

Sampoorna Revolution: Transforming Rice Cultivation Through Micronutrient Spray Technology (KVK, Malappuram)

Background/Existing Problem:

Paddy cultivation in Malappuram district faces several soil-related challenges due to the region's climatic and geographical conditions. The combination of high rainfall, varying soil types, and intensive farming practices, leached away the nutrients, especially, N, P and Mg. Low soil organic matter, acidity and salt water intrusion at low lying areas in turn declined the availability of secondary and micronutrients. Loss of topsoil due to erosion elevated the situation and resulting in a higher proportion of chaffy grains. The productivity of paddy in Malappuram district during 2012-13 was 2.5 t/ha only (DES 2015). Farmers struggled with declining productivity, economic losses, and a persistent lack of effective solutions to address this long-standing issue.

Intervention of the KVK to address the problem

Recognizing the severity of the problem, Kerala Agricultural University took the lead in research and development, to introduce a groundbreaking solution – the Micronutrient Spray Technology named "Sampoorna." in 2017. This technology aimed to rectify micronutrient deficiencies in rice crops, ensuring healthier plants and higher yields.

KVK intervened to address this problem of micronutrient deficiency with the support of this technology through various ways like

Front Line Demonstrations (FLD): In the years 2017 and 2018, KVK conducted Front Line Demonstrations on Sampoorna in rice fields. These demonstrations showcased the application process and the visible positive effects on crop health and yield, allowing farmers to witness the benefits firsthand.

Training Programs: KVK organized comprehensive training programs and workshops for farmers to educate them on the benefits of Sampoorna and proper application techniques. These sessions equipped farmers with the knowledge and skills necessary for effective implementation.

Input Provided Including KVK Advisories/Services:

1. **Advisories:** Regular advisories were disseminated by KVK, providing farmers with guidelines on the optimal usage of Sampoorna based on crop stages and local conditions.
2. **Multi Nutrient Mix Production Unit:** KVK took a proactive step by establishing the KVK Multi Nutrient Mix Production Unit, where the technology for producing Sampoorna was transferred from the research station. Since its inception, the production unit has played a crucial role in ensuring the availability and accessibility of Sampoorna to farmers in the region.

3. Sampoorna Production and Supply Data:

KVK has produced and supplied a total of 15 tonnes of Sampoorna from 2017 to till date.

Table 1. The details of Sampoorna distribution for the last five years

Year	Sampoorna Paddy sale in kg	Area of adoption of Sampoorna in Acres
2019-20	2339	468
2020-21	733	147
2021-22	478	95
2022-23	1953	390
2023-24	3950	789
Total	9453	1889

Output in Terms of Targets, Productivity, etc.:

1. **Adoption Rates:** Over the three years since the introduction of Sampoorna (2018-2021), there was a significant increase in the adoption rates, with a growing number of farmers incorporating the micronutrient spray into their cultivation practices. The total area of adoption of this technology during 2017 to 2024 is nearly 2100 Acres.
2. **Yield Improvement:** Farmers who adopted Sampoorna reported a substantial improvement in rice yield. The technology helped reduce the prevalence of chaffy grains, leading to better-quality produce. The additional yield of 4.2 q/ha was reported in sampoorna applied paddy than over the check. The productivity of paddy increased to 4 t/ha after adoption.
3. **Cost-Efficiency:** The micronutrient spray proved to be a cost-effective solution, as farmers observed a reduction in the need for additional fertilizers and pesticides and an additional net return of Rs. 9500 was obtained on adoption of this technology and BC ratio increased to 2.44 over the check of 2.31

Outcome and Impact of the Intervention:

1. **Yield Increase:** Overall rice productivity in the region witnessed a remarkable increase, surpassing the levels seen in pre-2017 periods.
2. **Qualitative benefits:** The intervention resulted in a significant enhancement of rice quality, with a reduction in chaffy grains and an increase in marketable produce.
3. **Economic Impact:** Farmers experienced higher incomes due to improved yields and better-quality rice, contributing to the economic prosperity of the region.



Summary: The sampoorana revolution marked a major breakthrough in rice cultivation in Kerala by addressing severe micronutrient deficiencies that previously led to low yields and poor grain quality. Implementation of Micronutrient Spray Technology by KVK, developed by Kerala Agricultural University, since 2017, helped to improve crop productivity and farmer income.

Enhancing Paddy Cultivation through UAV-Based Spraying of KAU Sampoorna Multimix in Thiruvananthapuram District

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Introduction

The paddy cultivation area in Thiruvananthapuram district is about 2,750 ha, with an average productivity of around 2,300 kg/ha (Directorate of Economics & Statistics, 2023). According to the District Economics and Statistics Department handbook, paddy production in the capital district recorded a 47% increase in 2023, despite a 7% decline in the area under cultivation compared to the previous year. The total production during 2022–23 was 6,530.81 tonnes, with productivity showing a remarkable 57% rise. The major paddy-growing regions in the district include Vamanapuram, Varkala, Attingal, Parassala, Kadinamkulam, Mangalapuram, Kadakavoor, and Anchuthengu.

At the same time, paddy farmers face serious operational challenges, especially in spraying and crop management. Traditional sprayers are slow, labour-intensive, and inefficient. This is where Unmanned Aerial Vehicles (UAVs), commonly known as drones, are emerging as game changers in precision farming.

Globally, drones are being increasingly used for aerial spraying of nutrients, pesticides, and biocontrol agents, as well as for crop scouting, moisture analysis, disease detection, irrigation planning, and yield estimation. Unlike conventional knapsack sprayers, drones are efficient and provide fast, uniform, and site-specific application, minimizing wastage of inputs and reducing the risk of human exposure to agrochemicals. Their ability to operate over difficult terrains, waterlogged fields, and fragmented holdings makes them particularly suited for paddy cultivation in Kerala.

Identified Problems

Paddy cultivation in Thiruvananthapuram is constrained by high input costs and operational inefficiencies, with labour requirements emerging as the single most critical challenge. Traditional crop management practices, particularly spraying operations, add further strain due to their low efficiency and heavy dependence on manual effort. These issues collectively affect profitability and highlight the need for precision-based technological interventions.

High Cost of Cultivation Driven by Labour Expenses

The cost of cultivating paddy in Kerala is considerably higher than other crops, with operational expenses exceeding ₹1 lakh per hectare (GoK, 2023). Labour constitutes nearly 58% of this expenditure, especially in transplanting, weeding, and spraying operations. Estimates suggest that labour charges alone range between ₹35,000–₹40,000 per hectare, making it the single largest cost component (Nair et al., 2021; Directorate of Economics & Statistics, 2023). This heavy dependence not only inflates production costs but also undermines the economic viability of paddy farming when compared to less labour-intensive alternatives.



Limitations of Conventional Sprayers

Knapsack sprayers, still widely used by farmers, pose multiple drawbacks. Inadequate nozzle design and wear often leading to non-uniform coverage and high drift losses, while the lack of calibration results in frequent under- or over-dosing. Manual pumping results in unstable pressure and inconsistent spray quality, further reducing effectiveness. Added to this are recurring problems such as leakage, clogging, and frequent repairs, all of which reduce field efficiency and make spraying operations both time-consuming and costly.

KVK Interventions: UAV Spraying Demonstrations

To address these limitations, KVK Thiruvananthapuram initiated drone-based nutrient spraying in paddy cultivation as part of the Front-Line Demonstrations (FLDs) from 2020 onwards. Two types of drones were deployed:

- Quadcopter drones – highly agile and suited for small to medium fields.
- Hexacopter drones – with higher payload capacity, longer flight stability, and suitability for larger field areas.

The demonstrations focused on spraying KAU Sampoorana Multimix @ 1 kg/acre, applied during the critical growth stage of 40–55 days after transplanting. Drones ensured uniform

droplet deposition, minimized wastage, and drastically reduced spraying time compared to manual knapsack sprayers.

Field observations showed that drone spraying resulted in improved efficiency up to five times compared to traditional methods, with savings of 30–40% in water and nutrient usage (MDPI, 2024; Springer Open, 2024). Farmers also reported better crop vigour and uniformity.

In Thiruvananthapuram district, demonstrations were carried out across the villages of Kizhuvillom, Varkala, Pulimath, Nagaroor, Chenkal, Kulathoor, and Chemmaruthy, covering a total of 100 hectares of paddy and directly benefiting 60 farmers. These interventions proved that UAV-based spraying reduces labour dependency, lowers costs, and enhances precision nutrient management, making paddy cultivation more sustainable and economically viable.

Table 1: Drone Specification used for demonstration

Item	Quadcopter	Hexacopter
Drone Size	1165 × 1175 × 490 mm	1400 × 1400 × 520 mm
Total Weight	20.5 kg	28 kg
Maximum Power	2400 W/rotor	3600 W/rotor
Battery Capacity	16,000 mAh	20,000 mAh
Battery Voltage	44.4 V	48 V
Take-off Weight	10 L	10 L
Number of Nozzles	4	6
Type of Nozzles	Single/Dual Pressure Nozzle	Single/Dual Pressure Nozzle
Spraying Volume	3.5 L/min	4.0 L/min
Spraying Width	4–6 m	5–8 m

Findings of the study

Field data were collected and discussed with farmers during the field day, where the application of micronutrients using drones received wide appreciation. Farmers highlighted that drone spraying substantially reduced labour costs, minimized effort, and enabled completion of spraying within a much shorter time compared to conventional methods.

Table 2: Comparative technical and economic parameters of drone spraying versus local knapsack sprayer use.

Parameter with unit	UAV	KMS
Field capacity (ha/h)	3.0	0.20
Field efficiency (%)	99.90	57.15
Labour requirement (man days /ha)	2	18
Cost of operation (Rs/ha)	3000	18000
Fertilizer savings compared to conventional method (%)	50	-
Yield (q/ha)	65.52	41.76
Gross Cost (Rs.)	122937.5	115800
Gross Return (Rs.)	185552.6	117763.20
Net return (Rs.)	62615.1	1963.20
BCR	1.51	1.01

The results clearly showed that the working capacity of UAV spraying was approximately 15 times higher than knapsack spraying. Yield under drone application increased by 56.96% over the conventional method. Farmers also benefited from significant labour reduction (2 man-days/ha vs. 18 man-days/ha) and lower operational costs.

Spray rates for UAV systems are generally 1–2 L/ha, which is 25–50 times lower than conventional spraying systems. Multi-rotor UAVs offer several advantages in paddy fields: compact size, high manoeuvrability, suitability for fragmented landholdings, and ability to operate without dedicated take-off sites. Their frequent take-off and landing ability, even under high temperature and humidity conditions, further enhances field applicability.

Larger Adoption Details

Building on the success of field demonstrations, large-scale adoption efforts were initiated to popularize drone-based spraying in paddy. Demonstrations were conducted using both Nano-urea and KAU Sampoorna multimix, showcasing their efficiency when applied through UAVs.

Farmers were further encouraged to adopt drones through the Sub-Mission on Agricultural Mechanization (SMAM), which provides 50% subsidy support for individual farmers and up to 75% for Farmer Producer Organizations (FPOs). Such initiatives not only reduce the financial burden but also strengthen the prospects of integrating drones into mainstream crop management practices, ensuring wider dissemination and long-term impact.

The wide acceptance of use of drones is evident from the field area covered by Agricultural Engineering Department in chart below where in 186ha area was covered in 2024 and it is 65ha in 2025 and still continuing.

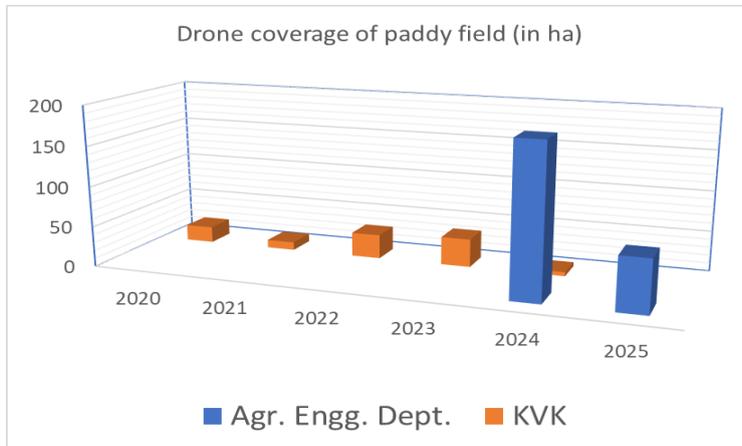


Figure 1: Paddy field area (in ha) covered by drone for spraying

Field Activities of Drone Demonstration



Inauguration of Aerial Spraying using Drone by Hon'ble MP Shri. Adoor Prakash at Pulimath Panchayat



Aerial Spraying of KAU Sampoorna using Drone at Kizhuvillom Padashekham



Inauguration of Aerial Spraying using Drone by Shri.V.Sasi Hon'ble Deputy Speaker, Kerala Legislative Assembly



Field Day Celebration at Chirayinkeezhu



Drone Aerial Spraying



Setting up of Drone before flight

Impact of Agricultural Drone Spraying

The use of drones for spraying the micronutrient solution KAU Sampoorana Multimix proved highly effective and efficient in paddy cultivation. Drones, being the latest and most farmer-friendly machinery, significantly reduce manual labour by eliminating the need to walk through puddled fields with conventional sprayers. The ULV (Ultra-Low Volume) spray mechanism ensures precise application with much lower solution requirements.

Key outcomes from the drone-based interventions include:

- **Field efficiency:** 99%, substantially higher than conventional methods.
- **Field coverage:** Rapid application over large areas, completing tasks in a fraction of the time.
- **Fertilizer savings:** Around 50% compared to traditional spraying.
- **Labour reduction:** Drastically fewer man-days required for spraying operations.
- **Yield improvement:** Approximately 57% increase in paddy yield compared to conventional methods.
- **Cost efficiency:** Significant reduction in operational expenses.

Overall, drones demonstrated clear advantages in precision nutrient management, labour savings, and yield enhancement, establishing them as a practical and sustainable technology for modern paddy farming in Kerala.

Impact for large scale adoption of technologies Sampoorna, nutrient mixture for correcting nutrient deficiency in paddy (KVK, Palakkad)

Introduction

Palakkad district, celebrated as the “**Rice Bowl of Kerala**”, stands as the leading centre of paddy cultivation in the state. The district has a vast expanse of fertile plains and assured irrigation sources, which together make it ideally suited for large-scale rice farming. As per the latest statistics, Palakkad records a **total area of 76,503.68 hectares under paddy cultivation**, with a **production of 1,89,229 metric tonnes** and an average **productivity of 2389 kg per hectare**. District contributes to 37% of rice production of the state. These figures not only underscore the dominance of Palakkad in Kerala’s rice sector but also reflect the district’s central role in ensuring food security for the state. Paddy cultivation here is spread across the major cropping seasons: **Virippu (Autumn), Mundakan (Winter), and Puncha (Summer)** which together sustain round-the-year production and contribute to the livelihoods of thousands of farming families.

Despite this favourable scenario, a persistent challenge affecting paddy cultivation in Palakkad is **soil acidity**. Large stretches of wetlands in the district are moderately to strongly acidic, with soil pH values often falling below the optimum level. This condition hampers the availability of vital micronutrients such as zinc, boron and copper. The resulting deficiencies are manifested in poor tillering, stunted growth, reduced panicle initiation, and incomplete grain filling, all of which can drag down yield potential. Left unaddressed, soil acidity continues to be a silent barrier that limits the efficiency of fertilizer use and sustainable productivity.

