil and water conservation strategies, aligned with Government of India initiatives such as PMKSY, NMSA, and the Soil Health Card Scheme, and recommends actionable measures for effective implementation at the block and community levels.

#### Policy Context and Rationale

Soil and water are foundational natural resources for Indian agriculture. In dryland regions like Vijayapura, unsustainable land use, climate variability, and limited awareness have accelerated soil erosion, runoff, and moisture stress. Conservation-oriented farming systems are critical to:

- Sustain crop yields under rainfed conditions
- Improve water-use efficiency
- Enhance soil health and carbon sequestration
- Reduce vulnerability to climate change

#### Key Policy Objectives

**Promote Sustainable Agriculture:** Conserve soil moisture, minimize erosion, and improve soil health.

**Enhance Climate Resilience:** Enable farmers to adopt climate-resilient land and water management practices.

**Improve Water Management Efficiency:** Promote water harvesting, micro-irrigation, and efficient use of available resources.

#### Recommended Soil and Moisture Conservation Practices

##### a. In-situ Soil and Moisture Conservation Techniques

- **Deep Tillage:** Enhances soil moisture storage, reduces runoff, and improves yields in crops such as pigeonpea and maize.
- **Conservation Furrows:** Suitable for lands with slopes up to 5%; reduces erosion and enhances rainwater retention.
- **Ridge and Furrow System:** Improves infiltration and safe drainage; effective for finger millet and maize.
- **Contour Farming:** Ploughing across slopes to reduce runoff and soil loss, particularly in dryland areas.

##### b. Bunding and Structural Measures

- **Compartmental Bunding:** Effective in gentle slopes ( $\leq 5\%$ ) for moisture conservation and erosion control.
- **Sand Crescent Bunds:** Low-height (approx. 1.5 ft) bunds suitable for rainfed fields.
- **Live Field Bunds:** Strengthened with vegetative barriers such as *Agave* and *Gliricidia*.
- **Nala-side Plantation:** Bamboo planting along drainage lines to stabilize banks and reduce erosion.

##### c. Mulching Practices

- **Organic Mulching:** Improves moisture retention, suppresses weeds, and moderates soil temperature in red and black soils.
- **Sand Mulching:** Particularly effective in black soils of northern Karnataka to conserve moisture and reduce evaporation losses.

##### d. Water Harvesting and Recharge Structures

- **Farm Ponds:** Harvest excess rainwater for protective irrigation and increased cropping intensity.
- **Percolation Tanks & Check Dams:** Improve groundwater recharge and enhance water availability during critical crop stages.

#### e. Vegetative and Technological Interventions

- **Agroforestry Systems:** Integrate multipurpose trees to improve soil structure, diversify income, and enhance ecosystem services.
- **Drip Irrigation:** Delivers water directly to the root zone, reducing evaporation losses and improving water-use efficiency.

#### Policy Recommendations

- Integrated Policy Framework:** Harmonize agricultural, water, and environmental policies for holistic resource conservation.
- Financial Incentives and Subsidies:** Support adoption through PMKSY, NMSA, and state-level incentive mechanisms.
- Capacity Building and Extension:** Strengthen KVK-led training, demonstrations, and farmer field schools.
- Research and Development:** Promote innovation in soil moisture conservation technologies and climate-smart practices.
- Monitoring, Evaluation, and Digital Tools:** Establish robust monitoring systems, including AI-based decision-support tools.

#### Implementation Strategy

- Farmer Training and Awareness Programs
- Establishment of Demonstration Plots and Model Farms
- Community Participation and Participatory Rural Appraisal (PRA)
- Partnerships with NGOs, Research Institutions, and Private Sector

#### Government of India Schemes Supporting Implementation

- Pradhan Mantri Krishi Sinchai Yojana (PMKSY)
- National Mission for Sustainable Agriculture (NMSA)
- Soil Health Card Scheme

#### Key Challenges

- Limited awareness and technical knowledge among farmers
- High initial investment costs
- Climate variability and extreme weather events

#### Policy Matters for Community Radio Stations (Extension Support)

Community Radio Stations (CRS) are vital tools for last-mile dissemination of agricultural innovations

#### Recommended Policy Measures

- Focus on livelihood enhancement and sustainable agriculture
- Maximize effective coverage and reliable transmission
- Promote farmer-centric programming on crops, irrigation, markets, and schemes
- Establish disaster alert and early warning systems
- Strengthen partnerships with KVKs, SAUs, ICAR institutes, and government departments
- Promote women's participation, youth entrepreneurship, and livelihood diversification
- Collaborate with schools for agricultural awareness among youth

#### Conclusion

A coordinated, farmer-centric, and data-driven approach to soil and water conservation is essential for achieving sustainable and climate-resilient agriculture in the Northern Dry Zone of Karnataka. Strengthening institutional mechanisms, leveraging GoI schemes, and empowering communities through knowledge dissemination will ensure long-term resource sustainability and improved rural livelihoods.

### Soybean Production and Value Chains: A Policy Framework for Karnataka

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#### Executive Summary

Soybean (*Glycine max* L.), popularly known as the “Golden Bean”, is a strategically important crop for India due to its dual role as an oilseed and pulse, its high protein content, and its relevance to food, feed, and industrial uses. Globally, soybean contributes nearly 25 per cent of edible oil production and about two-thirds of protein concentrate used in livestock feed. In India, soybean occupies a pivotal position in the oilseed economy, rainfed agriculture, and farmer livelihoods, particularly in central and southern states.

Despite its importance, soybean productivity in India remains constrained by seed quality issues, climate variability, pest and disease pressures, labour shortages, market volatility, and inadequate post-harvest infrastructure. This policy brief outlines the current status, challenges, and strategic policy reforms required to enhance soybean productivity, profitability, value addition, and sustainability.

#### Background and Rationale

Soybean originated in East Asia around 1100 BC and has since evolved into one of the most widely cultivated legumes globally. The crop is well adapted to warm tropical, subtropical, and temperate climates and is predominantly cultivated under rainfed conditions in India, with supplemental irrigation playing a critical role in stabilizing yields.

Soybean is a short-day plant, with varietal responses to photoperiod and temperature influencing flowering, growth duration, and yield. Growth rates decline at temperatures above 35°C and below 18°C, making climate resilience a key consideration for varietal development. Vegetative growth generally ceases during the reproductive phase, emphasizing the importance of timely agronomic and nutrient management.

#### Global and National Scenario

Globally, Brazil is the largest soybean producer, accounting for about 38.7 per cent of total world production, followed by the United States (31%), Argentina (13.5%), China (5%), and India (3%). India ranks fourth in area under soybean cultivation and fifth in production, highlighting its significance in the global soybean economy. During 2023–24, soybean was cultivated over 123.85 lakh hectares in India. Major soybean-growing states include:

- Madhya Pradesh: 53.30 lakh ha
- Maharashtra: 50.72 lakh ha
- Rajasthan: 10.00 lakh ha
- Karnataka: 3.97 lakh ha
- Gujarat: 2.66 lakh ha
- Telangana: 1.59 lakh ha

#### Status of Soybean in Karnataka

In Karnataka, soybean occupied 3.97 lakh hectares during 2023–24. District-wise distribution indicates strong regional concentration:



**Table 1. District-wise Area under Soybean Cultivation in Karnataka (2023–24)**

| Sl. No. | District   | Area (lakh ha) | Share of State Area (%) |
|---------|------------|----------------|-------------------------|
| 1       | Bidar      | 2.37           | 59.70                   |
| 2       | Belagavi   | 1.13           | 28.46                   |
| 3       | Dharwad    | 0.36           | 8.80                    |
| 4       | Kalaburagi | 0.28           | 7.25                    |
| 5       | Haveri     | 0.11           | 2.80                    |
| 6       | Bagalkot   | 0.008          | 0.20                    |
|         | Total      | 3.97           | 100.00                  |

Soybean plays a crucial role in crop diversification, soil fertility improvement through biological nitrogen fixation, and income enhancement for rainfed farmers in these regions.

### Recommended Soybean Varieties for Karnataka

The following high-yielding and disease-tolerant soybean varieties are recommended for cultivation in Karnataka:

**Table 2: The high-yielding and disease-tolerant soybean varieties recommended for cultivation in Karnataka**

| Sl. No. | Variety | Key Characteristics                                                   |
|---------|---------|-----------------------------------------------------------------------|
| 1       | JS-335  | High yielding, 85–90 days duration                                    |
| 2       | JS-9305 | High yielding, 80–85 days duration                                    |
| 3       | DSB-1   | High yielding, 90–95 days duration                                    |
| 4       | DSB-21  | High yielding, 90–95 days, rust resistant, tolerant to pod shattering |
| 5       | DSB-34  | High yielding, 85–90 days, rust resistant                             |

### Key Constraints in Soybean Production

#### a. Seed-Related Constraints

- Limited availability of quality certified seeds
- Inadequate production and timely distribution of high-yielding and stress-tolerant varieties

#### b. Labour Constraints

- Acute shortage of manpower during peak agricultural operations such as sowing, weeding, and harvesting

#### c. Pest and Disease Pressure

- Increasing incidence of soybean rust, anthracnose, stem fly, and major insect pests such as *Spodoptera* and *Helicoverpa*, leading to significant yield losses

#### d. Climate and Weather Risks

- High dependence on monsoon rainfall exposes soybean to droughts, dry spells, and occasional flooding
- Rising temperatures and erratic rainfall patterns due to climate change

### Market and Economic Challenges

#### A. Price Volatility

- Soybean prices are highly sensitive to domestic and international demand–supply dynamics, affecting farm income stability

#### B. Inadequate Storage and Processing Infrastructure

- Limited warehousing, scientific storage, and processing facilities result in post-harvest losses and distress sales
- Insufficient local value-addition units restrict farmer participation in higher-value markets

## Policy Recommendations

### a. Strengthening MSP and Procurement Mechanisms

- Ensure assured and timely procurement of soybean under the Minimum Support Price (MSP) mechanism
- Expand procurement centres in major soybean-growing regions

### b. Seed Systems and Seed Hubs

- Establish **Soybean Seed Hubs** at regional and state levels for large-scale production of quality breeder, foundation, and certified seed
- Strengthen monitoring mechanisms for seed quality and availability

### c. Research and Development

- Accelerate the release of varieties resistant to major pests (*Helicoverpa*, *Spodoptera*) and diseases (rust, anthracnose)
- Accelerate the release of varieties resistant to major pests (*Helicoverpa*, *Spodoptera*) and diseases (rust, anthracnose)
- Develop climate-resilient, short-duration, and photo-insensitive varieties suitable for cultivation across multiple seasons
- Promote varieties suitable for mechanical harvesting to address labour shortages

### d. Promotion of Mechanization and AI Technologies

- Encourage adoption of farm mechanization for sowing, interculture, and harvesting
- Promote AI-based decision support systems for weather forecasting, pest surveillance, and nutrient management

### e. Market Reforms and Infrastructure Development

- Improve rural market access through e-NAM integration and farmer aggregation models
- Invest in scientific storage, warehousing, and cold-chain infrastructure to minimize post-harvest losses

### f. Farmer Collectives and Value Chains

- Strengthen Farmer Producer Organizations (FPOs) and cooperatives to enhance bargaining power
- Link FPOs with sustainable domestic and export-oriented soybean supply chains

### g. Value Addition and Agro-Industrial Development

- Encourage establishment of soybean-based industries for:
- Edible oil production
- Soy protein concentrates and isolate
- Soy-based foods and nutraceuticals
- Livestock and poultry feed
- Provide fiscal incentives and credit support for MSMEs in soybean processing

## Expected Outcomes

- Enhanced soybean productivity and resilience under rainfed conditions
- Improved farmer incomes through assured markets, reduced losses, and value addition
- Strengthened domestic edible oil security and protein availability
- Generation of rural employment through processing and allied industries

## Conclusion

Soybean has immense potential to contribute to India's food, nutrition, and economic security. A coordinated policy approach under the Government of India framework integrating research, seed systems, market reforms, infrastructure development, and value addition can transform soybean cultivation into a resilient, profitable, and sustainable enterprise for Indian farmers.