Major Problem Identified

Paddy cultivation in Palakkad faces several critical constraints that directly affect crop health and yield potential. The foremost challenge is the **prevalence of soil acidity** across large tracts of wetlands, which reduces the availability of essential nutrients required for optimal plant growth. Nutrient deficiency symptoms were manifested in many fields. The paddy fields of Kerala are acidic in nature except in certain pockets. Many times, farmers do not apply correct quantity of lime for correcting acidity. This leads to increased iron toxicity which in turn leads to reduced availability of other micronutrients such as zinc. Bronzing of leaf tips are commonly noticed in these fields indicating deficiency of zinc. Analysis of soil samples collected from various locations of the district revealed severe deficiencies of secondary and micronutrients, especially magnesium, zinc, boron and copper. Deficiencies of zinc, boron, and copper are commonly observed, leading to poor tillering, reduced panicle initiation, spikelet sterility, and incomplete grain filling. These hidden deficiencies often go unnoticed until significant yield loss occurs, making them a silent but serious problem for farmers. Alongside this, continuous rice–rice cropping systems without adequate soil amendments have worsened nutrient imbalances, while heavy dependence on chemical fertilizers has further depleted soil health.

Solution developed

To counter these problems, Kerala Agricultural University developed and introduced the **nutrient mixture “Sampoorna”**, specifically formulated for rice. The product is mainly a mixture of micronutrients, zinc, boron and copper with traces of iron, manganese and molybdenum. Secondary nutrient magnesium and major nutrients, nitrogen and potassium are also added as a filler. This balanced blend of essential nutrients provides a comprehensive solution to correct multiple deficiencies at once. When applied as a foliar spray at critical growth stages, Sampoorna enhances nutrient uptake, strengthens crop vigour and improves flowering and grain set. Farmers who adopted Sampoorna consistently reported **healthier crops with stronger tillers, better panicle formation, and higher yields**. In addition, the ease of application and relatively low cost made it a farmer-friendly technology suitable for widespread adoption.

The **Krishi Vigyan Kendra (KVK), Palakkad** played a pivotal role in bringing this solution to farmers through systematic **Front Line Demonstrations (FLDs)**. These demonstrations were conducted in representative villages and directly compared conventional nutrient management practices with those integrating Sampoorna application. Such evidence built farmer confidence and generated word-of-mouth publicity across the district.

Interventions of KVKs to address the problem

Recognizing that hidden micronutrient deficiencies were constraining paddy yields in Palakkad, **KVK Palakkad** initiated targeted interventions to restore soil fertility and improve productivity. Soil analysis from various parts of the district revealed significant deficiencies, especially of magnesium and boron, which were major reasons for the non-realization of potential yields. To address this, KVK introduced the micronutrient mixture developed by Kerala Agricultural University through systematic demonstrations. In **2015–16**, Front Line Demonstrations (FLDs) were initiated in major paddy-growing areas, applying the mixture in nurseries and main fields at critical crop stages. Sampoorna is applied as foliar spray @ 10g/l in nursery at 2 days before transplanting and in main field at 30 days and 45 days after transplanting. These demonstrations created visible impact in terms of no. of tillers and grain filling contributing to yield.

In **2020**, KVK strengthened its efforts through a large-scale FLD on **Integrated Nutrient Management (INM)** in paddy, where micronutrient correction was incorporated into the package of practices. Conducted in Kollengode block, with seven demonstrations over an area of two hectares, the intervention resulted in a remarkable **43% increase in productivity** compared to farmers’ traditional practices. Farmers’ feedback highlighted healthier crops and more tillers, validating the effectiveness of integrated nutrient management for paddy.

Building on these successes, in **2021**, KVK Palakkad scaled up the technology further by conducting an innovative FLD covering **25 hectares**, where **aerial spraying using drones** was introduced for the first time in the district. Drone-based application not only reduced labour requirements but also made micronutrient spraying faster and more uniform, generating significant farmer interest. The demonstrations were continued in 2022-23 in other locations covering an additional 20 ha. Parallel to these demonstrations, KVK organized extensive **awareness campaigns, training programmes, farmer field schools, drone demonstrations, MTAs, and farmer–scientist interactions**. These extension activities helped to popularize the technology, enhance farmer confidence, and accelerate large-scale adoption across the district.



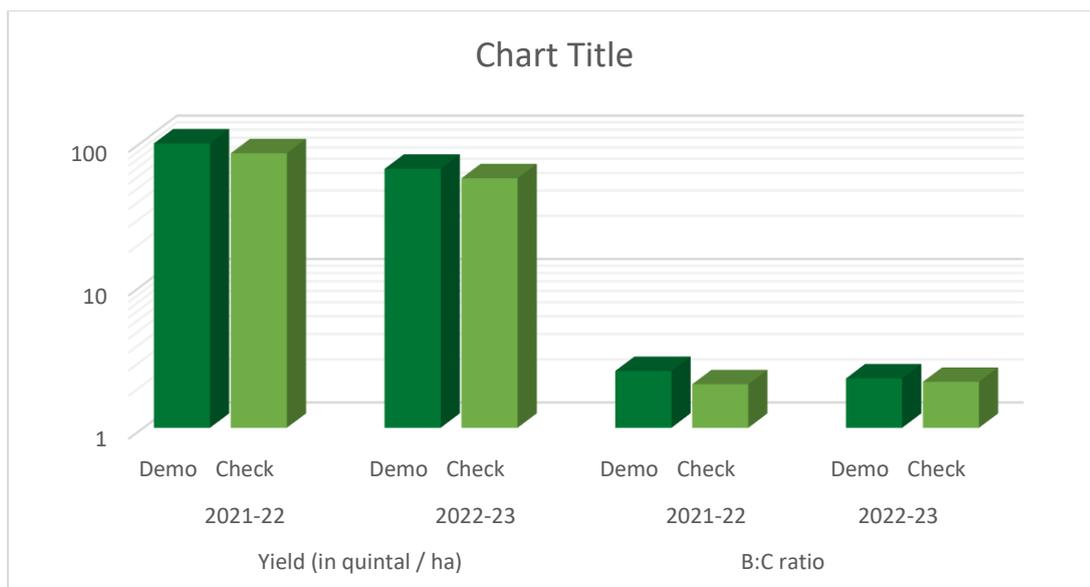
Demonstration of Sampoorna multinutrient application in paddy using UAV at Kollengode, Palakkad in 2021-22



Demonstration of Sampoorna multinutrient application in paddy using UAV at Nagalasseri, Palakkad in 2022-23

Feedback of technology

Application of Sampoorna multi-nutrient mixture in paddy fields of Palakkad district has consistently shown positive results across different interventions conducted by KVK. In the frontline demonstration during 2015-16, plots treated with Sampoorna recorded a yield of 4.3 t/ha (43 q/ha) compared to 3.2 t/ha (32 q/ha) in untreated fields, with higher tiller numbers and an improved benefit-cost ratio of 2.3 against 2.1. Large-scale demonstrations using drones further proved its effectiveness. In 2021-22, drone-applied Sampoorna resulted in a yield of 96 q/ha, surpassing the control yield of 82 q/ha, with a net return of ₹1,91,800 per hectare and a higher B:C ratio (2.49 vs 2.01). Similarly, in 2022-23, the yield advantage continued with 63.9 q/ha in treated fields against 54.9 q/ha in control plots, recording a net return of ₹99,615 per hectare. The multi-nutrient mixture, Sampoorna helped in overcoming nutrient deficiencies resulted from the reduced nutrient availability and intake in acidic soils. In 2022, when applied along with lime in iron toxicity-affected acidic soils, raised yields to 80 q/ha against 67.5 q/ha in untreated fields, registering an 18.5% increase. These results highlight that the use of Sampoorna not only corrects micronutrient deficiencies but also enhances crop productivity, profitability, and soil health, thereby facilitating its wide adoption among farmers in Palakkad.



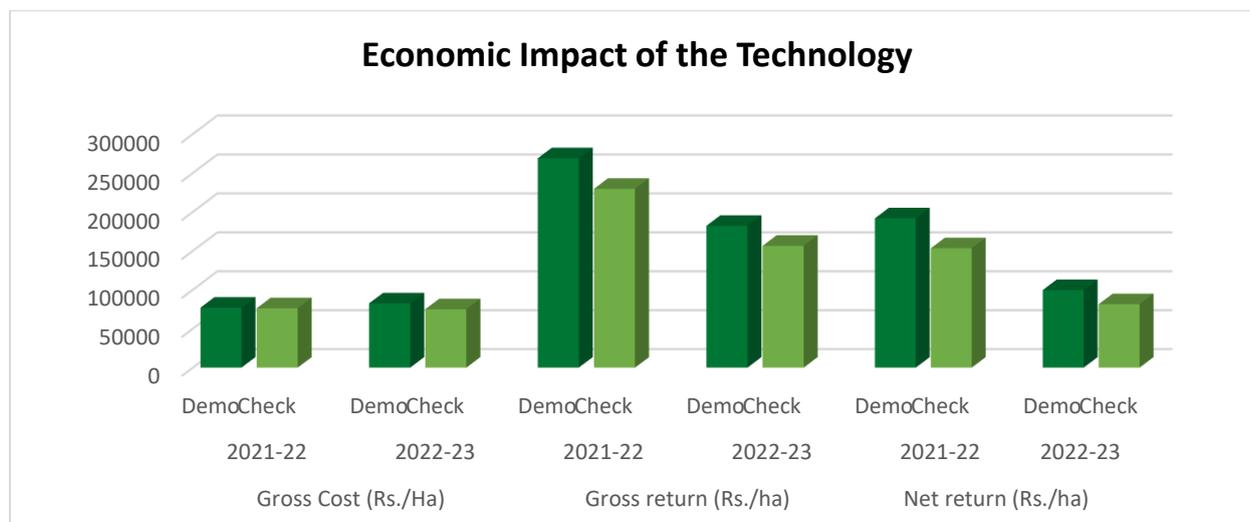
Spread of Technology

Beyond demonstrations, KVK Palakkad organized **field days, farmer-scientist interactions, and training sessions** to promote scientific awareness on soil health and balanced nutrient management. Farmers who initially experimented with Sampoorna shared their experiences with their peers, accelerating the process of community-level adoption. Under the project “Drone Technology Demonstration” application of micronutrient application using UAV was demonstrated in 138 ha during 2023-24. The drastic increase in yield made the technology very popular among farmers. Over successive seasons, the use of Sampoorna has now evolved from being a trial input to becoming a **widely accepted and integrated practice** in Palakkad’s paddy fields.



Large scale demonstration of micronutrient application using UAV under the project drone technology demonstration

Economic Impact of Technology



The economic analysis of demonstrations conducted in 2021–22 and 2022–23 clearly establishes the profitability of applying Sampoorna multi-nutrient mixture in paddy. In 2021–22, treated plots recorded a yield of 96 q/ha compared to 82 q/ha in the control, which translated into a gross return of ₹2,68,800/ha against ₹2,29,600/ha in control plots. After deducting the cost of cultivation, the net return stood at ₹1,91,800/ha in Sampoorna-applied fields compared to ₹1,53,350/ha in untreated fields, with the benefit–cost ratio improving significantly from 2.01 to 2.49. Similarly, in 2022–23, Sampoorna-applied fields yielded 63.9 q/ha against 54.9 q/ha in the control, giving a gross return of ₹1,82,115/ha compared to ₹1,56,465/ha. The net return in treated plots was ₹99,615/ha, higher than the ₹81,465/ha obtained in control fields, with the benefit–cost ratio improving from 2.09 to 2.21. These results clearly demonstrate that the intervention not only increases yield but also ensures higher profitability, making it a cost-effective and sustainable practice for large-scale adoption in paddy cultivation.

Other Beneficial Effects of micronutrient application in Paddy

- **Integral to INM** – Supplies critical micronutrients (boron, zinc, copper) along with magnesium, nitrogen and potassium ensuring balanced nutrition and improved physiological efficiency.
- **Healthier plants** – Greener foliage and robust growth indicate better photosynthetic activity and nutrient uptake.
- **Stress resilience** – Balanced micronutrient supply improves tolerance to drought spells, pests, and diseases.
- **Reduced deficiency symptoms** – Minimizes chlorosis, bronzing, and other nutrient-related disorders, ensuring a uniform crop stand.
- **Economic benefits** – Despite modest extra costs, farmers obtain higher net returns and improved B:C ratios due to better yields and quality produce.
- **Drone-based application** – Ensures uniform spraying, reduces labor dependency, saves time, and enables coverage of large areas efficiently.
- **Sustainability** – Contributes to crop health, and profitability, making it a farmer-friendly technology for paddy cultivation. As it is given as foliar application, there is no risk of accumulation of micronutrients in toxic level in soil.

Horizontal Spread of the Technology

The horizontal spread of the Sampoorna technology in paddy has been achieved primarily through the dedicated efforts of KVK, Palakkad. A total of 44 training programmes were conducted during the period 2020 to 2024 on importance of integrated nutrient management in paddy, directly benefitting 1980 farmers, while regular feedback and field-level interactions helped to refine practices and build farmer confidence. Demonstrations on drone-based spraying attracted wide attention, as they showcased how sampoorna could be applied efficiently, economically, and uniformly over large areas, thereby addressing the challenge of labor shortages. Farmer Field Schools and farmer–scientist interactions further supported peer-to-peer learning and encouraged rapid adoption among farming communities. Beyond KVK’s direct interventions, the Department of Agriculture has also collaborated in spreading the technology by incorporating it into various extension programmes, ensuring that the benefits reach farmers across wider regions. Together, these efforts have transformed Sampoorna from a demonstration-level intervention into a widely practiced and sustainable technology for micronutrient management in paddy cultivation.



Wide adoption of micronutrient application using UAV

Extent of Area Coverage

Realizing the importance of INM in achieving good yield, farmers of Palakkad district started adopting INM practices in field and micronutrient mixture, Sampoorna played a major part in correcting nutrient imbalance. The noticeable effects of Sampoorna application, particularly increase in yield contributed to the increased adoption of technology. Systematic efforts of KVK Palakkad to popularize the technology resulted in increased awareness among farmers. Production of this nutrient mixture in production units of the University indicate that the technology has spread to more than 10,000 ha.

Summary

The adoption of *Sampoorna multi-nutrient mixture* in paddy has led to a clear improvement in crop yield, grain quality, and overall profitability for farmers in Palakkad district. By addressing critical micronutrient deficiencies, the technology has enhanced tillering, panicle development, and stress tolerance, resulting in consistently higher productivity compared to untreated fields. KVK, Palakkad played a pivotal role in this success by conducting frontline demonstrations, validating the technology under local conditions, and introducing innovative methods such as drone-based spraying that made application more efficient and attractive to farmers. Through continuous farmer–scientist interactions and field-level backstopping, KVK created awareness, built confidence, and encouraged replication of the practice across different blocks. These efforts ensured that Sampoorna moved beyond small demonstration plots to achieve large-scale adoption, eventually being integrated into wider extension efforts. The technology today stands as a sustainable and widely accepted solution for micronutrient management in paddy, with KVK’s initiatives serving as the foundation for its successful scaling up.

Ayar Nutrient Mixture towards the Management of Secondary and Micro Nutrient Deficiencies in Banana

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Introduction

Banana is one of the major crops grown in Thiruvananthapuram district. It is a traditional crop of Kerala, which remains connected to the social and cultural heritage of the state in general, and Thiruvananthapuram district in particular. Not even a single day passes without banana or banana products being used in the daily life of an average Keralite—be it as a fresh fruit, a side dish for a regular meal, a teatime snack, or as part of the traditional Kerala feast during festive seasons and special occasions. It also holds an important place in religious rituals and rites. Banana is cultivated in about 3,507 hectares, with a total production estimated at 32,031 tonnes.