### A Policy Framework for Sustainable and Climate-Resilient Groundnut Production in Yadgir District, Karnataka

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#### Executive Summary

Groundnut (*Arachis hypogaea* L.) is a critical oilseed and protein-rich crop in India, contributing significantly to edible oil availability, rural livelihoods, and export earnings. India is the world's second-largest producer of groundnut, and the crop accounts for about 25.14 per cent of total oilseeds production (2021–22). In Karnataka, Yadgir district has emerged as one of the leading groundnut growing regions under predominantly rainfed conditions. However, farmers face persistent challenges related to climate variability, yield instability, pest and disease pressures, market gluts, and price volatility.

This policy brief, aligned with the Government of India (GoI) framework on sustainable agriculture, doubling farmers' income, climate-resilient farming, and value-chain development, proposes a comprehensive strategy to enhance productivity, resilience, and profitability of groundnut cultivation in Yadgir district and similar agro-ecologies of Karnataka.

#### Background and Rationale

Groundnut plays a dual role in India's agricultural economy as a major oilseed crop and as a nutritious food and fodder source. The crop is largely cultivated under rainfed conditions, making it highly vulnerable to rainfall variability and climate stress. India follows a two-crop cycle, with harvests typically in March and October, ensuring year-round availability.

Market dynamics indicate that groundnut prices often peak during the off-season months (August, September and March), coinciding with standing crop periods. Conversely, arrivals are highest from September to April, leading to market glut and price depression. Such seasonal price fluctuations, combined with inadequate storage and processing infrastructure, expose farmers especially smallholders to income instability.



In Karnataka, major groundnut-growing areas include Yadgir, Laxmeshwar, Raichur, Ballari, Challakere, Hubballi, Gadag, Mundargi, Chitradurga, and Kottur, with Yadgir district playing a prominent role. At the national level, India's groundnut exports (2023–24) are concentrated in Indonesia, Vietnam, the Philippines, Malaysia, and Thailand, highlighting strong international demand.

#### Despite its economic importance, groundnut cultivation in Yadgir district is constrained by:

- High dependence on erratic monsoon rainfall
- Low adoption of improved and climate-resilient varieties
- Inadequate access to quality seed and inputs
- Pest and disease incidence under changing climatic conditions
- Post-harvest losses due to poor storage and processing facilities
- Market price volatility and weak price discovery mechanisms

Addressing these constraints requires coordinated policy interventions across production, input supply, research, markets, and climate adaptation, in line with GoI priorities.

### **Policy Objectives**

- a. Enhance productivity and sustainability of groundnut cultivation in rainfed regions.
- b. Strengthen farmers' resilience to climate and market risks.
- c. Improve access to quality seeds, technologies, and advisory services.
- d. Ensure remunerative prices and stable incomes for groundnut farmers.
- e. Promote value addition, processing, and export competitiveness.

### **Strategic Policy Interventions**

#### **A. Promoting Sustainable and Climate-Resilient Production**

##### **a) Development and Promotion of Drought-Tolerant Varieties**

Research institutions should prioritize breeding and dissemination of water-stress-tolerant and high-yielding varieties suitable for Yadgir's agro-climatic conditions. Varieties such as *Dh-256* and *K-1812* have shown promise and should be scaled up through seed multiplication and demonstrations.

##### **b) Efficient Water Management**

- Promotion of micro-irrigation systems (drip and sprinkler) under schemes such as *Per Drop More Crop*.
- Rationalization of canal irrigation and reduction of conveyance losses.
- Encouraging water-efficient cropping patterns and rainwater harvesting structures at the farm and community level.

##### **c) Integrated Pest and Disease Management (IPDM)**

- Promotion of Integrated Pest Management (IPM) approaches to reduce chemical dependency.
- Use of biological control agents (e.g., *Trichoderma* for stem rot) and need-based pesticide application.
- Capacity building of farmers through KVKs and extension agencies.

##### **d) Soil Health Management**

- Adoption of Soil Health Card recommendations for balanced nutrient management.
- Promotion of crop rotation, organic amendments, and green manuring.
- Encouragement of sustainable and natural farming practices where feasible.

#### **B. Strengthening the Seed Supply System**

##### **a) Community Seed Banks**

Establishment of community-managed seed banks to ensure timely availability of quality seeds, particularly for small and marginal farmers.

##### **b) Public-Private Partnerships (PPP)**

Enhanced collaboration between ICAR institutes, State Agricultural Universities, and private seed companies for faster varietal development and dissemination.

##### **c) Seed Quality Assurance**

Strengthening seed certification, testing, and regulatory mechanisms to ensure genetic purity and germination standards.

#### **C. Enhancing Market Access and Price Stability**

##### **a) Minimum Support Price (MSP) and Procurement**

Effective implementation of MSP operations for groundnut through agencies such as NAFED to ensure remunerative prices.

#### **b) Price Stabilization Mechanisms**

- Exploration of price stabilization funds and market intelligence systems.
- Awareness and facilitation of futures and options trading for price risk management.

#### **c) Value Addition and Processing**

- Promotion of value-added products such as groundnut oil, peanut butter, roasted nuts, and ready-to-eat snacks.
- Support for Farmer Producer Organizations (FPOs) to establish primary processing units.

#### **d) Market Infrastructure Development**

Investment in modern warehousing, cold storage (where required), grading, and transportation facilities to reduce post-harvest losses and distress sales.

### **D. Research, Extension, and Capacity Building**

#### **a) Location-Specific Research**

Focused R&D on district-specific constraints, including soil types, rainfall patterns, and pest complexes of Yadgir district.

#### **b) Strengthening Technology Transfer**

- Enhanced role of Krishi Vigyan Kendras (KVKs) in frontline demonstrations.
- Use of digital platforms and ICT tools for real-time advisories.

#### **c) Public-Private Research Collaboration**

Encouraging collaborative research models to accelerate innovation and field-level adoption.

### **E. Addressing Climate Change Impacts**

#### **a) Climate-Resilient Varieties**

Acceleration of breeding programs for tolerance to drought, heat stress, and emerging pests.

#### **b) Climate-Smart Agricultural Practices**

- Promotion of conservation agriculture, integrated nutrient management, and agroforestry systems.
- Encouraging residue management and reduced tillage to improve soil moisture retention.

#### **c) Water Conservation and Risk Mitigation**

- Expansion of crop insurance under Pradhan Mantri Fasal Bima Yojana (PMFBY).
- Promotion of contingency crop planning and weather-based advisories.

### **Expected Outcomes**

- Increased and stable groundnut yields under rainfed conditions.
- Reduced production and market risks for farmers.
- Improved farm incomes and livelihood security.
- Enhanced value addition and export competitiveness.
- Contribution to national goals of edible oil self-reliance and sustainable agriculture.

### **Conclusion**

A comprehensive, GoI-aligned policy approach focusing on sustainability, resilience, and market integration is essential for strengthening groundnut cultivation in Yadgir district. By integrating climate-resilient technologies, robust seed systems, effective price support mechanisms, and value-chain development, groundnut farming can become a reliable pathway for income enhancement and rural prosperity in Karnataka.

### **An Integrated Policy Framework for Enhancing Productivity, Climate Resilience, and Farmer Income in Pigeonpea Cultivation in India**

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#### **Executive Summary**

Pigeonpea is a critical pulse crop for India's nutritional security, soil health and livelihoods in rainfed and semi-arid regions, yet national productivity remains low at around 700–800 kg/ha due to poor seed quality, inadequate crop establishment, moisture stress, flower and pod drop, pest and disease pressures, and fragmented technology adoption. The proposed policy framework recommends an integrated package of four proven interventions: quality seed mini-kits with mandatory seed treatment; ridge–furrow cultivation using seed-cum-fertilizer drills; foliar application of Pulse Magic at critical crop stages; and integrated pest and disease management through chemical kits with appropriate PPE. Together, these interventions aim to improve crop establishment, water-use efficiency, nutrient uptake, pod setting and protection from major pests and diseases while strengthening climate resilience.

The package is proposed for large-scale implementation through convergence of NFSM–Pulses, Sub-Mission on Agricultural Mechanization (SMAM) and IPM programmes, supported by KVKs, FPOs and Custom Hiring Centres. Adoption of the integrated package is expected to raise pigeonpea productivity from 700–800 to 920–1,050 kg/ha and increase net returns from ₹18,000–22,000 to ₹30,000–35,000/ha, representing about 30% higher productivity and 40% higher income. Mainstreaming the package through demonstrations, farmer training, mechanization support and local-language extension can reduce production risks, improve resource-use efficiency and contribute significantly to climate-resilient agriculture, pulse self-sufficiency and enhanced farmer livelihoods.

#### **Problem Statement**

The persistently low productivity of pigeonpea is attributed to the following interrelated constraints:

- Limited availability and adoption of quality seed of improved varieties
- Poor crop establishment due to soil-borne diseases and inadequate seed treatment
- Inefficient rainwater management under both drought and heavy rainfall situations
- High flower and pod drop, leading to significant yield losses
- Substantial damage from insect pests and diseases, coupled with unsafe pesticide handling practices
- Fragmented adoption of technologies due to lack of convergence among existing schemes

Without targeted policy interventions, these constraints will continue to suppress yield potential, discourage pulse cultivation, and affect national pulse self-sufficiency goals.

#### **Policy Objective**

To enhance pigeonpea productivity by 30% or more and farmer net income by 40% or more through the promotion of a convergent, integrated package of proven technologies, supported by existing Government of India schemes.

#### **Policy Recommendation Summary**

This policy brief recommends the promotion of a four-component integrated technology package, delivered through scheme convergence, institutional support, and strong extension mechanisms. Each component addresses a critical production constraint and collectively ensures yield stability, risk reduction, and income enhancement.

## Recommended Technology Interventions

### A. Distribution of Seed Mini-Kits of Improved Varieties with Mandatory Seed Treatment

#### Policy Action

- Supply certified seed mini-kits of high-yielding, disease-tolerant pigeonpea varieties (e.g., GRG 811, GRG 152) under NFSM–Pulses.
- Ensure mandatory seed treatment using bio-agents such as *Trichoderma* or recommended fungicides (carbendazim) prior to sowing.

#### Rationale and Benefits

- Improves farmer access to genetically superior planting material.
- Enhances yield potential by 10–15% compared to local varieties.
- Reduces seed and soil-borne diseases, ensuring better crop establishment and uniform plant stand.

### B. Promotion of Ridge–Furrow Method of Cultivation with Integrated Sowing and Fertilizer Application

#### Policy Action

- Promote tractor-drawn ridge–furrow seed-cum-fertilizer drills through Sub-Mission on Agricultural Mechanization (SMAM).
- Strengthen Custom Hiring Centres (CHCs) to ensure access for small and marginal farmers.
- Enhances rainwater use efficiency during dry spells and facilitates drainage during heavy rainfall events.
- Improves root aeration, reduces soil erosion, and promotes better nutrient uptake.
- Results in 10–20% higher yields compared to conventional flat sowing, particularly under rainfed conditions.