Banana cultivation is a key livelihood activity for small and marginal farmers in Thiruvananthapuram district. There is a good market demand for both fresh and processed banana products. Bananas from the district are sold not only within Kerala but also exported to neighbouring states. There is particularly high demand for Nendran bananas, both in ripe and processed forms which are a staple in Kerala's culinary culture. Banana is recognized as the ODOP crop for Thiruvananthapuram district. It aligns with the agro-climatic suitability, strong market linkages, and economic dependence of farm families on this crop.

Problem Identified



Thiruvananthapuram district mostly has strongly acidic soils. Soil acidity adversely affects nutrient availability, microbial activity, and overall soil health. Soil acidity often leads to reduced uptake of essential nutrients such as Phosphorus, Calcium, Magnesium, Boron and Zinc, which are critical for the proper growth and good yield of the crop. Soil acidity, combined

with the deficiency of secondary and micronutrients, is found to be a limiting factor for the production and productivity of banana in the district.

Calcium deficiency symptoms are very prevalent in the banana plantations of the district which is found to affect the young, actively growing tissues. New leaves are slow to emerge and often fail to unfold properly. Emerging leaves may be deformed, twisted, or stuck together resulting in a condition commonly called leaf choking. Leaves also become more brittle than normal. Zinc deficiency manifests as small, narrow, and upright leaves, giving a spiky appearance with a rosette or bushy look at the top. Plants become dwarfed with poor canopy development. These and other such conditions result in reduced yield and lower profitability in crop production.

Interventions of KVK

ICAR-KVK Mitraniketan has been able to address the issue effectively through Front Line Demonstrations on Ayar nutrient mixture. Ayar is a secondary and micronutrient mixture for banana, developed by Kerala Agricultural University. It contains nutrients such as Calcium, Magnesium, Sulphur, Boron, and Zinc. This is being recommended @ 200g/ plant in two equal split doses at 2nd and 4th months after planting. KVK adopted this technology to manage secondary and micronutrient deficiencies in banana, which is very much prevalent in the soils of Thiruvananthapuram district. Considering the importance of this technology, Ayar was included as a component in the FLDs on Integrated Crop Management (ICM) in banana, management of soil acidity in banana cultivation, and Integrated Nutrient Management (INM) in banana during the last few years.



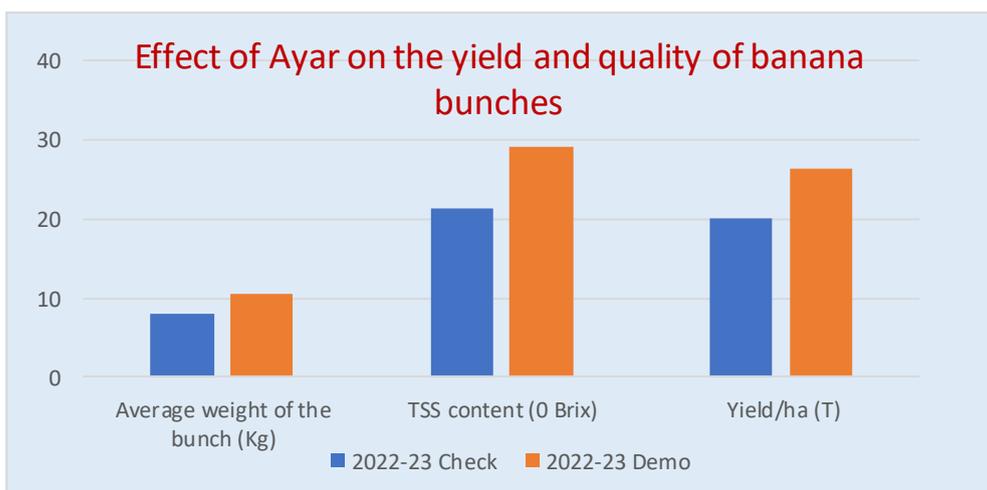
In addition to FLDs, KVK also conducted several training programmes and method demonstrations for farmers and extension officials of State Dept. of Agriculture, District and Block level Technology Managers of ATMA, Vegetable and Fruit Promotion Council of Kerala etc., who took up the lateral spread of the technology. Multi-disciplinary diagnostic

team visits were conducted and recommendations provided. Literatures and popular articles were published, radio talks were delivered, advisory services were provided so as to maximise the dissemination of technology. Ayar is made available to farmers through the KVK outlet, the sales counter of the College of Agriculture (KAU) and VFPCCK outlets across the district. VFPCCK obtained the production technology of Ayar from KAU and has started producing it on its own.

Feedback of the Technology



Ayar is found to be very effective in managing secondary and micronutrient deficiencies in banana. It is to be applied as a key component of the integrated nutrient management practice for banana. The application of lime to correct soil acidity has been found to enhance the efficacy of Ayar and can be considered as a pre requisite for the management of secondary and micro nutrient deficiency. Field evaluations indicate that Ayar application leads to a significant increase in average bunch weight, as well as an improvement in the total soluble solids (TSS) content of ripe banana fruits, thereby contributing to both yield and quality enhancement.



Data Recorded from the FLD Plots

Parameters	2022-23		2023-24	
	Check	Demo	Check	Demo
Average weight of the bunch	8.0 kg	10.5 kg	8.2 kg	9.8 kg
TSS content (° Brix)	21.2	29.0	21.0	28.5
Yield/ha (q)	200	262.5	205	245
Gross return (Rs)	10.00 L	13.13 L	8.20 L	9.80 L
Net return (Rs)	4.5 L	5.10 L	4.20 L	5.80 L
BCR	2.22	2.57	2.05	2.45

Lateral Spread of the Technology

Lateral spread of the technology is achieved through linkages with the State Department of Agriculture, ATMA, and the Vegetable and Fruit Promotion Council of Kerala (VFPCCK). The State Department of Agriculture, through its various schemes such as Farm Plan-based Programmes, Sanjeevini, SCSP, and TSP, promoted the use of Ayar in banana cultivation.



Ayar application in banana was taken up as a technology for ATMA FLDs in various blocks of Thiruvananthapuram. VFPCCK obtained the technology from KAU and started its own production. Ayar is made available to farmers through the KAU sales counter, 20 farmer-led outlets of VFPCCK in the district, and its Krishi Business Kendra. The spread of the technology is such that even private fertilizer dealers, FPOs, and FPCs are now selling it through their outlets.

Year	Quantity (T)	Area (Ha)	No. of farmers
2020-21	2.5	5.0	50
2021-22	8.0	16.0	160
2022-23	12.0	24.0	240
2023-24	15.0	30.0	300
2024-25	15.0	30.0	300

Economic Impact of the Technology

Ayar application is found to increase the yield by about 54 q/ha, and the average increase in net income is estimated to be about Rs. 0.70 lakhs/ha. Considering the spread of the technology in the district, Ayar application is found to have increased banana production in the district by

about 567 tons over a period of 5 years, and the increase in net income due to the technology adoption in the district is estimated to be Rs. 73.5 lakhs.

IMPACT OF ‘ARKA BANANA SPECIAL’ MICRONUTRIENT ON YIELD AND ITS ADOPTION AMONG BANANA FARMERS

Dr. C.P Robert, Dr. Rincy K Abraham and Dr. Sindhur Sadanandan, ICAR-Krishi Vigyan Kendra, CARD, Pathanamthitta

Introduction

Banana is an important fruit crop, has a great socio-economic significance in Kerala. The crop has also attained wide acceptability among farmers and consumers. Balanced nutrition is very important for high yield, quality and resistance to diseases. Banana is a high nutrient requiring crop. It requires a continuous supply of nutrients at proper growth stages for enhanced yield and productivity. Managing agricultural nutrients to provide a safe food supply



and secure the environment remains one of the immense challenges of the 21st century. The unscientific crop management practices being adopted by farmers led to poor utilization of nutrients and thereby resulted in low productivity. Due to low organic matter in the soil, introduction of high yielding cultivators and fast growing tissue culture plants, deficiency of micronutrients has become a major problem in banana cultivation. Continuous uptake of nutrients from the soil due to intensive cultivation and

unscientific methods fertilizer application had resulted in reduced nutrient use efficiency and soil degradation. Crop nutrient uptake and crop yields are the principal factors that determine optimal fertilization practices. Therefore, it is very important to apply fertilizers in an efficient way to minimize loss and to improve the nutrient use efficiency (Li et al., 2009). Micronutrients are often referred to as minor elements and their deficiency or toxicity can reduce plant yield similar to macronutrient deficiency or toxicity. The

intensive cropping, imbalanced fertilizer usage and minimum use of micronutrients and limited application of organic manures resulted in depletion of soil fertility. Balanced fertilizer is very much essential for better production and productivity of crops. For any particular crop micronutrient supply is as important as application of required amount of major and secondary nutrient. Keeping this in view, the present study was initiated to find out the impact of micronutrient application in banana crop in Pathanamthitta district as well as its spread among banana farmers.

Pathanamthitta district has around 4591 ha area under Banana crop. With this perspective a study on the application of Arka Banana Special (developed from Indian Institute of horticultural research, Bengaluru) on Banana crop was conducted in Pathanamthitta area of Kerala. These estimates will be helpful for improving fertilizer recommendations and for achieving sustainable production in Banana crop in the district. The main aim of the study was to

know the impact of application of Arka Banana Special as foliar application in critical phases of plant growth and its wide adoption level among farmers.

Problem Statement

- ✚ Banana is one of the most important fruit crops in the district, supporting farm income and rural livelihoods.
- ✚ Productivity is often limited due to imbalanced nutrition, especially micronutrient deficiencies.
- ✚ Farmers mainly apply NPK fertilizers, while secondary and micronutrients are neglected. This results in reduced bunch size, poor fruit quality, and lower economic returns.
- ✚ The level of awareness, adoption and spread of Arka Banana Special among banana farmers in the district also needs systematic assessment.

Understanding these aspects is necessary to design extension strategies, scale up its usage, and ensure sustainable banana cultivation.

Objectives

General Objective

- To assess the impact and adoption of *Arka Banana Special* on the yield and productivity of banana crop in the district.

Specific Objectives

- To evaluate the effect of Arka Banana Special application on banana yield and fruit quality.
- To study the level of awareness, acceptance and adoption of Arka Banana Special among banana farmers.
- To analyze the factors influencing farmers' decision to adopt Arka Banana Special.
- To document the spread and success of Arka Banana Special as a micronutrient intervention in the district.
- To suggest strategies for scaling up the use of Arka Banana Special for sustainable banana production.

Methodology

More than 80% of the banana cultivated in the district exhibit deficiency disorders due to various micronutrient deficiencies. Heavy dependence on chemical fertilizers and reduction in the use of organic manures in cultivation, intensive cultivation, root inactivity due to poor soil aeration, soil compaction, drought, root diseases, etc. are some of the reasons for micronutrient deficiency in plants. Micro nutrient deficiency results in lowering production to the tune of 30- 50%. Plants can absorb nutrients directly through stomata and cuticle. Foliar feeding of micronutrients is always better than soil application because of the complex nature of soil. Hardly 3-5% of the soil applied



Zinc, manganese, Iron, copper and molybdenum are available to the plants. It takes 2-3 weeks for the root-absorbed nutrients to reach the leaves and ultimately the crop shows deficiency even after application of the correct dosage of micronutrients. 30-40% of the micronutrients given through foliar application is absorbed by the plants against 3-5% of the soil applied nutrients and the nutrients sprayed is available to the plants within 24-48 hrs.

against 2-3 weeks in case of soil application. IIHR Arka Banana Special is a micronutrient foliar formulation, which can supply secondary and micronutrients such as zinc, boron, iron, manganese, copper, molybdenum, manganese and sulphur. The application of IIHR Arka Banana Special had shown to improve yields by 20-40%. The crop was raised with application of recommended dose of major and secondary nutrients and

general cropping practices were followed with the guidance of KVK scientists in respect of package of practices. Spread and adoption levels were tracked by recording the number of farmers who subsequently adopted Arka Banana Special after observing results in demonstrations.

$$\text{Increased Yield \%} = \frac{\text{Demonstration Yield} - \text{Farmer's yield}}{\text{Farmer's yield}} \times 100$$

Output

Effect of micronutrient – Arka Banana Special on yield and yield attributing parameter are presented in Table 1.

- Number of hands /bunch (No.)
- Average Fruit weight (Kg)
- Yield (t/ha)

Table 1. Effect of micronutrient “Arka Banana Special” on yield and yield attributing parameter in Banana

Year	Farmer's practice			Demonstration			Increase (%)		
	Number of hands /bunch (No.)	Average Bunch weight (Kg)	Yield (t/ha)	Number of hands /bunch (No.)	Average Bunch weight (Kg)	Yield (t/ha)	Number of hands /bunch	Average Bunch weight	Yield
2021	4	8	12	4.5	9	13.5	12.5	12.5	12.5
2022	4.2	8.2	12.3	5	9.5	14.3	19.05	15.85	16.26
2023	4	8.5	12.7	5	9.8	14.7	25.0	15.3	15.7
Mean	4.1	8.2	12.3	4.8	9.4	14.2	18.8	14.5	14.8

Table 2 infers that there is an increase in income level by 50 % by using Arka Banana Special. Net returns of any crop are very much important to improve the socio economic status of the farmers. The main aim of the any demonstration conducted through Krishi Vigyan Kendra is to improve the overall production, productivity and the quality of the produce. In these demonstrations the Micronutrient spray technology demonstrated resulted in getting the higher returns to the Banana grower. With the increased

productivity per hectare area was observed which resulted in increased net returns in every crop taken into consideration under demonstration. Table 3 clearly shows that there is an increase of Rs. 52,500, 84,500 and 96,500 per hectare in the net returns over farmers practice during 2021, 2022 and 2023 respectively.

The more price to the produce was obtained basically from increased yield of the individual crop under demonstration which was supported by the improved quality of the produce. According to the farmer’s opinion spray of micronutrient helped in improvement of bunch weight of the crop and reduced diseased incidence.

Table 2. Economic benefit from micronutrient “Arka Banana Special” spray in Banana in Pathanamthitta district

Year	Farmer’s practice				Demonstration			
	Gross Cost (Rs.)	Gross Return (Rs.)	Net Return (Rs.)	B.C Ratio	Gross Cost (Rs.)	Gross Return (Rs.)	Net Return (Rs.)	B.C Ratio
2021	387000	480000	93000	1.24	394500	540000	145500	1.4
2022	411000	565800	154800	1.38	418500	657800	239300	1.6
2023	442500	660400	217900	1.49	450000	764400	314400	1.7
Mean	1240500	1706200	465700	1.38	1263000	1962200	699200	1.6

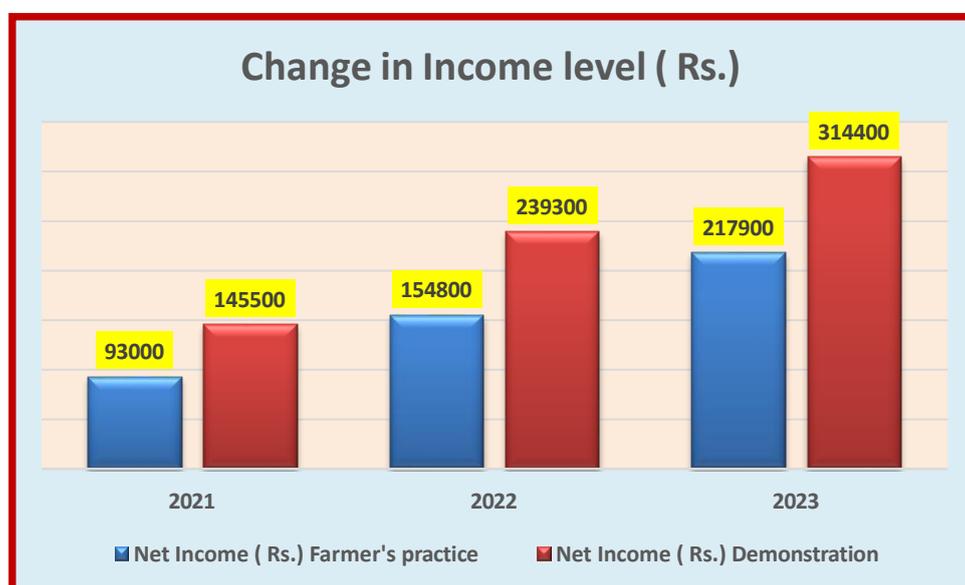


Fig 1. Change in income level of farmers

Spread of Technology

Table 3. Spread of the technology

Year	Sale of Arka Banana Special (Kg)	Area covered (ha)	Farmers adopted
2020	333	100	1994
2021	78	23.5	466
2022	118	35.3	706
2023	280	83.8	1676
2024	526	157.4	3148
Total	1335	400	7990



Table 3 about the spread of Arka Banana Special technology in Pathanamthitta district reflects an initial breakthrough, a temporary setback due to COVID-19, and a strong recovery leading to large-scale adoption. The impact of Arka Banana Special on banana yield and income in Pathanamthitta district aligns closely with its spread and adoption among farmers. Demonstration data from 2021 to 2023 clearly established that the technology enhanced productivity by 12.5 to 25 percent over farmers' practice, with bunch

weight, number of hands per bunch and overall yield showing consistent improvement. Such visible results on farmers' fields strongly influenced the technology's acceptance.