Ridge and furrow method of cultivation with sowing and fertilizer application



Standing pigeonpea crop under improved management

### C. Foliar Application of 'Pulse Magic' at Critical Crop Stages

#### Policy Action

- Support subsidized foliar application of Pulse Magic (a balanced formulation of nutrients and plant growth regulators) under NFSM–Pulses.
- Recommend application at 50% flowering and pod initiation stages.

### Rationale and Benefits

- Mitigates physiological stress and significantly reduces flower and pod drop (by 15–20%).
- Enhances pod setting, seed filling, and test weight.
- Improves fertilizer use efficiency and complements soil nutrient management practices.



Foliar application of Pulse Magic

### D. Provision of Chemical Kits with Protective Safety Equipment for Pest and Disease Management

#### Policy Action

- Supply pre-packed chemical kits containing recommended insecticides and fungicides along with personal protective equipment (PPE) such as gloves, masks, and goggles under IPM programs.

### Rationale and Benefits

- Effectively manages major constraints such as *Helicoverpa armigera*, Fusarium wilt, and Sterility Mosaic Disease.
- Reduces crop losses from 15–20% to 8–10%.
- Promotes safe pesticide handling, protecting farmer health and the environment.

### Expected Outcomes and Impact

| Parameter            | Current Scenario | With Integrated Package | Expected Improvement |
|----------------------|------------------|-------------------------|----------------------|
| Productivity (kg/ha) | 700–800          | 920 – 1,050             | +30%                 |
| Net Returns (₹/ha)   | 18,000–22,000    | 30,000 – 35,000         | +40%                 |

Additional impacts include improved climate resilience, reduced production risk, and enhanced adoption of sustainable crop management practices.

### Implementation Strategy

#### a. Scheme Convergence

- **NFSM–Pulses:** Seed mini-kits, foliar nutrients, and growth regulators
- **SMAM:** Ridge–furrow implements and mechanization support
- **IPM Programs:** Chemical and safety kits

#### b. Institutional Delivery Mechanism

- Krishi Vigyan Kendras (KVKs)
- Farmer Producer Organizations (FPOs)
- Custom Hiring Centres (CHCs)

#### c. Extension and Capacity Building

- Frontline demonstrations and on-farm trials
- Farmer trainings, field days, and awareness campaigns in local languages
- Use of ICT tools and local media for wider dissemination

#### d. Adoption Flexibility

Farmers may adopt the complete package or individual components based on resource availability, ensuring inclusiveness and scalability

### Conclusion and Policy Way Forward

The proposed integrated technology package provides a scientifically proven, economically viable, and farmer-friendly pathway to address the chronic productivity constraints of pigeonpea cultivation. By simultaneously improving seed quality, crop establishment, water and nutrient management, and pest control, this policy intervention can deliver sustained yield enhancement, income growth, and risk reduction.

It is strongly recommended that ICAR and State Departments of Agriculture mainstream this integrated package through existing flagship schemes and ensure last-mile delivery through KVKs, FPOs, and Custom Hiring Centres. Large-scale adoption of this approach will significantly contribute to national pulse self-sufficiency, climate-resilient agriculture, and improved livelihoods in rainfed regions.

## Policy Brief 9

### Millets for Nutrition, Income and Climate Resilience: A Scalable Policy Model from Bidar District

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#### Executive Summary

Millets offer a strategic pathway for strengthening **nutrition security, farmer incomes and climate resilience**, particularly in semi-arid and rainfed regions such as Bidar district of Karnataka. Despite strong policy support, their wider adoption is constrained by limited processing facilities, weak market linkages, inadequate assured demand and low consumer awareness. The **Hulsoor Farmer Producer Company Limited**, promoted by ICAR-IIMR with support from SFAC, demonstrates an integrated, women-centred model linking millet production with primary processing, value addition, nutrition awareness and direct marketing. The initiative has enhanced women's participation, reduced intermediary dependence and promoted greater household consumption of nutritious millet products.

The Hulsoor FPO experience provides a **scalable institutional model for millet-based livelihood development** that can be replicated across millet-producing districts. Strengthening FPO-led millet clusters through processing and storage infrastructure, affordable finance, branding, market linkages and entrepreneurship support can enhance farm incomes while creating employment for rural women and youth. Mainstreaming millets in **PDS, ICDS, school meals, hospitals and other public food programmes**, alongside climate-smart production, consumer awareness and export promotion, can further create assured demand. Scaling such integrated models will contribute simultaneously to **nutrition security, climate-resilient agriculture, rural employment and sustainable farmer income enhancement**.

#### Policy Context and Rationale

Millets, designated as *Nutri-Cereals* under national policy, are central to India's strategy for addressing climate variability, malnutrition, and agrarian distress in rainfed regions. India contributes over 40 percent of global millet production and has positioned millets as a strategic crop group through initiatives such as the National Food Security Mission (NFSM–Nutri-Cereals), POSHAN Abhiyaan, Farmer Producer Organisation (FPO) promotion schemes, and the inclusion of millets in public food programmes. The declaration of 2023 as the International Year of Millets further elevated their global and national relevance.

Despite this policy momentum, challenges remain in terms of consumer acceptance, organised value chains, processing infrastructure, and branding. Addressing these gaps requires district-level, institution-led models that integrate production, processing, nutrition awareness, and market access.

#### Problem Statement

While millets are agronomically suitable for semi-arid regions and nutritionally superior to refined cereals, their cultivation and consumption remain constrained by:

- Limited value addition and processing facilities at the local level
- Weak market linkages and branding mechanisms
- Inadequate institutional procurement and assured demand
- Insufficient consumer awareness regarding health and nutritional benefits

Bidar district in Karnataka exemplifies both the challenge and the opportunity, where favourable agro-climatic conditions coexist with underutilised market potential.

#### Objectives of the Policy Brief

This policy brief aims to:

1. Highlight the potential of Bidar district as a millet hub
2. Document the Hulsoor Farmer Producer Organisation (FPO) as a scalable model for millet promotion
3. Recommend policy interventions for scaling up millet-based livelihoods across India
4. Align millet promotion with national goals on nutrition, climate resilience, and farmer income enhancement

## State and District Context

### A. Karnataka's Leadership in Millet Promotion

Karnataka is among the leading millet-producing states, cultivating finger millet (ragi), foxtail millet, little millet, barnyard millet, kodo millet, and sorghum. The state's Millet Mission, supported by ICAR–Indian Institute of Millets Research (IIMR), has strengthened extension, processing, and awareness initiatives.

### B. Agro-climatic Suitability of Bidar District

#### Bidar district is characterised by:

- Semi-arid climate with moderate rainfall
- Red sandy loam soils suitable for dryland crops
- Traditional knowledge and farmer familiarity with millet cultivation

Millet's short duration, low water requirement, and tolerance to abiotic stresses make them ideal crops for climate-resilient agriculture in the district.

### Hulsoor FPO: An Institutional Model for Millet Value Chains

#### a. Institutional Profile

- **Name:** Hulsoor Farmer Producer Company Limited
- **Date of Registration:** 2 March 2021
- **Promoted by:** ICAR–Indian Institute of Millets Research (IIMR)
- **Financial Support:** Small Farmers' Agribusiness Consortium (SFAC), Central Sector Scheme
- **Registered Office:** Hulsoor, Basavakalyan Taluk, Bidar District, Karnataka

#### b. Vision and Objectives

##### The Hulsoor FPO was established to:

- Empower women farmers through collective enterprise
- Integrate millets into daily household diets
- Establish end-to-end value chains from production to marketing
- Enhance farmer incomes through value addition and direct market access

#### c. Infrastructure and Functional Interventions

- Establishment of a millet primary processing unit for cleaning, grading, and milling
- Capacity building programmes on production, processing, food safety, packaging, and marketing
- Promotion of women-led value addition units producing ready-to-cook and ready-to-eat millet products

Key commodities include finger millet, foxtail millet, sorghum, and allied crops such as soybean.

#### d. Outcomes and Recognition

- National recognition through mention in the Hon'ble Prime Minister's *Mann ki Baat* programme
- Increased participation of women in economic decision-making
- Enhanced farm-gate prices through reduced intermediary dependence
- Improved local nutritional outcomes through increased millet consumption

### National Relevance and Replicability

The Hulsoor FPO demonstrates a convergent approach linking agriculture, nutrition, women's empowerment, and climate resilience. Replication of this model across millet-producing districts can contribute to:

- Doubling farmers' income through value addition
- Achieving nutrition security objectives under POSHAN Abhiyaan
- Strengthening climate-resilient farming systems
- Generating rural employment for women and youth

## Policy Recommendations

### a. Strengthening FPO-led Millet Clusters

- Identify and notify millet clusters anchored around FPOs
- Provide capital subsidies for processing, storage, and packaging infrastructure
- Facilitate affordable working capital through interest subvention schemes

### b. Demand Creation and Consumption Promotion

- Launch a national “Millet in Every Meal” awareness campaign
- Mainstream millets in PDS, Mid-Day Meal, ICDS, hostels, and hospitals
- Develop a national millet recipe and knowledge repository

### c. Value Addition, Branding, and Marketing

- Support women SHGs and FPOs with grants for machinery, packaging, and branding
- Enable participation in domestic and international trade fairs
- Encourage GI tagging and region-specific millet branding

### d. Research, Development, and Extension

- Develop high-yielding and biofortified millet varieties through ICAR and SAUs
- Promote climate-smart cultivation practices
- Strengthen extension on processing technologies, quality standards, and e-commerce

### e. Export Promotion

- Establish district-level Millet Export Facilitation Centres
- Support certification and compliance with international food safety standards
- Forge partnerships with global health food companies

## Proposed Action Plan for Bidar District

| Action                                | Implementing Agency                | Timeline | Expected Outcome                    |
|---------------------------------------|------------------------------------|----------|-------------------------------------|
| Establish additional processing units | Dept. of Agriculture, SFAC, FPOs   | 1 year   | 50% increase in processing capacity |
| Districtwide nutrition campaigns      | ICAR– KVK Bidar, IIMR              | 6 months | 30% rise in local consumption       |
| Millet-based midday meals             | Dept. of Education, ICDS           | 1 year   | Improved child nutrition            |
| Launch Bidar Millet Brand             | Hulsoor FPO, State Marketing Board | 6 months | Premium pricing                     |
| E-commerce platform                   | FPOs, IT Dept.                     | 1 year   | Expanded urban markets              |

## Expected Outcomes

### Economic

- 20–30 percent increase in farmer incomes through value addition and direct marketing
- Employment generation in processing, packaging, and marketing, particularly for rural women

### Nutritional

- Improved intake of dietary fibre, protein, and micronutrients
- Reduction in lifestyle diseases associated with refined cereal consumption

### Environmental

- Reduced water and energy use compared to water-intensive crops
- Lower greenhouse gas emissions due to minimal chemical input use

## Conclusion

Millet promotion represents a strategic convergence of agricultural sustainability, nutritional security, and inclusive rural development. The Hulsoor FPO experience from Bidar district demonstrates that community-driven, women-centred, value-chain-integrated approaches can deliver measurable socio-economic and environmental benefits. Scaling such models through supportive national and state policies will position India as a global leader in millet-based agri-food systems while advancing national development priorities.

### **Puthari FPO: An Innovative Institutional Model for Strengthening Plantation-Based Livelihoods in Kodagu, Karnataka**

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#### **Executive Summary**

The Puthari Farmers Producer Organization (FPO), established in 2016–17 through the joint efforts of ICAR–KVK Kodagu and NABARD, demonstrates an effective institutional model for strengthening plantation-based livelihoods among small and medium farmers. Addressing high input and labour costs, price volatility and weak market integration in Kodagu's coffee-based farming systems, the FPO has grown from 186 members in 2017–18 to 1,126 members in 2024–25, covering more than 25,000 acres and aggregating around 7,500 tonnes of Robusta coffee annually. Through collective input procurement, aggregation, value addition, market linkages, capacity building and a farmer-oriented Rural Mart, the FPO has reduced input costs by 15–20%, lowered overall cultivation costs by 10–12%, and enabled coffee farmers to obtain about 10% higher prices. Its turnover increased from ₹0.3 crore to ₹5.2 crore during 2017–18 to 2024–25, reflecting strong institutional and commercial growth.

The Puthari model demonstrates that farmer collectivization, technical backstopping and business-oriented FPO governance can improve profitability, market access and resilience in plantation agriculture. The model offers significant potential for replication across coffee, horticulture and other high-value plantation regions. Policy support should focus on affordable working capital, post-harvest and processing infrastructure, direct market access, digital enablement, professional FPO management, value addition, crop-risk insurance and stronger convergence of government schemes, with KVKs, NABARD, FPOs and private-sector partners providing coordinated last-mile support. Mainstreaming such institutional models can strengthen farmer bargaining power, enhance value capture at farm level, create rural employment and contribute substantially to resilient and sustainable plantation-based livelihoods.

#### **Context and Policy Problem**

Indian agriculture is characterized by fragmented landholdings, with 86% of farmers operating less than 2 ha. In plantation-dominated regions such as Kodagu district, Karnataka, small and medium coffee growers face high production costs, labour scarcity, volatile international prices, and weak market integration.

Between 2007 and 2017, international prices of Robusta coffee increased by only 1.75%, while costs of cultivation increased 2.5 times, resulting in an estimated 33% decline in profitability. Rising costs of labour, fertilizers, pesticides, fuel, and declining returns constrained investments in replanting, irrigation, and post-harvest infrastructure, thereby reducing productivity.

These structural constraints underscored the need for institutional aggregation mechanisms, as envisaged under the Government of India's FPO Promotion Policy, to enhance farmers' bargaining power, market access, and income resilience.

#### **Policy Intervention: Formation of Puthari FPO**

In response to these challenges, ICAR–KVK Kodagu, in collaboration with NABARD, initiated an institutional intervention through the formation of Puthari Farmers Producer Organization (FPO) in 2016–17.

Following a KVK–NABARD sensitization seminar on FPOs (September 2016), progressive farmers and rural youth mobilized to establish the FPO with financial support from NABARD's Produce Fund.

## Role of ICAR–KVK Kodagu

ICAR–KVK Kodagu played a catalytic role in the establishment and operationalization of the Puthari Farmers Producer Organization by facilitating farmer mobilization and statutory registration of the FPO. The KVK provided structured capacity development programmes for both general members and the Board of Directors, focusing on governance, business management and scientific farming practices. Continuous advisory support was extended on input supply systems, aggregation strategies and value-chain development to strengthen commercial viability. To ensure effective coordination and reduce initial operational costs, office space was provided within the KVK campus at Gonikoppal. The FPO continues to receive regular technical backstopping, handholding and performance monitoring from KVK scientists through periodic reviews and field-level guidance, ensuring institutional stability and sustainable growth.

## Objectives of the FPO

- Capacity building in scientific coffee-based mixed farming systems
- Reduction in cost of cultivation through collective input procurement
- Aggregation, grading, branding and marketing of plantation produce
- Promotion of value addition and farmer-owned branding
- Strengthening financial inclusion and institutional linkages
- Adoption of digital platforms for input supply, marketing and advisory services

## Scale and Growth: Evidence of Institutional Strengthening

### Membership Growth

The Figure illustrates the consistent and robust growth in membership of the Puthari Farmers Producer Organization since its inception. Starting with 186 members in 2017–18, the FPO witnessed a rapid increase in enrolment, reaching 390 members in 2018–19 and 696 members by 2019–20, reflecting strong acceptance among farmers in the region. Despite a relatively moderate increase during 2020–21, attributable to operational constraints during the COVID-19 period, membership continued to expand steadily in subsequent years, rising to 840 in 2021–22 and 880 in 2022–23. The upward trajectory strengthened further in the post-pandemic phase, with membership increasing to 960 in 2023–24 and reaching 1,126 members by 2024–25. This sustained growth in membership indicates increasing farmer confidence in the FPO's governance, service delivery, and economic benefits, and underscores its institutional credibility and scalability in plantation-based farming systems.

As of **July 2025**, Puthari FPO has emerged as **one of the largest plantation-crop FPOs in Karnataka**.



**Coverage: Over 25,000 acres** under plantation crops

**Annual Coffee Production: ~7,500 tonnes of Robusta cherry**

## Major Business Interventions and Evidence

### a. Input Retailing and Cost Reduction

The FPO initiated its input retailing intervention with the launch of a dedicated retail outlet in September 2017 to address the high cost and quality issues associated with farm inputs. Starting with a limited portfolio of 15 essential inputs, the outlet has progressively expanded its product range to over 1,750 items, catering comprehensively to the needs of coffee-based mixed farming systems. Through collective procurement and minimal administrative margins, inputs are supplied to members at prices 15–20 per cent lower than prevailing market rates. Bulk procurement of critical soil amendments such as lime and dolomite alone has resulted in direct savings of approximately ₹1,750 per acre for farmers. This input-led business vertical has emerged as a major driver of financial sustainability for the FPO, with annual turnover increasing from ₹0.3 crore in 2017–18 to ₹5.2 crore in 2024–25, demonstrating the commercial viability of farmer-led input supply models.

### b. Market and Value Chain Interventions

- Aggregation and marketing of coffee, black pepper, avocado, banana, citrus, chilli, coconut
- Coffee marketed at ~10% premium over local prices
- Avocado marketing through private and retail chain tie-ups, addressing post-harvest losses

### c. Rural Mart Initiative (COVID Response and Beyond)

- Rural Mart launched on 11 November 2020 with NABARD support
- Enabled direct farmer-to-consumer sales of vegetables, fruits, eggs and fish
- Reduced intermediation and improved price realization during and after COVID-19



#### d. Capacity Development and Technology Adoption

The FPO, with technical support from ICAR-KVK Kodagu, has institutionalized regular training programmes aimed at promoting standardized packages of practices across coffee-based mixed farming systems. Special emphasis has been placed on engaging young and educated farmers returning to agriculture, providing them with technical guidance, confidence and institutional support during their initial years. Adoption of rationalized and need-based plant protection schedules has resulted in reduced and judicious use of chemical inputs, improved management of major pests and diseases, and enhanced crop health. These interventions have collectively contributed to a measurable reduction of 10–12 per cent in the overall cost of cultivation, while simultaneously improving productivity and environmental sustainability.

#### e. Single-Window Farmer Service Model

- Integration of KVK advisory services and FPO retail outlet
- 60–80 farmers visit KVK daily
- Improved access to technology, inputs, and market guidance

#### Financial Performance

The Figure highlights the steady growth and diversification of Puthari FPO's business operations over time. Between 2017–18 and 2024–25, the FPO's annual turnover increased from ₹0.3 crore to ₹5.2 crore, reflecting a more than seventeen-fold expansion in business volume. This growth was accompanied by a substantial increase in the number of products handled by the FPO, which rose from 150 to 880, indicating progressive diversification of input and output services offered to members. While a temporary dip in turnover was observed in 2021–22, largely attributable to market disruptions and operational constraints during the COVID-19 period, the subsequent recovery and growth underscore the resilience of the FPO's business model and its ability to adapt to changing market conditions. Overall, the trends demonstrate strengthening financial performance, improved service delivery and enhanced institutional capacity over time.



### Impact Outcomes

- 15–20% reduction in input costs
- 10% premium price for coffee
- 10–12% reduction in cultivation costs
- Enhanced farmer confidence and participation
- Strengthened market access and income stability
- Increased adoption of scientific practices

The interventions undertaken by the Puthari Farmers Producer Organization have resulted in tangible economic and institutional benefits for its members. Collective procurement and efficient input retailing have led to a reduction of 15–20 per cent in input costs, while rationalized production practices and improved advisory support have contributed to an overall 10–12 per cent reduction in the cost of cultivation. Through aggregation, quality management and improved market linkages, member farmers are realizing a premium of about 10 per cent for coffee compared to prevailing local market prices. Beyond direct economic gains, the FPO has strengthened farmer confidence, participation and collective decision-making, fostering a sense of ownership and trust among members. Improved access to markets and reduced-price volatility have enhanced income stability, while regular capacity-building programmes have accelerated the adoption of scientific and standardized farming practices, contributing to improved productivity and sustainability of plantation-based farming systems.

### Key Constraints Identified

- Weak post-harvest and cold-chain infrastructure
- Limited access to affordable working capital
- Human resource and managerial skill gaps
- Branding and processing limitations
- Market intelligence and digital adoption challenges

### Policy Recommendations (Actionable for Government)

#### a. APMC Reforms: Enabling Direct Procurement and Market Integration

State-level amendments to the APMC Acts are required to enable Farmers Producer Organizations to undertake direct procurement of members' produce without mandatory market fees or intermediary licensing requirements. FPOs should be recognized as eligible market participants under the Minimum Support Price (MSP) framework wherever applicable and be seamlessly integrated with digital trading platforms such as e-NAM and ONDC. Such reforms will enhance price discovery, reduce transaction costs, and allow FPOs to access wider domestic and institutional markets.

#### b. Targeted Credit Support: Affordable Finance for FPO Growth

Access to affordable and timely finance remains a critical bottleneck for FPOs, particularly during their formative years. The Government should strengthen targeted credit support through low-interest working capital loans, credit guarantee mechanisms, and equity grants, building upon existing schemes of SFAC, NABARD and SIDBI. Simplified loan appraisal norms and faster disbursement mechanisms will enable FPOs to scale input procurement, aggregation and marketing operations without liquidity constraints.

#### c. Infrastructure Grants: Strengthening Post-Harvest and Processing Capacity

Dedicated capital support should be provided to FPOs for establishing essential infrastructure such as collection centres, grading and packing units, cold storage facilities and primary processing units. These investments will reduce post-harvest losses, improve produce quality, and enable FPOs to access high-value domestic and export markets. Infrastructure grants should be linked with convergence of schemes such as MIDH, PMFME, RKVY and NABARD's infrastructure funds to maximize impact.

#### **d. Private Sector Participation: Promoting Public–Private Partnerships (PPPs)**

Private sector engagement can significantly enhance the technical, financial and market capabilities of FPOs. Policies should incentivize public–private partnerships through tax benefits, risk-sharing mechanisms and co-investment models to encourage private players to invest in aggregation, processing, branding and marketing activities of FPOs.

Strategic partnerships with agri-input companies, food processors, exporters and retail chains can accelerate value-chain integration and market access.

#### **e. Capacity Building: Professionalizing FPO Management**

Sustainable functioning of FPOs requires skilled human resources in governance, finance, marketing and agribusiness management. The Government should promote dedicated training and certification programmes on FPO management, in collaboration with agricultural universities, management institutions and private training providers. Existing schemes such as Agri Clinics and Agribusiness Centres (ACABC) may be redesigned to create a pool of trained professionals to support FPOs as CEOs, accountants and business managers.