The spread data reflects how this impact translated into farmer adoption over time. In 2020, 333 kg of Arka Banana Special was sold, covering 100 hectares and reaching 1,994 farmers, establishing a strong initial base. The following year, 2021, witnessed a sharp decline due to the COVID-19 pandemic, which restricted input supply and extension efforts, bringing down adoption to 78 kg over 23.5 hectares and 466 farmers. However, as the pandemic effects eased, the demonstrated yield gains and higher profitability began to attract wider interest. By 2022, adoption rose to 118 kg, covering 35.3 hectares with 706 farmers and gained strong momentum in 2023 with 280 kg spread over 83.8 hectares and 1,676 farmers. In 2024, the figures doubled again, reaching 526 kg, 157.4 hectares and 3,148 farmers. Over five years, the cumulative spread totaled 1,335 kg, covering 400 hectares and benefiting 7990 farmers. The consistent yield increase and

higher returns observed in demonstrations created the trust and confidence needed for large-scale adoption. The initial enthusiasm in 2020, the temporary setback in 2021 due to COVID, and the steady rise thereafter clearly illustrate how proven impact on productivity and income drives technology diffusion among farmers, transforming Arka Banana Special from a trial innovation into a widely accepted practice across the district.

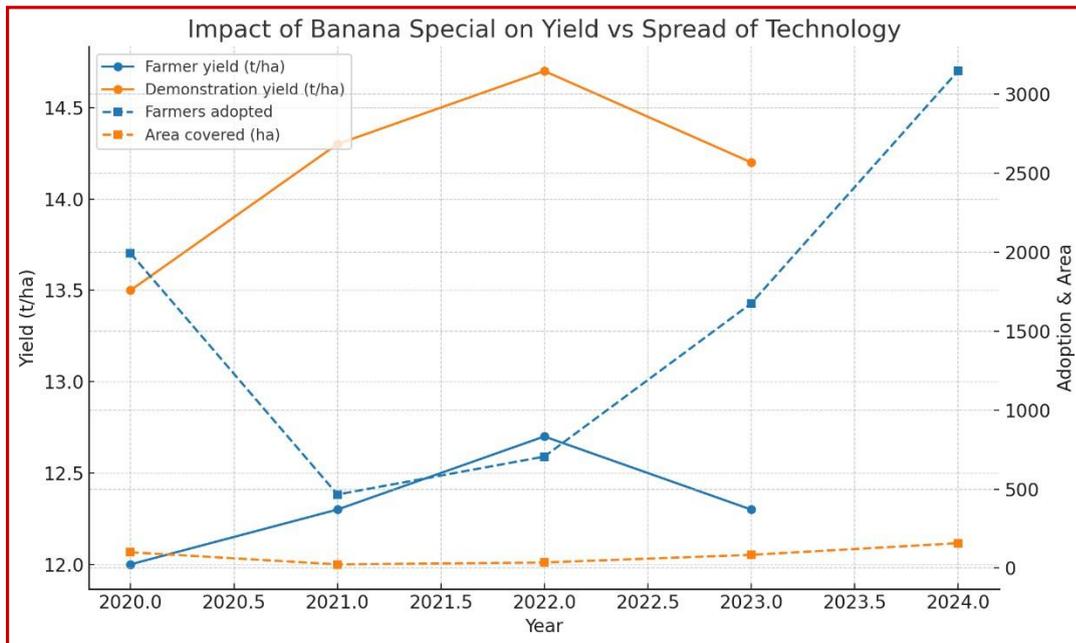


Fig 2. Impact of Arka Banana Special on yield vs Spread of Technology

In Fig 2. the left side tracks yield gain (farmer’s practice vs demonstration), while the right side shows adoption in terms of area covered and number of farmers. It clearly illustrates how the yield and income advantages observed in demonstrations influenced the steady rise in adoption after the COVID dip in 2021.

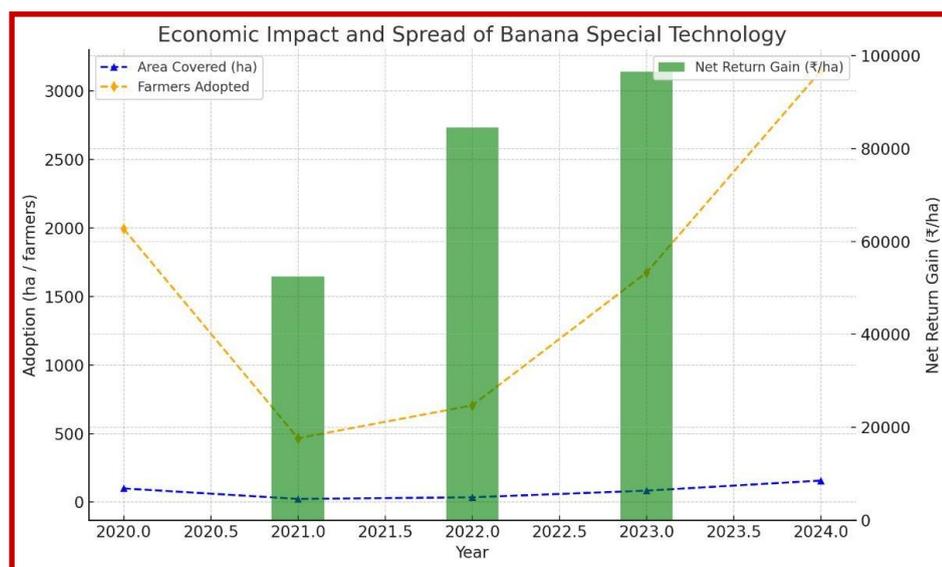


Fig 3. Economic impact and spread of Arka Banana Special Technology

Fig. 3 clearly infers that after the COVID dip in 2021, the steady rise in adoption closely followed the consistent increase in income gains demonstrated through Arka Banana Special application, reinforcing the link between proven impact and large-scale farmer uptake.

Way Forward

- **Scaling up demonstrations:** Expand the area under Arka Banana Special demonstrations to cover all major banana-growing pockets of the district for wider visibility.
- **Strengthening extension efforts:** Organize farmer training, field days and exposure visits to increase awareness and confidence in the technology.
- **Ensuring availability:** Establish linkages with input suppliers and farmer producer organizations (FPOs) to make Arka Banana Special readily accessible at the village level.
- **Cost-benefit awareness:** Promote the economic advantage of Arka Banana Special through case studies and success stories showing yield and income improvements.
- **Monitoring adoption trends:** Regularly track adoption rates, farmer feedback and performance data to refine extension strategies.
- **Policy support:** Recommend inclusion of Arka Banana Special in state/district-level subsidy or support schemes for micronutrient management.
- **Collaborative approach:** Involve research institutes, KVKs, input dealers and FPOs to ensure effective dissemination and sustained us

Conclusion

The introduction of *Arka Banana Special* has proven to be an effective intervention for addressing micronutrient deficiencies in banana cultivation. By ensuring balanced nutrition through foliar application, Arka Banana Special significantly enhanced bunch weight, fruit quality and overall productivity compared to conventional farmer practices. The higher nutrient

uptake efficiency, quick response and visible improvement in crop performance encouraged farmers to adopt the technology widely across the district. The results clearly demonstrate that Arka Banana Special not only bridges the yield gap but also improves the economic returns of banana farmers. Moreover, its adoption highlights the importance of integrating location- specific micronutrient formulations into regular crop management practices. With continued extension support, policy backing, and easy access to inputs, Arka Banana Special can play a pivotal role in strengthening banana-based livelihoods and promoting sustainable crop production in the district.



Enhancing Banana Productivity through AYAR: A Secondary and Micronutrient Mix (KVK, Malapuram)

Background/existing problem and Intervention of the KVK to address the problem

Nendran banana farmers of Malappuram district were grappling with reduced yields due to secondary and micronutrient deficiencies in the soil. Abnormalities in leaf and bunch formation were severe problem reported from the region. The Krishi Vigyan Kendra (KVK), Malappuram initiated demonstrations and popularization of a soil-based secondary and micronutrient formulation called AYAR (Kerala Agricultural University Technology, 2013) to address the specific nutrient needs of Nendran banana plants. The field-level demonstrations (FLD) in farmers' field were conducted since 2015-2016 period using AYAR, which contains Calcium, Magnesium, Sulphur, Zinc, and Boron. The primary goal of the demonstration was to showcase the efficacy of AYAR in alleviating secondary and micronutrient deficiencies, ultimately improving the productivity and economic returns for Nendran banana farmers.

Input Provided Including KVK Advisories/Services and outcome

Front Line Demonstration (FLD)

The FLD conducted in farmer fields involved the application of AYAR. The demonstration recorded a substantial increase in productivity, reaching 319.5 q/ha in comparison to the check (256.5 q/ha). AYAR-treated plot exhibited a significant 24.56% increase in yield compared to the check plot. The economic analysis also revealed a higher benefit-cost ratio for the AYAR demonstration (2.09) compared to the check plot (1.68), indicating the economic viability of AYAR usage.

AYAR Production and Distribution:

AYAR is manufactured at Multi-mix production unit established by KVK with an annual production capacity exceeding 25 tonnes. The micronutrient mix is efficiently distributed to various panchayats through Krishibhavan Eco shops and agro service centers ensuring accessibility for farmers. The following table data shows AYAR distributed during 2019-2024 in Malappuram district, from KVK AYAR production unit

Table 2. The details of Sampoorna distribution for the last five years

Year	Ayar sale in kg	No. of Banana plants treated with AYAR
2019-20	10348	51740
2020-21	34494	172470
2021-22	12668	63340
2022-23	3634	18170
2023-24	11,942	59710

Total	73086	365430
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Advisory and Training:

Alongside the FLD, KVK implemented an extensive advisory and training program for farmers. This initiative aimed to educate farmers on the benefits of AYAR, proper application methods, and the importance of addressing secondary and micronutrient deficiencies for sustainable banana cultivation.



Outcome and Impact of the Intervention:

1. Yield Increase:

Application of AYAR enhanced Nendran banana productivity, to the range of 10000 q/ha since the inception of AYAR production in KVK from 2019.

2. Qualitative Benefits:

AYAR application improved crop vigour, bunch size, and fruit quality by addressing secondary and micronutrient deficiencies, ensuring healthier plants and more marketable produce.

3. Economic Impact:

Farmers achieved a higher benefit-cost ratio (2.09 vs 1.68), reflecting greater profitability. Around 3.65 lakh banana plants were applied with ayar during 2019–24, which contributed an economic value to the tune of Rs. 3.5 crore.

Summary

Secondary and micronutrient deficiencies in nendran banana of Malappuram district created drastic decline in yield and income generation in farmers. To address this, KVK Malappuram introduced AYAR, a micronutrient mix (Ca, Mg, S, Zn, B) developed by Kerala Agricultural University (2013). With the proven benefits of yield (+24.56%), quality improvement, and higher economic returns, AYAR adoption has reached over 3.65 lakh banana plants (2019–24), contributing to sustainable banana cultivation and enhanced farmer livelihoods in the district.

Micronutrient mixture – for improving productivity

in rice, banana & vegetables

● Introduction

ICAR-
KVK,
KOTTAYA
M

Kottayam district, with its diverse agro-ecological conditions ranging from low-lying Kuttanad wetlands to midland and upland areas, supports intensive cultivation of banana, rice, and vegetables as major agricultural enterprises. Rice is predominantly grown in the below-sea-level paddy fields of Kuttanad, known as the “Rice Bowl of Kerala,” while banana is widely cultivated in homesteads, garden lands, and reclaimed paddy fields as a profitable intercrop. Vegetables are grown both in open fields and homestead gardens, ensuring household nutrition as well as market supply. Despite challenges such as soil acidity, micronutrient deficiencies, and high rainfall, these crops play a vital role in the farming economy of Kottayam, contributing to food security, income generation, and livelihood sustainability of farm families.

□ Major problems identified



Micronutrient deficiencies significantly affect the productivity of rice, banana, and vegetables due to the combined impact of high rainfall, soil acidity, and continuous intensive cultivation in Kottayam district. In rice, micro nutrient deficiencies are common, leading to weak panicle formation, grain discoloration and half-filled grain formation. In banana, shortages of calcium and magnesium cause weak pseudostems, interveinal chlorosis, smaller bunches, and boron deficiency further hampers flowering and fruit set. Vegetables often face boron and zinc deficiencies, resulting in poor seed and fruit development, reduced quality, and lower marketable yield.



- Intervention of the KVK to address the problem**

Kerala Agricultural University has developed two crop-specific micronutrient formulations such as Ayar and Sampoorana to correct hidden deficiencies and boost yield and quality in banana, rice and vegetables. In banana, Ayar supports vigorous vegetative growth, improved bunch size, and reduced physiological disorders by supplying balanced secondary and trace elements to crops. Sampoorana, specially designed for foliar application, is effectively used in vegetables to enhance crop growth, flowering, and fruit set, and in rice to improve panicle development, grain filling and reduce grain discoloration under nutrient-stressed wetland conditions. In Kottayam district, the challenges of high rainfall, acidic soils, and intensive cultivation often result in micronutrient deficiencies. To address these, KAU-recommended micro nutrient mixtures through timely soil and foliar application as part of integrated nutrient management practices. This approach provides farmers with a practical solution to enhance crop productivity, improve resilience, and ensure better quality produce, while promoting sustainable farming practices.

- Ayar - Multinutrient mixture for yield enhancement in banana.**

Frontline demonstration on secondary and micronutrient management in banana was conducted with the application of Ayar @ 200g/plant/year in addition to NPK

recommendation as per POP. Ayar is a mixture of secondary and micronutrients comprising of Calcium (15%), Magnesium (5%), Sulphur (6%), Zinc (1.5%), and Boron (0.6%) with Silicon as filler. Application of Ayar resulted in earlier bunch emergence by two weeks and could enhance bunch yield by 23.5 per cent.

● **Feedback of the technology**

The technology was widely accepted by the farmers due to better fruit appearance and higher market price.

● **Sampoorna KAU multimix for rice, vegetables and banana**

Demonstrations on the use of Sampoorna in vegetables were carried out at different farmers' fields in Kottayam district to address micronutrient deficiencies. The mixture is recommended as a foliar spray at 15, 30, and 45 days after planting @ 5g/litre, ensuring timely nutrient supplementation. Its application improved flowering and fruit set, which in turn increased yield by 18 to 25 per cent, highlighting its effectiveness in enhancing both productivity and crop health.

The foliar application of the micronutrient mixture KAU Sampoorna Multimix in rice, using drones, has been shown significantly improved yield-attributing traits, such as productive tillers per plant, higher number of filled grains per panicle and increased 1000-grain weight, thereby directly contributing to enhanced yields. The recommended schedule of application is three sprays, at the nursery stage (@ 5 g/litre and at both tillering and panicle initiation stages (@ 10 g/litre. Yield increase observed through different demonstrations ranged from 15 to 25 per cent, confirming its effectiveness in boosting rice productivity.

Sampoorna micronutrient mixture can also be effectively used in banana as a foliar spray @ 10 g/litre, first applied two months after planting and repeated at two-months interval for a total of four applications. This practice has shown a notable improvement in plant growth and resulted in increased yield in banana.



● **Feedback of the technology**

Farmers in Kottayam district who adopted sampoorina in vegetable and banana cultivation reported highly positive feedback. They observed increased flowering, enhanced fruit set, which leads to higher yields and better marketable quality of produce in vegetables and bigger bunches with improved fruit quality in banana.

The drone application of Sampoorina in rice is gaining popularity among farmers due to the significant time and labor savings and precise application of nutrients. It offers, making it an efficient and effective solution for boosting productivity while reducing manual effort. As a result, more farmers are adopting drone-assisted nutrient application to enhance productivity and profitability of crops. The continued growth in drone adoption points to a future where technology plays an integral role in modern agriculture.

- **Spread of technology**

To meet the increasing demand from farmers, Ayar and sampoorina production unit was established at KVK Kottayam in 2019. From 2020 to 2024, the spread of KAU's micronutrient technologies in Kottayam district has been remarkable, with a total production and distribution of 54.7 tonnes of Ayar and 21.4 tonnes of Sampoorina. Between 2020 and 2024, farmers treated 110 hectares of banana fields with Ayar, while Sampoorina was applied in 4,280 hectares of fields with rice, vegetables and banana. The wide adoption of these formulations highlights the increasing awareness and acceptance among farming communities on the importance of balanced nutrient management for enhancing crop productivity. Continuous demonstrations, farmer trainings, and extension support facilitated the effective dissemination of the technologies, leading to their large-scale utilization in rice, banana, vegetables, and other crops across the district. This steady increase in demand and distribution clearly reflects the positive impact and trust built among farmers regarding the performance of Ayar and Sampoorina in improving crop health and yield.



Women empowerment mainly focus on enhancing livelihood opportunities and self-reliance among women through skill development. One such successful intervention is the training and support pro to the SHG group for the mass production of KAU micronutrient mixtures namely Ayar and Sampoc. A dedicated group of five women are actively involved in the formulation and packaging of these products for crops such as rice, banana, and vegetables. This not only generates sustainable income for the women but also ensures the timely availability of quality micronutrient mixtures to farmers for improving crop health and productivity. By engaging women in this activity, KVK fosters economic independence, strengthens their role in agricultural development, and promotes community-level adoption of scientific nutrient management practices.







□ Summary

The use of micronutrient mixtures has emerged as an effective strategy to overcome hidden hunger in crops and ensure balanced plant nutrition for sustained productivity. Deficiencies of secondary and micronutrients often limit crop yields even under adequate NPK application, and the adoption of scientifically formulated mixtures helps bridge this gap. Field demonstrations and farmer feedback have consistently shown improvements in crop vigor, and yield enhancement, with yield responses ranging from 15 to 25 per cent in rice and significant benefits in banana, vegetables, and other crops. Foliar and soil application of sampoorna and ayar have facilitated wide acceptance among farmers, making micronutrient mixtures an integral component of nutrient management practices in Kottayam district and beyond.



Sampoorna KAU Multimix for micronutrient deficiency management in banana, rice, and vegetable crops (KVK, Thrissur)

Introduction

Banana, paddy and vegetables are the major crops grown in Thrissur District. Paddy is the most important crop grown in an area of 23946 ha mainly in wetlands. Other major crops grown are banana and vegetables, which are cultivated in an area of 9137 hectares in the district. Thrissur is also renowned for *Chengalikodan Nendran* banana, which is a GI-tagged banana variety predominantly cultivated in the Wadakkanchery block.

Major problem identified:

Soil fertility assessments in the major crop growing areas of Thrissur district revealed that the soils are highly acidic and deficient in nutrients potassium (K), magnesium (Mg), zinc (Zn) and boron (B) in nearly three-quarters of the samples analyzed. These multi-nutrient deficiencies have resulted in yield reduction, increased pest and disease infestation and poor crop quality. The farmers typically apply only small amounts of lime and farmyard manure, apply micronutrients after deficiency symptoms expression and rely on pesticides to reduce the crop damage.

Intervention of ICAR-KVK Thrissur to address the problem:

To address these constraints, ICAR-Krishi Vigyan Kendra, Thrissur planned to demonstrate Sampoorna KAU Multimix micronutrient mixture developed by Kerala Agricultural University specifically for banana, paddy, and vegetable crops. The on-farm trials conducted during 2013-2018 underlined the efficacy of this mixture in improving crop yield and quality. The mixture contained potassium (K), magnesium (Mg), sulphur (S), zinc (Zn), boron (B), copper (Cu), molybdenum (Mo), iron (Fe), and manganese (Mn). In the past five years KVK had conducted five frontline demonstrations in 70 farmers' fields and also provided sampoorna as input for 80 farmers cultivating the three crops. Pilot demonstration of Sampoorna multimix (paddy) using UAV was done in 50 acres of land in Thrissur kole paddy lands and 20% increase in yield was recorded. Through this intervention the technology was successfully transferred to 100 farmers of the kole lands. This was further taken up by the department of Agricultural development and Farmers welfare, Govt. of Kerala, reaching out to a larger section of farming community

The crop-specific recommendations for implementing the technology are as follows:

Banana: Foliar application of Sampoorna KAU Multimix at 1%, starting from 2 months after planting, repeated at 60-day intervals.

Paddy: Foliar application at 0.5% in nursery, two days before pulling for transplanting, followed by 1% application twice—at the tillering and panicle initiation stages.

Vegetables: Foliar spray of 0.5% at 30 days after planting or 15 days after transplanting, followed by two additional sprays at 15-day intervals.

Feedback of the technology:

The results revealed that the foliar application of the mixture could improve the productivity of banana, paddy and vegetables by more than 23 %, 20 % and 24-65 % (depending on the crop) respectively. In addition, the quality of the produce was found to have improved significantly. As foliar application reduces the nutrient load to the environment, Sampoorna KAU Multimix offers sustainable nutrient management. From the pilot demonstration of Sampoorna using UAV in paddy it was observed that the nutrient deficiency of soil was rectified and there was significant reduction in labour cost.

Spread of the technology:

Based on the results and feedback obtained from the farmers, KVK Thrissur promoted the use of Sampoorna KAU Multimix through frontline demonstrations, farmer field schools, nutri-gardens, training programmes, and awareness campaigns.

Horizontal spread of the technology:

Recently, this has emerged as one of the most popular technologies in Thrissur district. To meet the growing demand from farmers, ICAR-KVK, Thrissur has established its own production unit, while other KAU stations in the district have also set up Sampoorna KAU Multimix production units to cater to increasing farmer demand.

Extend of area coverage:

Over the past five years, KVK Thrissur has produced and marketed 9406 kg of Sampoorna KAU Multimix vegetables, 3275 kg of paddy, and 970 kg of banana. These efforts correspond to an area coverage of 1880 ha of vegetables, 655 ha of paddy, and 34 ha of banana in Thrissur district. During this period, 17,513 farmers were introduced to the Sampoorna technology through 663 training programmes conducted at KVK.

Summary:

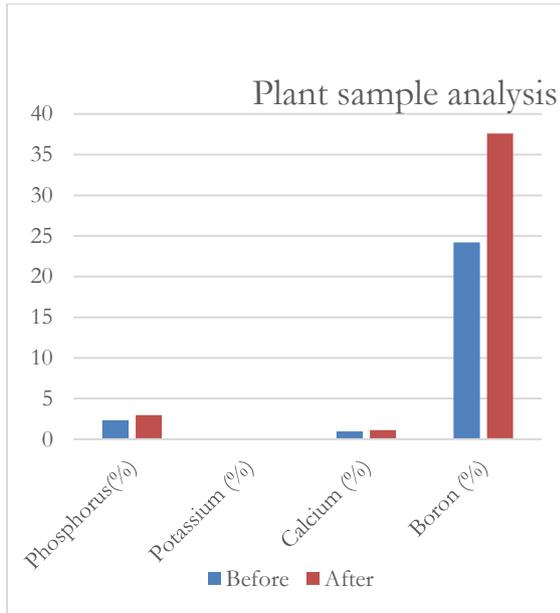
The introduction of Sampoorna KAU multimix has proven highly effective in enhancing yield, quality and thus profitability of banana, paddy and vegetables when applied as foliar spray. In vegetable crops, the yield and quality improvement are highly noticeable as it gives 20-60 % yield increase depending on the crop. The wide adoption and establishment of production units underline its success as one of the most impactful technologies promoted by ICAR-KVK Thrissur.





Sampoorna Multimix applied fields of farmers

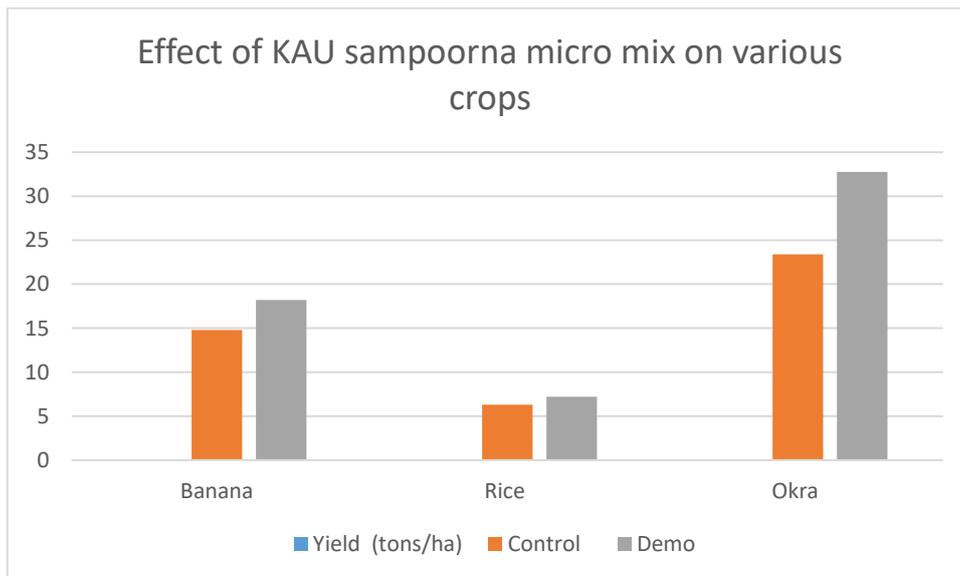




Parameter	Demo	Control
Plant Height (cm)	112.5	93.2
Leaf Length (cm)	35.3	24.5



Result of KAU micronutrient mix Sampoorna through UAV demonstration



Effect of sampoorna micro mix on yield attributes of various crops

Trichoderma coirpith cake for bud rot management in coconut (KVK, Kannur)

1. Introduction

Coconut farming holds a pivotal role in the agrarian economy of Kerala and is deeply embedded in the socio-cultural fabric of the state. Traditionally, Kerala has been regarded as the “land of coconut,” symbolizing rural prosperity. The state contributes 7.60 lakh hectares out of the 2.277 million hectares of coconut cultivation in India and produces about 5,641 million nuts annually. However, despite maintaining the highest share in production, Kerala ranks only fifth in productivity. Over the past two decades, the area under coconut cultivation in Kerala has been shrinking, declining from 8.09 lakh hectares in 2013–14 to 7.60 lakh hectares in 2022–23, while other states recorded an increase of 17% in the same period.

The declining share in coconut production, coupled with several agronomic and economic constraints, has placed coconut farmers in Kerala under severe distress. Factors such as fluctuating market prices, senile palms, soil constraints, inadequate irrigation, labor shortages, pest and disease outbreaks, and low diversification of products have contributed to this crisis.

2. Major Problems Identified

In Kannur district, coconut cultivation is facing a serious challenge due to **bud rot disease**, caused by *Phytophthora palmivora*. This fatal disease primarily affects young palms and is prevalent during the monsoon season under high humidity. Bud rot leads to rotting of the terminal bud and surrounding tissues, ultimately killing the palm. In recent years, the incidence has intensified in Kannur due to the large-scale adoption of hybrid coconut varieties.

The main issues identified are:

- High disease incidence in Kannur district, causing severe yield loss.
- Limited availability of effective and eco-friendly disease management solutions.
- Farmers unable to manage coconut cultivation profitably due to crop loss.

Therefore, it became essential to develop and popularize an effective, low-cost, and sustainable management strategy for bud rot.

3. Intervention of KVK to Address the Problem

To address the bud rot disease, **Krishi Vigyan Kendra (KVK), Kannur**, in collaboration with **CPCRI, Kasaragod**, adopted an innovative biocontrol approach using

Trichoderma coir pith cake (TCPC). This technology utilizes *Trichoderma harzianum* formulated with coir pith and maida flour, offering an eco-friendly, cost-effective, and long-shelf-life solution.



**Trichoderma coirpith cake-
Non -activated**



Trichoderma coirpith cake- Activated

Key Interventions by KVK Kannur:

- **Front Line Demonstrations (FLDs):** Demonstrated the effectiveness of Trichocake in bud rot management across farmers' fields.
- **Technology Transfer:** Signed a **Memorandum of Understanding (MoU)** with CPCRI on **29th September 2021**.
- **Small-Scale Production:** Initiated production of Trichocake at KVK from **20th October 2021**.
- **Establishment of Advanced Biocontrol Lab:**
 - Set up under the project **“Establishing a Mass Production Unit for Biocontrol Agents at KVK Kannur”**.
 - Financial assistance of **₹89.55 lakhs** provided by the **State Horticulture Mission**.
 - Facility aimed at **producing beneficial microorganisms including Trichocake** and ensuring **timely supply to farmers**.
- **Technology Dissemination:** Through **Keragramam Programme, ATMA Programme**, and KVK-led **training and extension activities** across the state.



Technology transfer from CPCRI

Mass production of trichocake at KVK Kannur

Application Protocol:

- Apply Trichocake in leaf axils adjacent to the spindle leaf before the onset of southwest and northeast monsoons.
- Use 2–4 cakes per palm, depending on palm age and crown size.
- Continuous application for 3–4 years enhances *Trichoderma* population buildup for long-term protection.



4. Impact of the Technology

The technology has been successfully disseminated across Kerala, significantly reducing bud rot incidence and protecting coconut plantations.

Achievements:

- Covered **1,806 hectares (4,515 acres)** of coconut plantations.
- Promoted **eco-friendly and sustainable disease management** practices.