#### **f. Digital Enablement: Leveraging Technology for Efficiency and Transparency**

Digital technologies should be mainstreamed into FPO operations to improve efficiency, transparency and decision-making. Government support is needed to promote the adoption of e-trading platforms, management information systems (MIS), digital bookkeeping tools and mobile-based advisory services. Digital enablement will enhance real-time market intelligence, traceability, inventory management and financial transparency, making FPOs more competitive and resilient.

#### **g. Value Addition Support: Enhancing Farmer Share in Consumer Price**

FPOs require focused support for value addition, branding, packaging and labeling to move beyond primary produce marketing. Policy interventions should provide financial assistance, technical guidance and market facilitation to enable FPOs to market products under their own brands. Supporting value-added enterprises will help FPOs capture higher margins, reduce dependency on volatile commodity markets and increase farmers' share in the consumer rupee.

#### **h. Crop Insurance Integration: Mitigating Production and Climate Risks**

Given the increasing risks from climate variability, pests and diseases, FPO members should be provided enhanced access to crop insurance schemes such as PMFBY, including customized products for plantation and horticulture crops. FPO-based enrollment, premium payment and claim settlement mechanisms can improve coverage, reduce administrative costs and ensure timely compensation, thereby enhancing income security for member farmers.

#### **i. Dedicated National FPO Mission: Integrated and Coordinated Support**

A dedicated National FPO Support Mission should be established to provide integrated financial assistance, capacity building, infrastructure support, market linkage facilitation and regulatory simplification. The Mission should ensure convergence among central and state schemes, establish standardized monitoring and evaluation frameworks, and provide handholding support during the critical initial years. Regular performance assessments will help identify gaps, improve policy design and ensure long-term sustainability of FPOs.

#### **Conclusion**

The Puthari FPO model, nurtured by ICAR–KVK Kodagu and NABARD, demonstrates that institution-led farmer collectivization can effectively address scale inefficiencies, reduce production costs, enhance price realization and improve livelihood resilience in plantation agriculture.

This evidence-based model offers strong replicability potential across coffee, plantation and horticulture-based regions under the Government of India's ongoing FPO expansion and Doubling Farmers' Income

### Jackfruit Commercialization through Farmer Associations

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#### Executive Summary

Jackfruit (*Artocarpus heterophyllus*) is a highly nutritious, versatile and climate-resilient fruit crop with substantial potential for income generation, value addition and rural employment. Despite India's leading position in jackfruit production, the crop remains largely underutilized due to scattered backyard cultivation, distress sales, high perishability, inadequate aggregation and limited processing and market infrastructure. ICAR-KVK Hadonahalli, Bengaluru Rural, has been promoting improved production practices, processing, value addition, entrepreneurship and capacity building among farmers, women, SHGs and rural youth, thereby demonstrating the potential of jackfruit as a viable peri-urban livelihood enterprise.

A coordinated policy approach is required to transform jackfruit from an underutilized backyard crop into a commercially organized commodity. Key interventions include identification and multiplication of elite planting material, promotion of Commodity-Based Associations/FPOs, establishment of collection and common processing facilities, mechanization of harvesting and processing, skill development, digital traceability and stronger market linkages. Promotion of diversified value-added products, regional branding, e-marketing and public-private partnerships can reduce post-harvest losses, improve price realization and generate employment. Strengthened convergence among KVKs, universities, government departments, FPOs, SHGs and industry can substantially enhance farmer incomes and establish a sustainable jackfruit value chain in Karnataka.

#### Background and Rationale

Jackfruit (*Artocarpus heterophyllus*) is one of India's most versatile yet underutilized fruit crops, valued for its multiple uses including fresh consumption, processed food products, timber, fodder, medicinal applications, and industrial raw materials. India ranks first globally in jackfruit production, with an estimated production of 18.8 lakh tonnes from 1.88 lakh hectares.

Despite this production potential, jackfruit remains largely neglected in organized value chains. Karnataka ranks eighth in national jackfruit production with 23,616 tonnes, primarily grown as scattered backyard trees rather than in commercial orchards. The absence of organized aggregation, processing, branding, and market linkages has resulted in post-harvest losses estimated at nearly 50%. At a conservative farm-gate price of ₹10 per kg, this translates into an annual national loss of approximately ₹940 crore worth of nutritious food and income opportunities.

In alignment with Gol's vision of Doubling Farmers' Income, reducing post-harvest losses, and promoting value addition and agri-entrepreneurship, jackfruit presents a strong case for structured intervention through Commodity-Based Associations (CBAs), Farmer Producer Organizations (FPOs), and market-oriented institutional mechanisms.

#### Problem Statement

Jackfruit commercialization is constrained by structural, technical, and institutional challenges:

- Low farm-gate prices due to distress sales and on-tree contracting
- High post-harvest losses owing to perishability and handling difficulties
- Absence of organized processing and marketing infrastructure
- Weak institutional mechanisms for producer aggregation and branding

These challenges collectively prevent jackfruit growers from realizing remunerative returns despite the crop's high nutritional and economic potential.

### Role of ICAR–KVK in Jackfruit Development

ICAR–Krishi Vigyan Kendra, Hadonahalli, Bengaluru Rural District, has played a catalytic role in promoting jackfruit-based livelihood models by:

- Demonstrating improved production and management practices
- Conducting capacity-building programmes on processing, value addition, and entrepreneurship
- Empowering rural youth, farm women, Self-Help Groups (SHGs), and smallholders
- Facilitating exposure to jackfruit-based value-added enterprises

These interventions align with national missions such as Skill India, Startup India, and National Horticulture Mission (NHM).

### Entrepreneurship and Livelihood Opportunities

Bengaluru Rural District, being a peri-urban region, offers strong market proximity and demand for ready-to-eat, minimally processed, and branded jackfruit products. Jackfruit-based enterprises can provide:

- Supplementary income to small and marginal farmers
- Sustainable livelihood opportunities for SHGs and rural youth
- Scope for women-led food processing enterprises
- Raw material for MSME-based food and by-product industries

### Key Constraints and Bottlenecks

#### a. Collection and Aggregation

- Jackfruit trees are scattered and predominantly grown as backyard crops
- Harvesting is labour-intensive due to latex oozing and spiny fruit rind
- Lack of organized collection centers leads to inconsistent quality and volumes





#### **b. Nursery and Planting Material**

- Acute shortage of quality planting material for area expansion
- Low success rates in grafting and budding
- Limited availability of skilled manpower and specialized nurseries

#### **c. Market Access**

- Dependence on middlemen through on-tree contracts at low prices
- Limited availability in local regulated markets
- Absence of processing, grading, branding, and direct consumer linkage

#### **d. Regulatory and Institutional Gaps**

- Inadequate marketing infrastructure in APMCs, HOPCOMS, and mandis
- Absence of a dedicated State Jackfruit Development and Marketing Board
- Limited policy focus on jackfruit as a commercial horticultural commodity

### **Policy Interventions and Recommendations**

#### **a. Elite Clone Identification and Area Expansion**

- Identification, characterization, and registration of elite jackfruit progenies under PPV&FRA, ensuring farmers' rights and benefit sharing
- Launch of dedicated state/central schemes for jackfruit area expansion under dryland horticulture
- Promotion of climate-resilient jackfruit orchards under MIDH/NHM

#### **b. Institutionalization and Infrastructure Development**

- Establishment of a Jackfruit Development and Marketing Board at the state level to stabilize prices and coordinate production, processing, and exports
- Promotion of Commodity-Based Associations, FPOs, and Jackfruit Federations for aggregation and collective marketing
- Development of mechanized solutions for harvesting, cleaning, cutting, and processing to reduce drudgery and post-harvest losses
- Creation of Common Facility Centres (CFCs) for processing and storage under PMFME and MSME schemes

#### **c. Capacity Building and Skill Development**

- Training skilled manpower in nursery production, processing, packaging, branding, and entrepreneurship
- Strengthening KVK–University–Department convergence for technology upscaling
- Promotion of jackfruit-based by-product industries (seed flour, animal feed, timber substitutes, latex-based products)

#### **d. Collaboration with NGOs, Startups, and Industry**

- Adoption of AI-based tools and RFID tagging for geo-referencing elite trees and orchards
- Development of digital platforms for traceability, advance booking, and buyer–seller linkage
- Encouraging public–private partnerships (PPP) for processing and export promotion

#### **e. Market Access, Value Addition, and Branding**

- Promotion of diversified jackfruit value-added products such as chips, flakes, papad, laddus, juice, jam, ice-cream flavoring, and ready-to-cook items
- Development of regional branding and GI-based marketing strategies
- Creation of e-marketing platforms and integration with ONDC and agri e-marketplaces

#### **Expected Outcomes and Impact**

- Production of one lakh quality jackfruit saplings within three years through capacity building
- Establishment of organized aggregation and collection systems
- Improved price realization through auction centres and regulated mandis
- Reduction in post-harvest losses and dependence on intermediaries
- Doubling of farmers' income through processing, branding, and entrepreneurship
- Generation of rural employment, particularly for youth and women

#### **Conclusion**

Jackfruit has significant potential as a climate-resilient, nutrient-dense, and income-enhancing horticultural crop, especially suited to dryland and peri-urban regions. With targeted policy support focused on strengthening commodity-based farmer associations, developing infrastructure, promoting value addition, and improving market linkages aligned with the Government of India's agricultural development framework and supported by KVKs, universities, and government departments jackfruit can be transformed from an underutilized backyard fruit into a commercially viable commodity.

### Balekai Hudi (BaKaHu): Banana Flour Value Chain Model from Farm to Market

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#### Executive Summary

India is the world's largest producer of bananas, accounting for over 19 percent of global production with an annual output exceeding 33 million tonnes. Despite this strength, the banana sector experiences post-harvest losses of 15–20 percent due to perishability, inadequate storage, transportation bottlenecks, and seasonal market gluts. These losses translate into reduced farmer incomes and inefficient use of valuable agricultural resources.

BaKaHu (banana flour), produced by drying and milling unripe or surplus bananas, offers a scalable and sustainable solution to this challenge. It converts a highly perishable fruit into a shelf-stable, nutrient-rich, and versatile product suitable for health foods, gluten-free diets, bakery products, infant foods, and functional food formulations. BaKaHu also aligns strongly with national priorities such as women's empowerment, value addition, reduction of food losses, and promotion of agri-based micro-enterprises.

The ICAR–KVK, Uttara Kannada, Sirsi, has pioneered the promotion of BaKaHu in coastal Karnataka and the Malnad region through training, demonstrations, market exposure, and institutional linkages. The initiative has received national recognition, including acknowledgment by the Hon'ble Prime Minister in *Mann Ki Baat*, highlighting the leadership of rural women in transforming banana surplus into income-generating enterprises. However, despite proven success at the pilot level, large-scale adoption remains constrained by awareness gaps, infrastructure limitations, market access challenges, and financing barriers.

#### Background and Context

Banana is a major horticultural crop cultivated extensively in Andhra Pradesh, Maharashtra, Gujarat, Tamil Nadu, and Karnataka. Its year-round production and high productivity make it a critical contributor to food security and farmer livelihoods. However, bananas are highly perishable, and market saturation during peak harvest periods leads to distress sales and wastage.

BaKaHu, or banana flour, is produced by slicing, drying, and milling unripe or surplus bananas. The product retains key nutritional attributes such as resistant starch, dietary fibre, potassium, and essential micronutrients. Its long shelf life and diverse applications make it a strategic value-added product with strong domestic and export potential.

In India, growing consumer demand for clean-label, plant-based, gluten-free, and functional foods has opened new markets for banana flour. Internationally, BaKaHu has significant potential in health food and specialty ingredient segments. Leveraging this opportunity requires coordinated policy support, infrastructure development, and capacity building.

#### ICAR–KVK Uttara Kannada, Sirsi: Intervention and Achievements

ICAR–KVK Uttara Kannada, Sirsi, has undertaken systematic interventions to promote BaKaHu as a livelihood option for farm women and rural entrepreneurs. Key initiatives include:

- Capacity building through hands-on training, workshops, and demonstrations on banana processing and value addition.
- Promotion of low-cost, locally adaptable processing techniques suitable for household and group-level enterprises.
- Linking women farmers and entrepreneurs with Self-Help Groups (SHGs), Farmer Producer Organizations (FPOs), and government schemes for financial and institutional support.
- Facilitating market exposure through exhibitions, fairs, competitions, and consumer awareness programmes.
- Guidance on packaging, branding, and basic quality assurance practices.



A notable success story is that of Mrs. Ganga Hegde, who was selected under the RKVY–RAFTAAR scheme and received financial support of ₹12 lakh to establish a banana flour enterprise, serving as a role model for others.

On 11 August 2021, KVK Sirsi, in collaboration with the Uttara Kannada Organic Federation, Department of Horticulture, and ATMA, organized a BaKaHu Value Addition and Competition Workshop under the “Azadi Ka Amrut Mahotsav” celebrations. The event witnessed participation from 56 farm women and SHG members, showcasing over 175 BaKaHu-based products, including cakes, idli, chakli, jalebi, and other innovative food items. The event demonstrated the nutritional value, culinary versatility, and market potential of banana flour.



Despite these achievements, scaling up production beyond localized success remains limited.

### Key Constraints in Scaling up BaKaHu Production

#### a. Limited Awareness and Adoption

- Inadequate awareness among banana growers and rural entrepreneurs regarding the economic potential of banana flour.
- Limited exposure to successful business models, case studies, and technology demonstrations.
- Perception that processing is complex, risky, and capital-intensive.
- Absence of focused awareness campaigns and demonstration units in major banana-growing clusters.

#### b. Processing Infrastructure Gaps

- Lack of access to affordable dryers, slicers, grinders, and hygienic packaging facilities in rural areas.
- Concentration of processing infrastructure in urban and semi-urban locations, increasing transportation costs.
- Limited availability of community-level or shared processing facilities.

### c. Quality Standards and Certification Challenges

- Limited technical knowledge on FSSAI norms, moisture control, microbial safety, and shelf-life management.
- Perception that certification and compliance processes are costly and time-consuming.
- Inadequate quality control leading to inconsistent products and reduced market trust.

### d. Weak Market Linkages

- Dependence on local and informal markets with low and unstable returns.
- Poor integration with organized retail, e-commerce platforms, and export channels.
- Limited branding, packaging, and promotion support.

### e. Seasonal Price Volatility

- Sharp decline in banana prices during peak harvest periods.
- Inability to synchronize processing with surplus availability due to lack of storage and drying capacity.
- Uncertainty discouraging long-term investment in processing units.

### f. Credit and Capital Constraints

- Difficulty in accessing affordable credit under schemes such as PMFME and PMEGP.
- Complex procedures, documentation requirements, and lack of collateral.
- Limited financial literacy among rural entrepreneurs.

### g. Skill and Capacity Gaps

- Insufficient training in food safety, hygiene, equipment handling, and quality assurance.
- Risk of compromised food safety, shorter shelf life, and lower consumer acceptance.

## Rationale for Scaling up BaKaHu Production

- **Reduction of Post-Harvest Losses:** Processing surplus bananas into flour can save 15–20 percent of produce currently lost, improving resource efficiency.
- **Enhanced Farmer Income:** Value addition through BaKaHu can increase farmer returns by 30–50 percent compared to raw fruit sales.
- **Employment Generation:** Creation of rural jobs across processing, packaging, quality control, logistics, and marketing.
- **Nutrition Security:** Availability of an affordable, nutritious, and gluten-free food option for children, elderly populations, and individuals with dietary restrictions.
- **Export Promotion:** Standardized and certified banana flour can tap into growing global demand for functional and health foods.
- **Women's Empowerment:** The enterprise model is well suited to women-led SHGs and cooperatives, strengthening their economic participation and decision-making power.

## Role of Government and Policy Recommendations

### a. Infrastructure and Technology Support

- Establish Common Facility Centres (CFCs) with banana drying, milling, and packaging units under PMFME, MIDH, and allied schemes.
- Promote low-cost solar dryers, portable slicing and milling equipment suitable for rural micro-enterprises.
- Locate facilities strategically in banana-producing clusters.

### b. Financial and Institutional Support

- Provide subsidized credit and capital grants to SHGs, FPOs, and MSMEs engaged in banana flour production.
- Simplify loan procedures and enhance handholding support.
- Integrate BaKaHu into the One District One Product (ODOP) initiative in banana-rich districts.

### c. Capacity Building and Skill Development

- Organize structured training programmes through KVKs, ICAR institutes, and State Agricultural Universities.
- Develop standardized training modules on processing, hygiene, packaging, and entrepreneurship.

#### **d. Market Development and Branding**

- Facilitate linkages with organized retail chains, e-commerce platforms, and health food companies.
- Support branding, labeling, organic certification, and exploration of GI tagging.
- Promote BaKaHu-based products through exhibitions, trade fairs, and national campaigns.

#### **e. Quality Assurance and Standards**

- Provide technical guidance to comply with FSSAI, ISO, and international export standards.
- Develop and disseminate Standard Operating Procedures (SOPs) for hygienic and standardized production.
- Strengthen quality testing and certification support at the local level.

#### **Conclusion**

Scaling up BaKaHu production represents a strategic opportunity to reduce post-harvest losses, enhance farmer incomes, empower rural women, and promote sustainable agri-based enterprises. With India's position as the world's leading banana producer, systematic policy support can transform banana flour into a nationally and globally competitive product. Integrating BaKaHu into agricultural value-chain development, rural livelihood missions, and nutrition strategies will contribute significantly to inclusive growth, food and nutrition security, as well as building resilient rural livelihoods.

### Farm Ponds: Enhancing Farmers Income Through Aquaculture and Farmer based Enterprises

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#### Executive Summary

Farm ponds, created primarily to ensure protective irrigation under various Government of India and State Government schemes, have emerged as a significant yet underutilized resource for inland aquaculture. Evidence from Belagavi district, Karnataka, demonstrates that scientifically managed aquaculture in existing farm ponds can substantially enhance fish production, diversify farm income, generate rural employment, and strengthen local agri-based enterprises.

This policy brief highlights field-level experiences, technological interventions by ICAR-KVK Belagavi-1, and policy measures required to mainstream farm pond aquaculture as a viable component of India's fisheries and rural livelihood strategy under the Pradhan Mantri Matsya Sampada Yojana (PMMSY) and allied programmes.

#### Background and Context

Farm ponds have become a cornerstone of India's rainfed agriculture resilience strategy. Major public investments through schemes such as:

- Krishi Bhagya Yojane
- Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)
- National Horticulture Mission (NHM)
- MGNREGA

have resulted in the creation of lakhs of farm ponds nationwide.



In Belagavi district alone, more than 22,000 farm ponds have been established since 2010, primarily benefiting rainfed and smallholder farmers. While these ponds are designed for irrigation during critical crop growth stages, their year-round water retention potential presents a strong opportunity for integrated aquaculture, which remains largely untapped.

#### Rationale: Scope for Aquaculture in Farm Ponds

Farm ponds offer a unique institutional and technical advantage for aquaculture development:

##### a. Individual Ownership and Management

Since farm ponds are owned by individual farmers, timely decision-making, monitoring, biosecurity, and adoption of scientific practices are feasible—critical requirements for successful fisheries enterprises.

##### b. Augmentation of Inland Fish Production

Utilizing existing water bodies increases fish output without additional land acquisition, contributing to district and state-level fish production targets.

##### c. Enterprise and Value Chain Development

Expansion of farm pond aquaculture stimulates ancillary sectors such as fish seed production, feed supply, aqua-inputs, harvesting equipment, and cold-chain logistics.

##### d. Employment Generation

Aquaculture generates skilled and semi-skilled employment for rural youth, women, and landless households.

##### e. Supplementary Income from Existing Assets

Farm ponds otherwise idle after irrigation cycles can generate regular cash income, improving farm household resilience.

### Current Status and Challenges: Evidence from Belagavi District

Field assessments conducted by ICAR-KVK Belagavi-1 indicate both success stories and mixed outcomes, highlighting the need for systematic policy support.

#### Key Constraints Identified

- **Species Selection Issues**

Most farm ponds are **HDPE-lined**, limiting natural plankton productivity. Traditional carp species, which depend heavily on natural food, showed sub-optimal growth.

- **Imbalanced Feeding Practices**

Farmers largely relied on self-produced grain flours, meeting only carbohydrate requirements. Inadequate protein supplementation resulted in poor growth and feed conversion.

- **Partial Adoption of Technology Packages**

Non-adherence to complete scientific aquaculture practices led to reduced yields and inconsistent performance.

- **Marketing and Price Realization Constraints**

The absence of organized fish markets and dependence on intermediaries reduced farmer profitability.

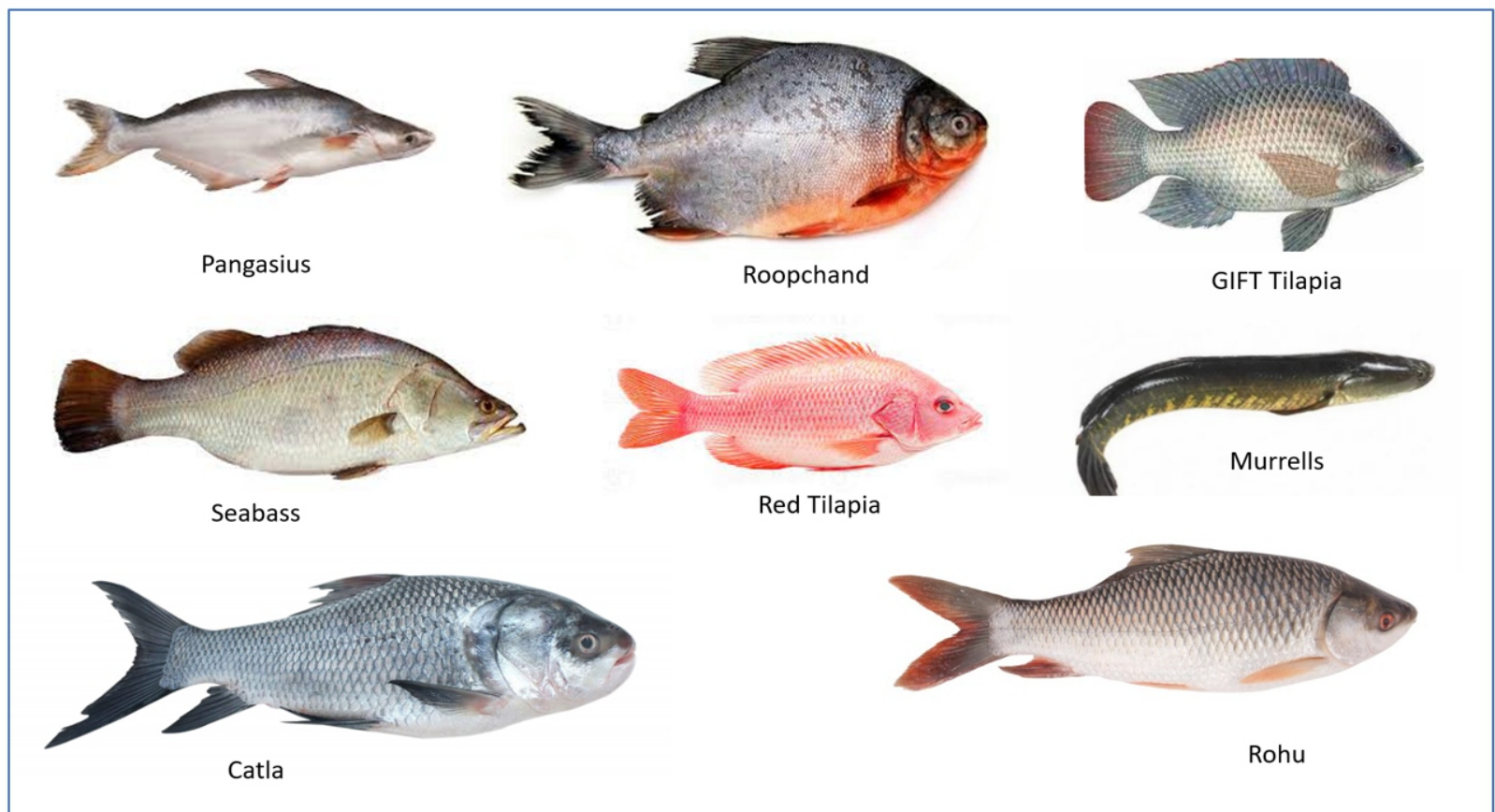
#### Institutional Interventions by ICAR-KVK Belagavi-1

To address these challenges, ICAR-KVK Belagavi-1 implemented need-based technology assessment, demonstrations, and capacity building.