- Reported the **lowest incidence of bud rot** and a **27% increase in yield** in coconut plantations where Trichocake was applied.
- Protected an annual coconut cultivation area of **1,806 hectares (4,515 acres)**
- Achieved an **average additional income of ₹1.00 lakh per hectare** through effective bud rot management using Trichocake.
- Generated an income of ₹61.70 lakhs through the mass production of 1.23 lakh Trichocakes at the Biocontrol Lab, KVK Kannur, during the period from November 2021 to August 2025

Production and Income Status of trichocake at KVK Kannur:

Time period	Quantity (Nos)	Income (Rs)	Area covered/ Protected (ha)
November 2021 to March 2022	182114	910570	260
April 2022 to March 2023	297182	1485910	437
April 2023 to March 2024	448393	2241965	659
April 2024 to August 2025	306318	1531590	450
Total	1234007	6170035	1806

The intervention has not only reduced bud rot incidence but also provided farmers with a sustainable and economically viable solution, improving profitability and strengthening the coconut sector in the region.

Conclusion

The large-scale adoption of Trichocake for bud rot management in coconut has emerged as a practical, eco-friendly, and cost-effective solution, safeguarding Kerala’s coconut sector from a major disease threat. Through strategic interventions such as frontline demonstrations, technology transfer, and establishment of a biocontrol lab at KVK Kannur successfully demonstrated the efficacy of this innovation, covering 1800 hectares and generating substantial additional income for farmers. This initiative not only reduced crop losses but also enhanced sustainability by minimizing chemical fungicide use. Continued efforts to scale up production

and ensure wider dissemination will be critical to sustaining coconut farming as a profitable and resilient enterprise in the state.

Sd/-

Programme coordinator

KVK Kannur

IISR PGPR CAPSULE- A ENCAPSULATED FORMULATION FOR THE BLACK PEPPER GROWERS (KVK, IDUKKI)

Manju, J. V., Ashiba, A., Preethu, K. P., Geethu, M. and Marimuthu, R.

Introduction:

Black pepper (*Piper nigrum* L.), often dubbed “black gold” for its high economic value, is heralded as the “king of spices” and holds a central place in global spice trade. In India, especially in Kerala’s Idukki district, this crop is not only culturally significant but economically vital. However, yields in these regions remain comparatively low, largely due to soil health constraints and suboptimal crop management practices. Kerala continues to be India’s foremost black pepper producer. The state cultivates approximately 82,000 hectares of black pepper, accounting for over 59% of the country’s total pepper growing area. Within Kerala, Idukki stands out prominently it contributes about 51% of the state's pepper cultivated land and delivers a remarkable 59.5% of the state’s total production.

Major problem identified:

Black pepper is a highly valuable spice crop, but its productivity is often constrained by soil-related problems such as nutrient deficiency, low organic matter, and reduced soil microbial activity. Continuous and imbalanced use of chemical fertilizers has led to deterioration of soil health, nutrient mining, and decreased efficiency of applied inputs. In addition, black pepper is highly susceptible to biotic stresses, particularly foot rot disease, and abiotic stresses like drought, which further affect crop establishment, growth, and yield. Farmers are in need of sustainable, eco-friendly solutions that not only supply nutrients but also enhance soil biological activity and provide stress tolerance.

Although Plant Growth-Promoting Rhizobacteria (PGPR) have shown significant potential in improving nutrient uptake, disease suppression, and root development, their adoption in black pepper cultivation is limited due to issues in handling, storage, and short shelf life of liquid bio-fertilizers. The lack of a user-friendly, stable, and effective formulation restricts the widespread use of microbial inoculants at the farm level. Therefore, developing PGPR in capsule form, which ensures easy transport, long shelf life, and effective delivery of beneficial microbes, is necessary to address soil fertility constraints and enhance sustainable productivity in black pepper.



Interventions Undertaken by the KVK

The details of the KVK activities undertaken are given hereunder

Table 1. Interventions of the KVK

Activities	Number of Activities	No. of farmers covered
FLD	10	58

OFT	4	30
Trainings	220	6439
Extension activities	321	4120
Total	465	9404

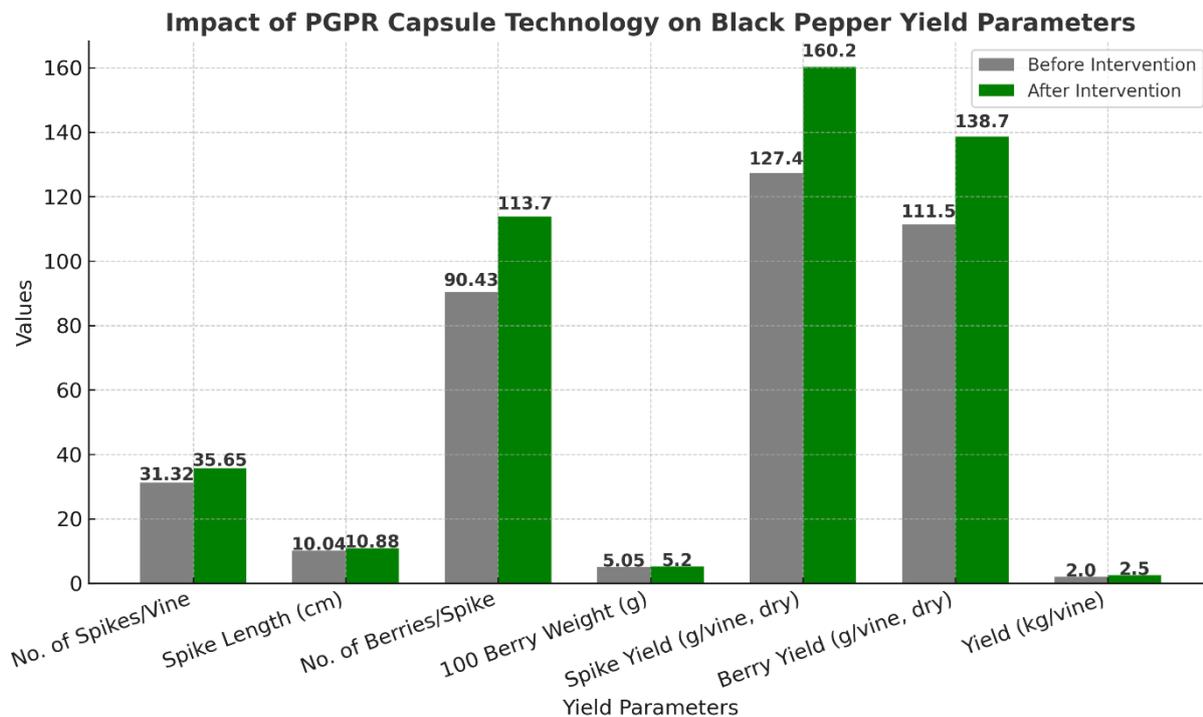
In addition to the above activities, to create awareness among farmers on PGPR technology, KVK has organized various in-house, off-campus, and sponsored trainings in collaboration with agricultural and allied departments across the district. Field demonstrations, farmer-scientist interactions, exposure visits, and method demonstrations were also conducted to ensure practical understanding and adoption of the technology.



Further, convergence with developmental schemes and line departments has significantly accelerated the reach and impact of the initiative. Collaborative efforts were made with the Department of Agriculture Development and Farmers' Welfare (Kerala), Spices Board, State Horticulture Mission (SHM), ATMA and FPOs. Through these linkages, PGPR capsules were integrated into ongoing crop health management programs, subsidy-based distribution systems, and capacity-building initiatives, ensuring wider dissemination among black pepper growers in Idukki district.

Feedback of the technology

Farmers who adopted the PGPR capsule technology in black pepper reported remarkable improvements in crop performance and profitability. They observed healthier vines with vigorous growth, increased number of productive laterals, and enhanced spike development, which collectively led to a yield increase of about 18–25% over conventional practices. Many farmers expressed satisfaction with the reduced dependence on chemical fertilizers, noting a 20–25% saving in fertilizer use without compromising productivity. They also highlighted improved soil health, evidenced by better soil structure and biological activity, and appreciated



Graph 1. Impact of PGPR capsule technology on black pepper yield parameters

the economic benefits with a 15–20% reduction in cultivation costs and higher net returns. Overall, the technology was perceived as a cost-effective and sustainable solution for improving black pepper production in Idukki.

The introduction of PGPR capsule technology in black pepper cultivation significantly improved various yield parameters. The number of spikes per vine increased from 31.32 to 35.65, while the average spike length showed a remarkable rise from 10.04 cm to 10.88 cm. The number of berries per spike improved from 90.43 to 113.7, and 100-berry weight slightly increased from 5.05 g to 5.20 g. Consequently, the dry spike yield per vine rose from 127.4 g to 160.2 g, and the dry berry yield increased from 111.5 g to 138.7 g. Overall, the yield per vine enhanced from 2.0 kg to 2.5 kg, registering a 22% increase in productivity compared to the pre-intervention period. These results clearly demonstrate the effectiveness of PGPR capsule technology in boosting black pepper yield and profitability.

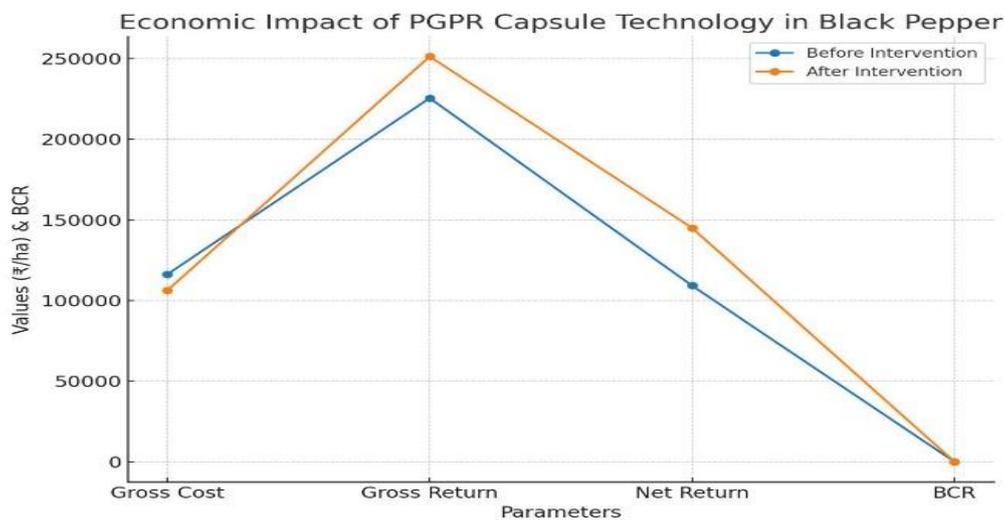
Spread of the technology

The PGPR capsule technology in black pepper was actively promoted by KVK Idukki from 2020 to 2024, resulting in its adoption across 400 hectares in the district. This was achieved

through a range of interventions including Frontline Demonstrations (FLDs), On-Farm Trials (OFTs), capacity-building trainings, farmer-scientist interactions, and convergence with various schemes and departments. The sustained efforts led to a steady expansion of the technology from small pilot plots to large-scale adoption by progressive farmers.

Economic Impact of the technology

The adoption of PGPR capsule technology in black pepper cultivation brought about a substantial positive economic impact for farmers in Idukki district. The gross cost of cultivation reduced from ₹1,16,250/ha before intervention to ₹1,09,250/ha after intervention, mainly due to the reduced reliance on chemical fertilizers and pesticides. At the same time, enhanced productivity resulted in a remarkable increase in farm income, with net returns rising from ₹1,09,250/ha under conventional practices to ₹1,45,039/ha with PGPR application. Consequently, the gross return improved from ₹2,25,500/ha to ₹2,51,289/ha, and the Benefit Cost Ratio (BCR) advanced from 1.94 to 2.37- an increase of 22% in BCR over the pre-



Graph 2. Economic Impact of PGPR capsule technology in black pepper

intervention level. This clearly demonstrates that PGPR technology not only improves profitability but also promotes a cost-effective and sustainable production system, significantly strengthening the economic resilience of black pepper farmers in the region.

Other beneficial Effect of the technology:

The adoption of PGPR technology in black pepper cultivation has shown multiple beneficial effects beyond yield and economic gains. It significantly improves overall plant health, promoting vigorous growth with healthier, greener foliage and stronger vines. Reduction in plant mortality is another major advantage, as PGPR enhances root development and increases the plant's resistance to common soil-borne diseases like foot rot (*Phytophthora*), leading to improved crop stand. The technology also enhances soil health by enriching beneficial microorganisms such as nitrogen-fixing bacteria, phosphate-solubilizing bacteria, and other rhizospheric microbes, improving nutrient availability and uptake. Additionally, it reduces the dependency on chemical fertilizers and pesticides, lowering production costs and minimizing

environmental pollution. Long-term adoption of PGPR fosters sustainable soil fertility, resilience against biotic and abiotic stresses, and contributes to maintaining a balanced agro-ecosystem, thereby ensuring stable and profitable black pepper production.

Horizontal spread of the technology:

The horizontal spread of PGPR capsule technology in black pepper cultivation across Idukki district has been remarkable, as the intervention steadily moved from initial frontline



demonstrations to widespread farmer adoption through training programmes, peer-to-peer learning, and institutional support from KVK and the Department of Agriculture. Beginning with small clusters, the practice expanded across multiple blocks and panchayats, reaching a large number of farmers who were convinced by visible yield improvement, better plant health, and higher net returns compared to conventional practices. The technology's adaptability to smallholder conditions and its cost-effectiveness further encouraged repeat use, gradually increasing the treated area and enhancing adoption rates in major pepper-growing tracts of the district. This diffusion not only improved productivity and profitability for individual farmers but also contributed to strengthening sustainable production practices in the pepper sector of Idukki.

Extend of area coverage:

In Idukki district, the horizontal spread of PGPR capsule technology in black pepper has covered a substantial area, with adoption reported across major pepper-growing blocks such as Adimaly, Nedumkandam, Kattappana, and Kumily. Demonstrations and training programmes enabled by KVK, Idukki, facilitated diffusion of the practice to more than 1,900 farmers, covering an estimated 350–400 ha of black pepper plantations within a short span. With repeat users and peer-to-peer adoption, the cumulative coverage has been steadily increasing, accounting for nearly 10–12% of the total black pepper area in the target locations, indicating strong farmer confidence and technology acceptance.

Summary:

Plant Growth Promoting Rhizobacteria (PGPR) Capsule is an innovative biofertilizer technology developed to enhance soil fertility and crop productivity in a sustainable manner. Each capsule contains a concentrated population of beneficial microbes that, when applied to crops, colonize the rhizosphere and improve nutrient availability, root growth, and plant health. The encapsulated form ensures longer shelf life, easy handling, and targeted delivery compared to liquid or powder formulations. PGPR capsules reduce the dependency on chemical fertilizers, improve soil microbial diversity, and promote eco-friendly farming. Successful demonstrations in crops like black pepper, cardamom, and spices in Idukki and other regions have shown increased yield, reduced cost of cultivation, and improved farmer income.

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Bush Pepper Production as an Innovative Self-Employment Enterprise for Sustainable Income Generation

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Introduction

Black pepper, the “King of Spices” is a major spice crop cultivated in Kerala. It is a perennial climbing vine grown for its berries extensively used as spice and medicine. It is mainly grown as an intercrop in coconut and arecanut gardens and also as a pure crop on various tree standards. It is a major revenue earning crop of the country through exports to foreign markets.

Problem identification

Most of the farmers in Kerala are either marginal or small farmers and they are unable to take up cultivation of this export oriented crop on a large scale due to low farm holding size. Cultivation of bush pepper hence is a viable option wherein pepper can be grown without trailing on a standard tree, in potted form in places where land availability is limited especially in urban or semi urban areas. It can be grown in any place as a garden plant, in kitchen garden, roof terraces and shade houses or in the field. It gives early yield from six months of age onwards and also ensures the availability of green pepper throughout the year. Being a bushy plant, harvesting is also easy unlike the normal climbing plant.

The process

Production of bush pepper plants

The normal way of producing planting material of black pepper is to use the rooted cuttings of runners or climbing shoots. But for production of bush pepper plants, the fruiting lateral branches are used as planting material.