#### Technology Testing and Demonstration

Eight fish species were evaluated for growth performance, adaptability, and market acceptance in farm ponds:

- Pangasius
- GIFT Tilapia
- Red Tilapia
- Roopchand (Pacu)
- Seabass
- Murrel (Channa spp.)
- Indian Major Carps



## Capacity Building Initiatives

Farmers were provided with comprehensive capacity-building support focusing on scientific feed and nutrition management to ensure balanced rations and optimal growth performance, along with fish health and disease management practices for early diagnosis, prevention, and biosecurity. Training also covered advanced aquaculture technologies such as Biofloc and Recirculatory Aquaculture Systems (RAS) to enhance productivity under limited water conditions. In addition, farmers were sensitized to scientific harvesting methods, post-harvest handling, value addition, and market-oriented strategies, enabling them to improve

## Market Infrastructure Development

Under Pradhan Mantri Matsya Sampada Yojana (PMMSY), KVK facilitated the establishment of a Fish Kiosk, providing assured market access and fair price realization.

### Outcomes

- **21% annual expansion** in farm pond aquaculture adoption
- Increased farmer confidence due to assured marketing
- Adoption of high-yielding, fast-growing species
- Improved productivity and income per unit water area



## Policy Implications

The success of farm pond aquaculture in Belagavi underscores the need to institutionalize fisheries integration within existing water harvesting and irrigation infrastructure. Leveraging current investments can significantly contribute to:

- Doubling farmers' income
- Achieving PMMSY targets
- Enhancing nutritional security through affordable fish protein

## Policy Recommendations

To mainstream farm pond aquaculture at the national level, the following measures are recommended:

### a. Cluster-Based Promotion

- Introduce cluster demonstrations for farm pond aquaculture, on the lines of cluster demonstrations in oilseeds and pulses, to accelerate adoption and impact.

### b. Market Infrastructure and FPO Integration

- Strengthen fish marketing infrastructure through Fish Farmer Producer Organizations (FFPOs) to ensure assured markets and fair pricing.

**c. Skill Development and Capacity Building**

- Implement structured skill training programmes on fish seed rearing, scientific aquaculture practices, and value addition to enhance rural employability.

**d. Promotion of Fisheries-Based Enterprises**

- Encourage entrepreneurship in
- Fish seed and feed production
- Aqua-input supply
- Aggregation and retailing
- Exclusive fish kiosks and value-added fish products

**e. Credit and Financial Inclusion**

- Facilitate credit linkage, interest subvention, and simplified access to financial support under PMMSY and allied schemes to accelerate sectoral growth.

**Conclusion**

Farm ponds, initially created for irrigation security, represent a strategic national asset for inland aquaculture development. With targeted policy support, scientific extension, and market integration, farm pond aquaculture can become a powerful driver of income diversification, employment generation, and sustainable fisheries growth in rainfed and semi-arid regions of India.

### Kisan Drone: Opportunities, Challenges and Way Forward

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#### Executive Summary

Kisan Drones are emerging as an important precision-agriculture technology in India, offering significant potential for timely input application, labour saving, reduced chemical exposure, efficient use of pesticides and nutrients, crop monitoring and precision farming. Under ICAR–ATARI Zone XI, 32 drones were sanctioned to KVKs, SAUs and ICAR institutes in Karnataka and Kerala, with 2,757 demonstrations covering 4,129 ha and involving 25,017 farmers. Field experiences in Karnataka and Kerala have demonstrated promising applications in pesticide and micronutrient spraying, biopesticide application and seed sowing, particularly in crops such as paddy, ragi, sugarcane, coconut, arecanut, cashew and horticultural crops.

However, large-scale adoption is constrained by limited battery endurance, inadequate charging and repair infrastructure, high initial and maintenance costs, lack of crop- and location-specific SOPs, spray drift and penetration issues, difficult terrain, shortage of trained pilots and regulatory complexities. The way forward should focus on strengthening Drone-as-a-Service/custom-hiring models, rural drone service and charging centres, crop-specific SOPs, farmer and operator capacity building, women and youth participation, affordable credit and insurance, and simplified regulatory awareness. Greater collaboration among ICAR institutes, KVKs, SAUs, FPOs, start-ups and private sector agencies can accelerate evidence-based and economically viable drone adoption, contributing to precision, sustainable and climate-resilient agriculture.

#### Introduction and Context

The Government of India (GoI) has identified drone technology as a key enabler for digital transformation in agriculture. Under the National e-Governance Plan in Agriculture (NeGPA) and policy announcements in the Union Budget 2022–23, drones—popularly referred to as *Kisan Drones*—have been promoted for applications such as crop assessment, precision input application, land record digitization, and yield estimation. The policy thrust aligns with the broader vision of Digital Agriculture Mission, Atmanirbhar Bharat, and Doubling Farmers' Income.

Kisan Drones are being promoted through a Public–Private Partnership (PPP) model, integrating efforts of ICAR institutes, State Agricultural Universities (SAUs), Krishi Vigyan Kendras (KVKs), agri-tech start-ups, private input companies, and Farmer Producer Organizations (FPOs). These drones are equipped with cameras, sensors, GPS and variable-rate application systems, enabling precise, time-efficient and safer agricultural operations.

While drone adoption in Indian agriculture is still at a nascent stage, rapid technological improvements, declining costs, and strong policy backing have accelerated field-level demonstrations and early adoption, particularly in states like Karnataka and Kerala.

#### Institutional Support and Demonstrations under ICAR–ATARI

During 2022–23, the Indian Council of Agricultural Research (ICAR), through ATARI Zone XI, sanctioned 32 Kisan Drones to selected KVKs, SAUs and ICAR institutes in Karnataka and Kerala. All Project Implementing Centres (PICs) procured drones and trained technical staff as certified pilots.



**Table 1. Project Implementing Centres**

| S.No.        | Name on the Project Implementing Centre (PIC) | No. of Kisan Drones Sanctioned | No. of Kisan Drones Purchased by the PIC | No of Pilot trained |
|--------------|-----------------------------------------------|--------------------------------|------------------------------------------|---------------------|
| 1            | KVK Ramanagara                                | 1                              | 1                                        | 1                   |
| 2            | KVK Uttara Kannada                            | 1                              | 1                                        | 1                   |
| 3            | KVK Kolar                                     | 1                              | 1                                        | 1                   |
| 4            | KVK Udipi                                     | 1                              | 1                                        | 1                   |
| 5            | KVK Belagavi II                               | 1                              | 1                                        | 1                   |
| 6            | KVK Kalaburgi I                               | 1                              | 1                                        | 1                   |
| 7            | KVK Wayanad                                   | 1                              | 1                                        | 2                   |
| 8            | KVK Palakkad                                  | 1                              | 1                                        | 2                   |
| 9            | KVK Kottayam                                  | 1                              | 1                                        | 2                   |
| 10           | KVK Kollam                                    | 1                              | 1                                        | 2                   |
| 12           | KVK Pathanamthitta                            | 1                              | 1                                        | 1                   |
| 13           | KVK Davanagere                                | 1                              | 1                                        | 1                   |
| 14           | ICAR- CMFRI                                   | 2                              | 2                                        | 2                   |
| 15           | ICAR- NBAIR, Bengaluru                        | 2                              | 2                                        | 2                   |
| 16           | ICAR- DCR, Puttur                             | 2                              | 2                                        | 2                   |
| 17           | ICAR- IIHR, Bengaluru                         | 2                              | 2                                        | 2                   |
| 18           | ICAR- CPCRI, Kasaragod                        | 2                              | 2                                        | 2                   |
| 19           | ICAR- CTCRI, Thiruvananthapuram               | 2                              | 2                                        | 2                   |
| 20           | ICAR- IISR, Calicut                           | 2                              | 2                                        | 2                   |
| 21           | KAU- Thrissur                                 | 2                              | 2                                        | 2                   |
| 22           | UAS- Raichur                                  | 2                              | 2                                        | 2                   |
| 23           | UHS- Bagalkot                                 | 2                              | 2                                        | 2                   |
| <b>Total</b> |                                               | <b>32</b>                      | <b>32</b>                                | <b>36</b>           |

**Key Achievements (till date):**

- 2,757 drone-based demonstrations conducted
- 4,129 ha area covered
- 25,017 farmers directly participated

These demonstrations focused on pesticide spraying, micronutrient application, bio-pesticides, and seed sowing, showcasing drones as labour-saving and precision-enhancing tools.

**State-wise Experience**

**A. Karnataka**

Karnataka has emerged as a frontrunner in agricultural drone demonstrations and service models:

- **ICAR-NBAIR, Bengaluru (March 2024):** Conducted demonstrations on drone-based biopesticide spraying in coconut, brinjal, mango, sugarcane, arecanut and rice, highlighting precision and reduced exposure to chemicals.
- **UAS Bengaluru (2023–2025):** Implemented a multi-district study covering ragi and tur across 10 southern districts. Crop-specific Standard Operating Procedures (SOPs) were developed covering spray height, discharge rates, chemical compatibility and optimal timing.

- **IFFCO–Garuda Aerospace Demonstration (July 2023, Belagavi):** Drone-based fertilizer spraying in sugarcane used only 10 L water per acre, covering 5 acres in 50 minutes and saving approximately ₹9,400 per operation compared to manual spraying.
- **ICAR–Directorate of Cashew Research, Puttur (January 2024):** Demonstrated drone-based micronutrient spraying in cashew plantations. Over 500 farmers participated during Krishimela events, reflecting strong farmer interest.
- **Agri-Drone Spraying Centres (2025):** Karnataka established hobli-level drone service centres in Kalaburagi with rental-based models to address labour shortages, improve spray efficiency and promote precision farming. Expansion to all hoblis is planned.
- **'Drone Didis' Initiative (May 2025):** In collaboration with CropLife India and UAS Bengaluru, women farmers and SHG members were trained on drone operation and safety. State support included 100% subsidy for FPOs and 70% subsidy for individuals, promoting gender-inclusive technology adoption.