Collect young healthy laterals, preferably one year old, from high yielding and disease free pepper vines in a bucket of water as a precaution against drying. It is better to avoid branches with tender leaves at the time of collection of lateral branches from the mother vine. Collection of cuttings at early morning or evening hours is better to avoid drying. These laterals should then be dipped in 0.2% copper oxy chloride solution or 2 % *Pseudomonas*

solution for 20-30 minutes and pruned to 2-4 nodes with a sharp knife. The lower cut portion of the lateral branches is then dipped in any one of the rooting hormone solution like IAA, IBA or commercially available formulations like Keradix, Rootex etc. The cut and treated branches can be directly planted in polybags (25 cm x 15 cm size) filled with potting medium (1 part of soil, 1 part of sand/ coir pith and 1 part of FYM) watered and is kept in humid chambers until good rooting is observed in a period of two months. These rooted laterals can be kept in partial shade up to 4-6 month and then planted in field or earthen /plastic pot of size 10 inch or more. Likewise grafted bush pepper plants can also be produced using Brazilian pepper (*Piper colubrinum*), a wild related species of black pepper as rootstock. Depending upon the spread of the plants and age, an approximate yield of 0.5 kg green pepper per plant year can be expected from second year onwards which will increase up to 4 – 5 kg green pepper per plant year for 5 to 10 year old plant.

Any variety of black pepper can be made into a bush pepper plant. Sreekara, Subhakara, IISR-Thevam, Panniyur 1 to 10, Vijay are some of the varieties suitable for the purpose.

Interventions

ICAR – Krishi Vigyan Kendra under ICAR – Indian Institute of Spices Research at Kozhikode, Kerala conducts regular training programmes on bush pepper production and cultivation technology to create awareness as well as to promote its cultivation in Kozhikode and neighbouring districts. Bush pepper plants of various sizes are also produced in KVK nursery.

During the last 10 years, 69 training programmes were organized benefitting 2678 farmers (Table 1).

Table 1. Training programmes conducted during the last ten years on bush pepper technology

Sl. No,	Year	No. of trainings	No. of participants
1	2015-16	2	45
2	2016-17	2	109
3	2017-18	5	231

4	2018-19	4	132
5	2019-20	18	797
6	2020-21	6	435
7	2021-22	2	126
8	2022-23	8	224
9	2023-24	10	285
10	2024-25	12	294
Grand Total		69	2678

KVK also took up the production and sale of bush pepper plants to meet the demand from farmers. A total of 42,415 plants costing Rs.42.42 lakhs were supplied to 5476 farmers mainly for homestead cultivation (Fig. 1).

Fig.1 Production and supply of bush pepper plants during the last ten years under KVK RF

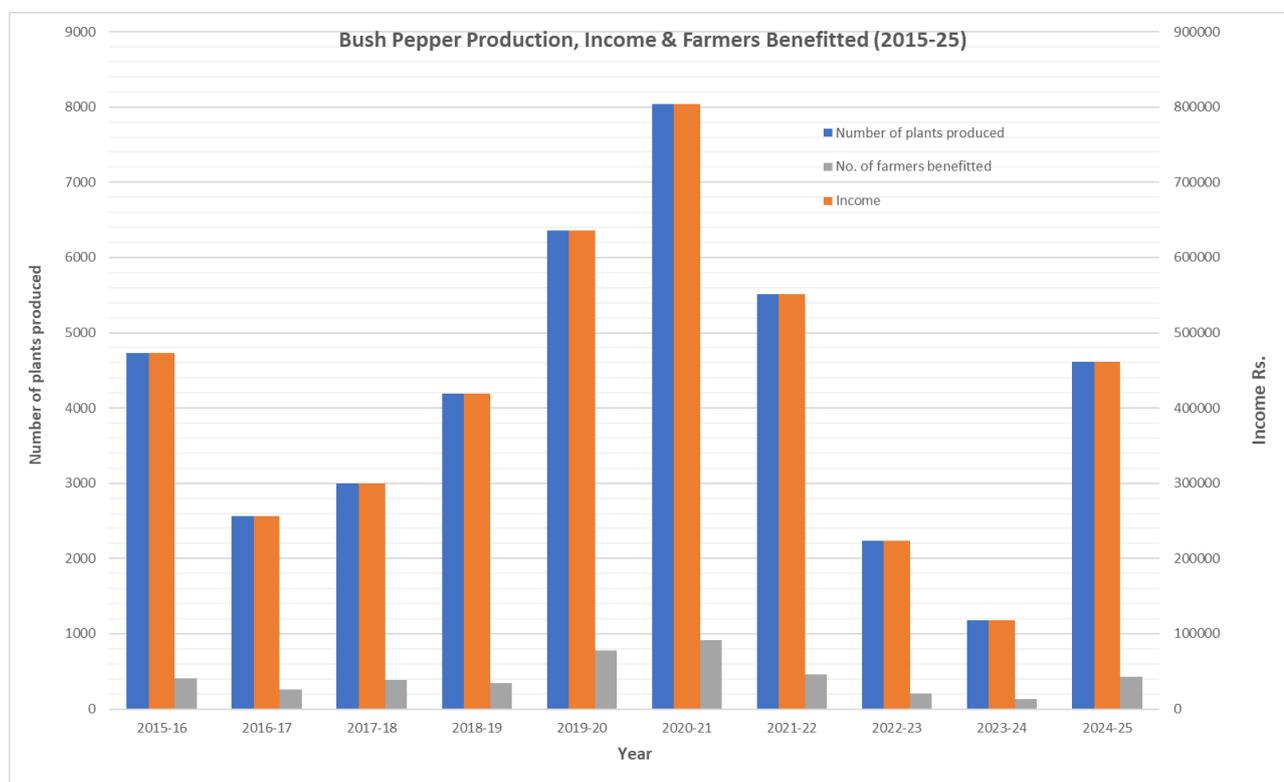
Impact of Technology

A survey was conducted to study the impact of trainings and demonstration programmes by assessing the performance of bush pepper plants in the homesteads as well as popularizing the technology through production and supply of bush pepper plants through establishment of plant nurseries. The findings of the study are furnished below.

A. Performance of bush pepper plants in the homesteads: Rooted plagiotropes in pots

Survey was conducted in seven farmers' fields comprising 332 bush pepper plants of different age groups (Table 2). The plants were of mainly Karimunda and Panniyur 1 types. The maximum number of plants was in the age group of one to five years with 213 plants. The average yield obtained in different age groups varied from 0.20 to 2.9 kg green pepper per plant per year. The highest yield obtained was 3 kg green pepper per plant per year in the case of 14 year old plants. A mortality of 1 to 2 per cent was noticed among bush pepper plants due to foot root disease and mealy bug infestation.

These farmers also produce and sell bush pepper plants. Altogether, farmers



realize an amount of Rs.10, 57,000 per year by way sale of bush pepper plants.

B. Performance of bush pepper plants in the homesteads: Grafted plants in pots

Bush pepper plants are also affected by the dreaded disease, *Phytophthora* foot rot like field grown plants. In order to avoid the disease, some farmers are growing grafted bush pepper plants either in pots or in field. Out of 12 farmers surveyed, four were having 312 grafted plants (Table 2). Maximum age of the grafted plant was eight years. The average yield obtained in different age groups varied from 0.15 to 0.80 kg green pepper per plant per year.

Though mortality of plants was not observed due to root infection, an average of 1 to 3 per cent mortality was observed among plants by way of foliar infection. The highest yield obtained was 1 kg green pepper per plant per year in the case of an eight year old plant. Here the average income realized by way of sale of grafted bush pepper plants is Rs.1,44,000 per year.

C. Performance of bush pepper plants in the homesteads: Grafted plants in the field

Out of 12 farmers surveyed, one farmer was cultivating grafted bush pepper plants in an extensive area totalling about 250 (Table 2). These plants were mainly grown as an intercrop in coconut garden and majority were in the age group of 1 – 5 years with maximum age of five years. Grafting was done at a height of two feet from the ground level using *Piper colubrinum* as rootstock. The grafted plants are supported by four inch diameter PVC pipes. Grafting is also done at different levels in a single rootstock in different branches originating from the base. Bone meal and biogas slurry are the main manures given for the grafts. Grafts are also irrigated once in a week during summer months.

Grafted plants also yield throughout the year. On an average, five year old plant give an average yield of 2.1 kg green pepper per plant per year. He also earns an average income of Rs.15,000 per year by sale of grafted polybag plants.

Table 2. Performance of bush pepper plants in the homesteads

f g	Total No. of plants	Varieties	Age group	No. of plants	Average yield (green pepper per plant per year) (kg)	Pest and disease incidence	Mortality (%)	Sales if any (average per year)	M a
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					H	L	Avg.			No.	Avg Sale price (Rs.)	Amount (Rs.)
d pes s	332	Karimunda, Panniyur- 1, Pepper Thekkan, Neelimundi	< 1 year	56	0.25	0.025	0.20	Foot rot, mealy bugs	1- 2	Pots/ grow bag – 280	Rs. 400 (150 – 1000)	1,12,000
			1- 5 years	213	1.5	0.1	0.80					
			5 – 10 years	49	2.75	0.2	2.10					
			> 10 years	14	3	2.9	2.95					
d n	312	Karimunda, Panniyur- 1, Pepper Thekkan	< 1 year	148	0.2	0.1	0.15	Foliar infection	1-3	Pots/ grow bag – 320	Rs. 250 (100 – 500)	80,000
			1- 5 years	114	0.80	0.25	0.55					
			5 – 10 years	2	1	0.45	0.80					
			> 10 years	0								
d the	250	Karimunda, Panniyur- 1	< 1 year	10	0.5	0.2	0.40	Nil	Nil	Poybag- 100	Rs.150 (100 - 175)	15,000
			5 years	240	2.5	1.5	2.10					

D. Impact of trainings

During the last 10 years, 69 training programmes were organized benefitting 2678 farmers. After attending the training programmes about 11 nursery units were started by KVK trainees over a period of time and are functional in different parts of Kozhikode district. Many of these are run by woman farmers. The income of these units ranges from Rs.10,000 to Rs.15 lakhs per year. A list of such successful units is given in Annexure I.

In addition, at household level, farmers are producing about 300 g to 4.5 kg green pepper per plant per year from various locations in Kozhikode district. This is sufficient for their internal requirement and a few sell surplus produce also.

Horizontal Spread

More Panchayats are presently impressed by these interventions and Krishi Bhavans like Velam, Unnikulam, Panangad, Karasseri, Changaroth, Kakkodi, Kayakkodi etc. in Kozhikode district, Muthuvalloor, Ponnani, Kondotty etc. in Malappuram District, Vythiri in

Wynad district, Cheruthazham in Kannur district, KVK Ernakulam also procured 1000 to 2000 bush pepper plants each from KVK, Calicut and distributed to households. The plants were also taken to various states such as Karnataka, Tamil Nadu, Andhra Pradesh, Telegana etc. through farmers as well as respective State government departments. The technology is fast spreading to more locations.

Economic gains

The bush pepper plants will start yielding as early as six months onwards. It is expected to yield at least 150 g green pepper per plant per year after second year. The yield will increase gradually as per plant management and high yield levels of 4 to 4.5 kg green pepper per plant per year can be realized from 12 to 14 year old potted plants.

By the homestead production of bush black pepper in semi urban and urban areas, the domestic demand of black pepper can be met with, favouring creation of exportable surplus from the main production areas contributing to the economy of the country.

Conclusion

Bush pepper is a viable technology for production of black pepper especially in areas where land availability is a major constraint. Production of black pepper in households though in small quantities will help to reduce demand for black pepper from the market and will add to the quantity available for export. The technology is spreading fast in Kozhikode and neighbouring districts. KVK is supporting the technology through trainings, demonstration and production of bush pepper plants. The convenience in harvesting without the need of labourers as well as the year round availability of spikes makes it an attraction for the women and elder persons at home compared to the vine pepper in the field.



Bush pepper in pots



Plagiotropic/ lateral branches



Bush pepper polybag plants



A progressive farmer with bush pepper in pots (Mr.Jojo Jacob and Mrs.Bindu Joseph)



Bush pepper commercial nursery (Mr.Sabu Jacob)	Small-scale bush pepper nursery (Mrs.Shylamma Thomas)
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Fig. 2 Bush pepper and its impact among farmers

Annexure I

List of bush pepper nursery units functional in Kozhikode district

1. Jojo Jacob, Randuplackal House, Avadukka Post, Peruvannamuzhi, Kozhikode– 673 528, Kerala (Mobile Number: 9446668879/9446865899).
2. Jancy Thomas, Mookkanthottathil, Kunduthode, Kozhikode – 673 513, Kerala (Mobile: 9496808639)
3. Buds and Blooms, Chalikkara, Kozhikode – 673 525, Kerala (Mobile:9947490106)
4. Saji Madathiparambil, Koorachundu, Kozhikode – 673 527, Kerala (Mobile:9946139248)
5. Xavier, Vazhappally, Koorachundu, Kozhikode – 673 527, Kerala (Mobile:9495859483)
6. Binu John, Ilappunkal House, Peruvannamuzhi Post, Kozhikode– 673 528, Kerala (Mobile Number: 8157858021)
7. Shylamma Thomas, Arackel House, Koyiparamb, Koorachundu Post, Kozhikode – 673 527 (Mobile Number: 95675231188).
8. Joby Manoj, Edathi House, Koorachundu Post, Kozhikode – 673 527, Kerala (Mobile Number: 7306120745)
9. Remi Joseph, Ponganpara House, Chembanoda Post, Kozhikode – 673 528, Kerala (Mobile Number: 9744366102)
10. Mr.Sabu Jacob, Randuplackal House, Avadukka post, Kozhikode – 673 528, Kerala

(Mobile Number: 9447346325)

7. Mr.Kunhiraman P, Keezhillathu House, Kallode, Perambra Post, Kozhikode 673 525, Kerala, (Mobile Number: 9645055963)
8. Stalin. M, Malayil House, Peruvannamuzhi Post, Perambra, Kozhikode – 673 528, Kerala (Mobile Number: 9048503274).
9. Panakkavayal Agricultural Nursery, C/o Mr.George Thomas, Panakkvayal House, Koorachundu, Kozhikode - 673 527 (Mobile: 9645492007)
10. Raju Paikayil, Paikayil House, Peruvannamuzhi Post, Kozhikode – 673 528
11. Rajesh. E.M, Punarjani, Iyyatteri Madathil, Pantheeramkavu P O, Kozhikode- 673 019 (Mobile Number: 8111964785/9142064785).

Economic Impact of Value Chain Interventions in Turmeric (KVK, Alappuzha)

Introduction

Turmeric (*Curcuma longa*) is a major spice crop with high potential for export, which can be cultivated in homesteads and as intercrop in coconut gardens. Even though known for turmeric farming in history, Alappuzha district lost its status when farmers faced constraints like poor yielding varieties, low market price, and lack of processing facilities which resulted in poor returns from the crop. The non-profitability of turmeric farming brought down the enthusiasm of farmers. As per 2012-13 statistics, Alappuzha district stood at the second last position among all the districts in Kerala with an area of 33 ha and production of 33 t cured turmeric. At this stage, Krishi Vigyan Kendra –Alappuzha started making efforts to improve the turmeric farming sector in the district through a package of value chain interventions *viz.*, identifying high yielding varieties suitable to the agro-ecological situation, good agricultural practices like soil test based nutrition and pest and disease management, efficient processing technologies and marketing initiatives.