Drone Demonstration in Brinjal Field in Karnataka



Drone demonstration and training program in Karnataka

## B. Kerala

Kerala's experience highlights innovative applications in paddy cultivation:

- **KVK Kottayam (July 2024):** Demonstrated drone-based paddy seed sowing, covering one acre in 25 minutes with only 30 kg seed (compared to the conventional 50 kg), saving time, labour and seed cost.
- **KVK Thrissur:** Showcased micronutrient spraying (*Sampoorna*) over a 50-acre paddy field. Water usage reduced from 100–200 L to 16–25 L per acre, with yield improvement from about 1.8 t to nearly 3 t per acre.

## Constraints Observed During Field Demonstrations

Despite positive outcomes, KVKs and implementing institutions reported several operational constraints:

- Absence of crop- and location-specific SOPs for pesticide and nutrient spraying
- Limited battery life and lack of field charging infrastructure
- Inadequate spray penetration in tall and dense crops (oil palm, coconut, arecanut, banana)
- Poor drone visibility in plantation and multi-cropping systems
- Chemical drift and wastage during spraying
- Operational difficulties during light drizzling or high humidity
- Ineffectiveness against pests with internal feeding or nocturnal habits
- Challenges in maintaining visual line of sight in undulating and plantation terrains
- Logistical issues related to drone transportation in remote and hilly areas

## Advantages of Kisan Drones

Demonstrations clearly established the following benefits:

- Reduced quantity of pesticides and nutrients
- Significant savings in time and labour
- Uniform and precise application in field crops
- Rapid coverage of large areas
- Enhanced operator safety by minimizing direct chemical exposure

## Key Challenges to Large-scale Adoption

### Technical

- Limited battery endurance and payload capacity
- Poor rural infrastructure for charging, repair and data processing
- GPS and connectivity issues in remote areas

### Economic

- High initial cost (₹1–3 lakh or more)
- Maintenance and repair expenses
- Limited access to tailored credit and insurance products

### Regulatory

- Complex DGCA licensing (UIN, UAOP)
- Airspace restrictions near sensitive zones
- Low awareness of legal and safety guidelines

### Social and Operational

- Low digital literacy among farmers
- Resistance to new technologies
- Shortage of trained and certified drone pilots
- Lack of regional-language interfaces

## Policy Recommendations

To mainstream drone usage in agriculture, the following policy interventions are suggested:

- Capacity Building:** Regular farmer training programmes through KVKs, SAUs and FPOs, with emphasis on women and youth.
- Demonstration and Evidence:** Documentation and dissemination of local success stories to build farmer confidence.
- Drone-as-a-Service (DaaS):** Promotion of custom hiring and startup-led service models to ensure affordability for smallholders.
- Rural Drone Service Centres:** Establishment of maintenance, repair and battery charging hubs at block or hobli level.
- Standard Operating Protocols:** Development of crop-, pest- and region-specific SOPs for agrochemical application, ensuring safety, efficacy and regulatory compliance.
- Financial Incentives:** Enhanced subsidies, credit support and insurance coverage under central and state schemes.
- Regulatory Simplification:** Farmer-friendly licensing processes and awareness campaigns on DGCA norms.

## Summary and Way Forward

Kisan Drones represent a transformative tool for Indian agriculture by improving efficiency, reducing labour dependency, enhancing input-use efficiency, and promoting safer farming practices. Experiences from Karnataka and Kerala demonstrate strong potential, particularly when supported by institutional backing, subsidies and capacity building. With Government support, drones can help farmers use precision farming, empowering farmers including women and promote sustainable and climate resilient agriculture.

# Strengthening Community Radio Stations (CRS) for Sustainable Rural and Agricultural Development in India: With Special Reference to Sahakara Radio Gadag, Karnataka

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### Executive Summary

Community Radio Stations (CRS) represent a vital third tier of broadcasting in India, complementing public and private radio by addressing hyper-local developmental needs. Operating on low-power FM frequencies, CRS empower communities by amplifying local voices, indigenous knowledge systems, and region-specific advisories. Sahakara Radio Gadag (FM 89.6 MHz – *Namma Dhwani Nimagagi*), established in 2022 by ICAR–K.H. Patil Krishi Vigyan Kendra (KVK), Hulkoti, exemplifies the role of CRS in advancing agriculture, livelihoods, health, nutrition, and social development in Gadag district, Karnataka.

This policy brief proposes strategic policy reforms to ensure financial, institutional, and technological sustainability of CRS, with a special emphasis on agricultural extension, disaster preparedness, and inclusive rural transformation.

### Community Radio in the National Development Context

The Government of India recognizes communication as a critical enabler of inclusive growth, as reflected in flagship initiatives such as *Digital India*, *Doubling Farmers' Income*, *Atmanirbhar Bharat*, and *Viksit Bharat @2047*. Community Radio Stations align strongly with these national priorities by:

- Providing last-mile dissemination of agricultural technologies and advisories
- Enhancing participatory governance and social inclusion
- Strengthening rural knowledge systems through local languages and cultural contexts
- Supporting climate-resilient agriculture and disaster risk reduction

CRS thus function as grassroots knowledge institutions and are well positioned to complement the extension ecosystem of ICAR, State Agricultural Universities, line departments, and Panchayati Raj Institutions.

### Profile of Sahakara Radio Gadag (FM 89.6 MHz)

Sahakara Radio Gadag operates from the ICAR–K.H. Patil Krishi Vigyan Kendra campus at Hulkoti, Gadag district. With over four decades of service in agriculture and rural development, KVK Gadag has leveraged Community Radio as an innovative extension tool to reach farmers, rural youth, women, and local stakeholders.

### Key Operational Features:

- Year of Establishment: 2022
- Frequency: 89.6 MHz (FM)
- Broadcast Duration: 7 hours per day
- Morning: 7.00 – 9.30 AM
- Afternoon: 12.30 – 2.45 PM
- Evening: 6.00 – 8.15 PM
- Coverage: Approximately 10–15 km radius
- Access Platforms: Low-cost radio sets and mobile phones

The station serves as a participatory platform for scientists, progressive farmers, local artists, youth, and subject-matter experts, thereby ensuring relevance, credibility, and community ownership of content.

## **Role of Community Radio as a Pathway for Agricultural Development**

### **CRS Interventions by ICAR-KVK Gadag**

Sahakara Radio Gadag has institutionalized agriculture-centric programming as part of its daily broadcast schedule. Major thematic areas include:

- Crop-specific and location-specific advisories
- Weather- and season-based farm guidance
- Market intelligence and price dissemination
- Post-harvest management and value addition
- Interactive discussions with successful farmers and agri-entrepreneurs

### **Developmental Outcomes:**

- Improved awareness and adoption of scientific farming practices
- Timely farm-level decision-making
- Reduction in post-harvest losses
- Enhanced farm profitability and livelihood resilience

These outcomes directly contribute to national objectives of increasing agricultural productivity, reducing wastage, and strengthening rural incomes.

### **Existing Policy Guidelines for Community Radio Stations in India**

Community Radio Stations in India operate under policy guidelines issued by the Ministry of Information and Broadcasting (MIB), Government of India. The framework seeks to promote CRS as instruments of community development while ensuring regulatory compliance.

#### **a. Eligibility Criteria**

- Applicant organizations must be registered non-profit entities with a minimum of three years of community service
- Mandatory registration on the NITI Aayog NGO-Darpan portal
- Programming must reflect local community needs and participation
- Recommendations from District Administration may be required in specific cases

#### **b. Licensing and Approval Process**

- Online application for CRS license
- Frequency allocation and SACFA clearance
- Signing of Grant of Permission Agreement (GOPA) with bank guarantee
- Acquisition of Wireless Operating License (WOL) prior to commencement

#### **c. Content and Programming Regulations**

- Minimum 50% locally produced content
- Use of local languages and dialects
- Adherence to AIR Programme and Advertising Code
- News and current affairs restricted, except unaltered AIR bulletins
- Advertising limited to 12 minutes per hour, restricted to local services and events

#### **d. Technical Parameters**

- Effective Radiated Power (ERP): up to 100 Watts
- Coverage radius: typically 5–10 km
- Antenna height: 15–30 meters

#### **e. Funding, Monitoring, and Compliance**

- Government financial assistance for establishment and upgrades
- Revenue utilization restricted to station operations
- FCRA compliance for foreign funding
- Mandatory submission of audited annual accounts

## Policy Gaps and Sustainability Challenges

Despite a supportive policy intent, CRS face multiple constraints:

- Limited revenue generation due to strict advertising caps
- Dependence on short-term, project-based funding
- High regulatory and licensing costs
- Limited access to modern broadcasting technologies
- Inadequate capacity-building mechanisms

Addressing these challenges is critical for ensuring long-term viability of CRS.

## Policy Recommendations for Strengthening CRS Sustainability

### a. Rationalization of Advertising Norms

- Enhance permissible advertising duration beyond the current 12 minutes per hour
- Allow structured participation of CSR-funded messaging aligned with community development goals
- Introduce differentiated advertising norms for development-oriented CRS

### b. Diversification of Funding Mechanisms

- Establish dedicated GoI grant schemes for CRS sustainability
- Enable formal partnerships with public sector undertakings and private corporates under CSR
- Promote convergence with agricultural, health, nutrition, and rural development schemes

### c. Capacity Building and Human Resource Development

- Institutionalize training programs on financial management, content creation, and audience engagement
- Facilitate centralized procurement or provision of licensed audio processing and automation software by the Ministry
- Strengthen technical and editorial skills of CRS personnel

### d. Simplification of Regulatory and Licensing Processes

- Rationalize and reduce Wireless Operating License (WOL) charges for CRS
- Fast-track processing of financial assistance and renewal applications
- Introduce single-window mechanisms for CRS-related approvals

### e. Technology Adoption and Digital Integration

- Support acquisition of modern radio automation systems
- Promote interactive programming through mobile-based feedback and field reporting tools
- Encourage digital archiving and podcasting of CRS content

### f. Integration with National and District-Level Systems

- Integrate CRS into District Disaster Management Plans for early warning dissemination on floods, droughts, pests, and disease outbreaks
- Link CRS with IMD weather advisories and agricultural market intelligence platforms
- Recognize CRS as official partners in extension delivery under ICAR and State Agriculture Departments

## Conclusion

Community Radio Stations are indispensable grassroots communication institutions that align closely with the Government of India's vision for inclusive, sustainable, and participatory development. Strengthening CRS through policy reforms, financial support, and institutional convergence will significantly enhance their impact on agriculture, rural livelihoods, disaster resilience, and social empowerment.

Sahakara Radio Gadag stands as a replicable model demonstrating how CRS, when anchored within ICAR-KVK systems, can effectively translate national priorities into local action. A forward-looking, enabling policy environment will ensure that Community Radio continues to serve as the people's voice for development across rural India.

## Policy Briefs

# Strengthening Agricultural Growth and Resilience in Karnataka

### Key Strategies for Inclusive, Sustainable and Climate-Smart Agriculture

Karnataka's agriculture is the backbone of its rural economy, supporting millions of farmers and providing food, nutrition and livelihoods. These policy briefs bring together key evidence based strategies and actionable recommendations to strengthen agricultural growth, enhance resilience to climate change and ensure inclusive and sustainable development across the state.

Drawing from field experiences, research insights and stakeholder consultations, these briefs highlight priority areas for intervention - from productivity enhancement and resource management to market access, value addition and climate-smart practices - for a prosperous and resilient agricultural future in Karnataka.



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