Major gaps/problems identified

- Underutilization of interspaces of coconut gardens
- Non adoption of high yielding varieties of turmeric
- High cost of inputs and cultivation but low cost of produce
- Lack of scientific cultivation practices
- Lack of processing facilities
- Unorganized marketing system
- Altogether leading to low income for farmers

Interventions of the KVK

- Identification of the problems faced by turmeric farmers through group meetings, field visits, and discussion with officials of line departments were done.
- Capacity building of farmers and entrepreneurs for scientific and profitable cultivation of turmeric and processing were planned. Technology assessments and front line demonstrations to address the identified and prioritized problems were taken up. Assessment of high yielding turmeric varieties as intercrop in coconut gardens, Demonstration of scientific cultivation of IISR-Prathibha, Assessment of short duration turmeric variety IISR-Pragati, Demonstration of IISR-Pragati, Demonstration of integrated management of dry rot and turmeric rhizome maggot management, Micro nutrient management for productivity enhancement of turmeric using IISR- micro nutrient mix and introduction of turmeric boiler for processing turmeric were done as part of the technology interventions.
- Enhancement of production, and productivity could be achieved through the interventions. Further enhancement of profitability in turmeric cultivation through

value chain interventions from good quality HY seeds to value addition and marketing were planned and organized activities to achieve them.

- Formation of a Farmers Producer Company named ‘Onattukara Spices Farmer Producer Company Limited’ (OSFPC) was initiated during 2016 with the financial support of NABARD and the FPC was registered with KVK as the POPI and with 300 shareholders from 6 panchayaths of Bharanikkavu block.
- The company started providing good quality planting materials and KVK resource persons took up timely field visits and advisory services for improving the cultivation of turmeric.
- OSFPC started aggregation, processing, value addition, branding and marketing of turmeric in the form of seeds, dried figures, powder etc.

All these activities resulted in enhancement of the farmers’ income (Table 1) and spread of turmeric farming to larger areas in the district and even in adjacent districts.

Table 1 Enhancement of yield and income from turmeric over a period of 5 years

Variety	Av. Yield (kg/ha)	Cost of cultivation (Rs./ha)	Gross income (Rs./ha)	Net income (Rs./ha)	BCR
Local	9362	205445	234050*	25605	1.12
Prathibha	20040	353200	601200**	248000	1.70
Pragati	19460	353200	583800**	230600	1.65

*Average market price of fresh rhizomes: Rs 15-25/kg

**Realized by shareholder farmers: Rs.25-30/kg

Procurement: OSFPC procured 7.8 t of fresh turmeric rhizomes from 25 farmers in 2016-17 which gradually increased to 28.5 t from 75 farmers in 2023-24.

Spread of the technology

- To strengthen the activities of the FPC and further ensure the spread of the technologies, KVK initiated a project on ‘Value Chain in Turmeric’ for implementation in 10 Grama panchayaths of the adjacent Mavelikkara and Chengannur blocks with 300 farmer partners on a cluster approach.
- Farmers were mobilized in clusters of 25-30 in all the 10 panchayaths and trainings were given to all the partners farmers in ‘Scientific production of turmeric’
- 10 WhatsApp groups were formed for timely advisories like weather updates, crop production, pest and disease management, harvesting, processing and value addition.

- Turmeric cultivation with high yielding varieties in an area of 12.0 hectare was achieved by the partner farmers over a period of three years with average production of 15-18 t/ha

Thus more than 1500 farmers of the district and adjoining districts directly involved in turmeric cultivation with the continuous interventions of KVK.

Economic impact of the technology

- ✓ As a result of the interventions, the average production of high yielding varieties of turmeric was 20 tons per hectare compared to 9.3 t/ha of local varieties prevalent earlier. The average cost of production was Rs. 353200/hectare with a net income of Rs.248000/ha resulting in a benefit cost ratio (BCR) of 1.70.
- ✓ 90-100 man days of employment was created for the cultivation per ha
- ✓ 20-25 man days employment was created for processing the produce from a ha
- ✓ Turmeric became an important intercrop in coconut based cropping system

Horizontal spread/ Extent of area coverage

Good quality seed materials of high yielding turmeric varieties of Prathibha, Pragati and Alleppey supreme varieties were ensured by KVK and OSFPC and were provided to farmers not only in the district but also to neighboring districts like Pathanamthitta, Kollam, Kottayam and Ernakulum for further area expansion. More than 780 farmers adopted the cultivation of high yielding varieties of turmeric in the adjacent districts of Alappuzha resulted in an area expansion of 36.5 hectares from the seeds supplied by KVK and OSFPC alone (Table 2).

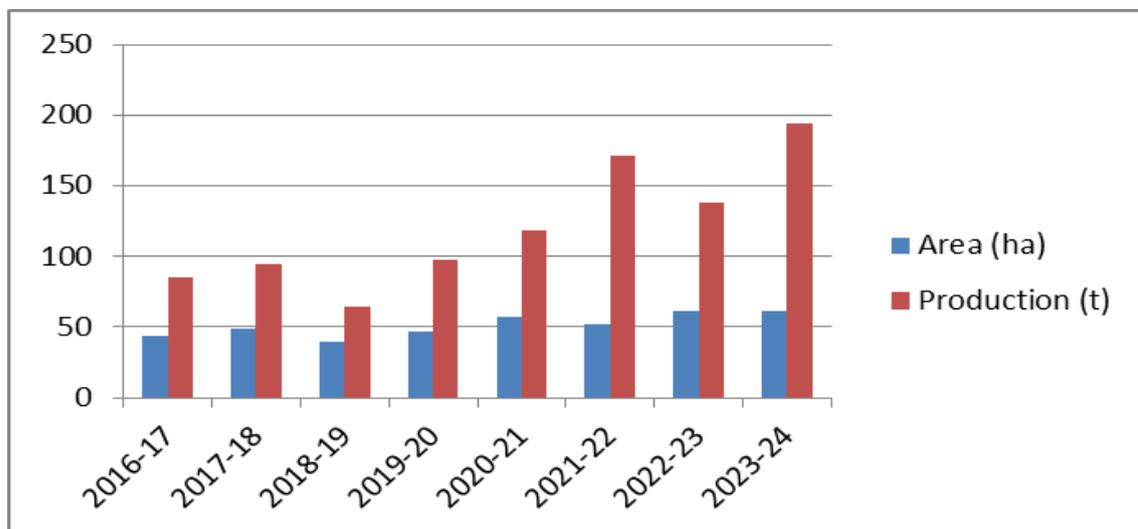
Table 2. Horizontal (Area) expansion of HY variety of turmeric by KVK and FPC interventions (alone) in Alappuzha and adjoining districts and the economic impact

Year	Additional area cultivated (ha)	Av. Yield (t/ha)	Production due to area expansion (t)	Gross returns (Rs., lakhs)
2016-17	1.4	20.4	28560	7.14
2017-18	5.5	21.5	118250	29.56
2018-19	13.8	21.2	292560	73.14
2019-20	22.9	21.75	498075	124.52
2020-21	26.2	21.75	569850	142.46
2021-22	28.4	21.8	619120	154.78
2022-23	31.9	21.85	697015	174.25
2023-24	36.5	22.0	803000	200.75

Summary

As a result of the value chain interventions pursued in the turmeric farming sector for a decade, significant achievements could be made by the KVK and the related organizations promoted by the KVK. The area of cultivation of turmeric and production increased from 31 ha and 31 ton cured turmeric in 2012-13 to 61 ha and 194 ton, respectively in 2023-24 (Fig 1) as per the Govt. estimates (Agricultural Statistics, Dept. of Economics and Statistics, 2023-24). This increase in area and production of turmeric in the region especially Alappuzha district is phenomenal and has attracted the attention of many exporters and entrepreneurs in addition to the enhanced internal consumption of good quality turmeric powder.

Fig 1. Change in area and production of (cured) turmeric in Alappuzha district from 2016-17 to 2023-24.



Photos of interventions/activities





Enhancing Cowpea Yield and Income through Foliar Application of ‘KAU Sampoorna Multi Mix’ (KVK, Kollam)

Introduction:

Vegetable cowpea (*Vigna unguiculata* var. *sesquipedalis*), popularly grown in Kollam district for its good market price, year round cultivation and consumer preference, also enriches soil fertility through nitrogen fixation. The high-yielding variety ‘Vellayani Jyothika’, with a potential yield of 18 t/ha, is widely cultivated, yet farmers harvest only 10–11 t/ha, leaving a considerable yield gap. This reduction is largely due to soil acidity, toxic levels of iron, manganese and aluminium, and deficiencies of calcium, magnesium and boron, which are typical of the midland laterite soils of Kollam. Indiscriminate use of complex fertilizers without soil test recommendations further aggravates nutrient imbalances, while pests, diseases and unfavourable weather also contribute to yield loss. Soil health studies confirm these challenges, underlining the need for balanced nutrient management. Krishi Vigyan Kendra, Kollam has addressed this issue by promoting foliar application of secondary and micronutrients through KAU Sampoorna Multimix, which ensures efficient nutrient absorption, corrects deficiencies, improves crop vigour, pod length and yield, and reduces dependency on excessive soil-applied fertilizers, thereby offering a sustainable and profitable solution for vegetable cowpea growers.

Main problem identified:

In Kollam district, the cultivation of vegetable cowpea is often constrained by poor soil health and imbalanced nutrient management practices. In the existing farmer’s practice, most cowpea growers largely depend on the indiscriminate application of complex fertilizers, applied directly to the soil without considering soil test results or the recommendations provided in the soil health card. This approach not only results in an unbalanced nutrient supply but also worsens inherent soil problems such as high acidity and toxicities of iron, manganese, aluminium and phosphorus. These conditions lead to reduced availability of essential secondary and micronutrients such as potassium, zinc and magnesium. Consequently, nutrient uptake by cowpea plants is poor, leading to low yields of around 10–11 t/ha, much below the potential yield of the crop. Another critical gap in the existing practice is the lack of attention given to foliar nutrition. Farmers tend to overlook the importance of foliar application of secondary and micronutrients, even though these nutrients play a vital role in supporting the crop during critical growth stages such as flowering and pod formation.

To address these issues, KVK Kollam has demonstrated an improved practice centred on balanced nutrient management with special emphasis on foliar application of KAU Sampoorna Multimix. This multi-nutrient formulation contains a well-balanced combination of secondary and micronutrients, including zinc, boron, copper, iron, manganese, molybdenum, potassium, magnesium, nitrogen and sulphur. When applied as a foliar spray, these nutrients are rapidly absorbed by the leaves, ensuring efficient utilization by the plant. This not only reduces wastage and minimizes the chemical load on soil but also ensures the timely availability of nutrients exactly when the crop needs them. Farmers who adopted this practice observed significant improvements in crop vigour, pod length, and overall yield. By correcting soil-related nutrient

deficiencies and toxicities through targeted foliar feeding, the improved practice helped bridge the yield gap and contributed to enhanced farm income, offering a sustainable, economically viable solution for vegetable cowpea growers in the district.

Technology:

The application of KAU Sampoorana Multimix at 5 g/L is strategically recommended at 30, 45 and 60 DAS for direct-sown crops and 15, 30 and 45 DAT for transplanted crops to ensure that the plants receive timely supplementation of secondary and micronutrients during their critical growth stages. These periods correspond to phases of active vegetative growth, flowering, and pod/fruit development, when the crop's nutrient demand is at its peak. Foliar application at these intervals ensures better physiological growth, efficient nutrient absorption and corrects deficiencies which ultimately enhances yield and quality of pods. This schedule also helps reduce dependence on indiscriminate soil fertilization, thereby minimizing soil toxicity and improving long-term soil health.

Feedback of the technology:

The farmers who participated in the frontline demonstrations of KAU Sampoorana Multimix in cowpea cultivation shared highly positive experiences regarding the performance of the technology. They consistently reported that the foliar application of this multi-nutrient formulation resulted in visibly better crop vigour, healthier foliage, improved flowering, and longer, more uniform pods compared to their usual farmer practices. One of the most significant advantages highlighted was the effective correction of nutrient deficiencies, which are common in the midland laterite soils of Kollam. The soils in this region are highly acidic and often suffer from toxicities of iron, manganese, and aluminium, along with deficiencies of essential nutrients such as calcium, magnesium, zinc, and boron. Farmers acknowledged that, through timely foliar feeding, these deficiencies were efficiently addressed, allowing the crop to achieve healthier growth and greater productivity.

Another major benefit observed by the farmers was the reduced dependence on indiscriminate use of complex fertilizers applied to the soil. In the traditional practice, heavy reliance on such fertilizers not only failed to provide balanced nutrition but also contributed to soil degradation and increased cultivation costs. By adopting KAU Sampoorana Multimix as a foliar spray, farmers were able to optimize nutrient use efficiency, reduce wastage, and lower their overall expenditure on fertilizers. This change directly contributed to lowering the input costs of cultivation.

The demonstrations also revealed a clear yield advantage. Farmers recorded an average yield increase of 3.25 t/ha compared to their conventional practice. This improvement translated into a substantial rise in net returns, thereby enhancing the profitability of cowpea cultivation. The combination of higher yields, reduced costs, and improved soil health convinced many farmers of the economic and environmental benefits of this improved practice.

Overall, the farmers expressed high levels of satisfaction with the technology. They not only appreciated the immediate results in terms of better crop performance but also recognized its

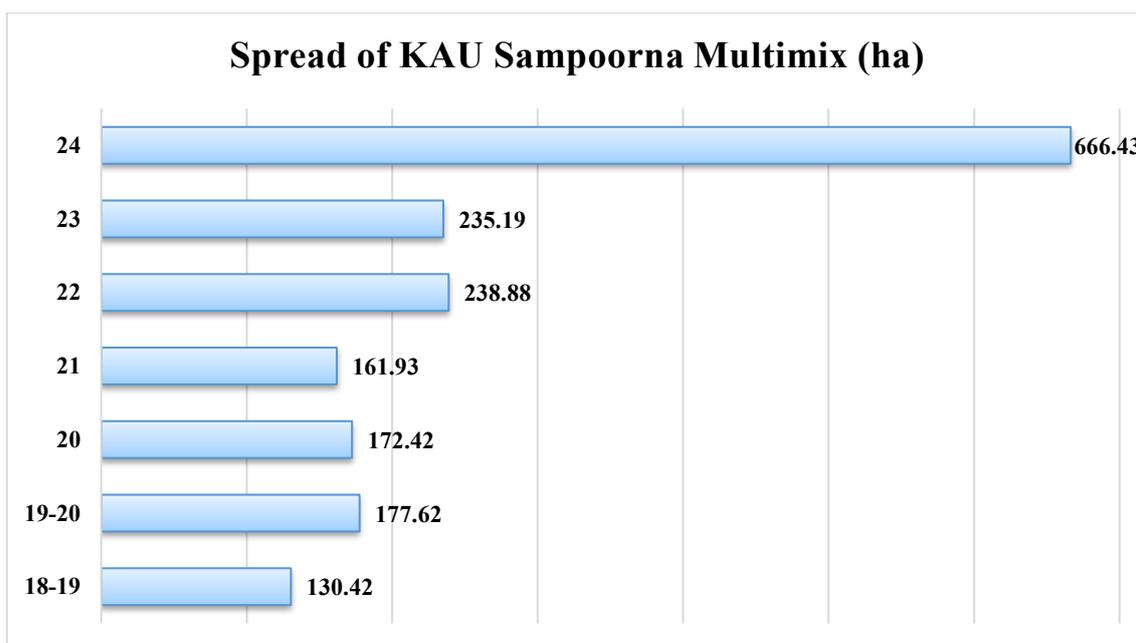
potential for long-term sustainability. Many recommended that the practice be extended and popularized among a larger number of vegetable growers in the region. Given its economic viability, ease of application, and ability to address critical soil and nutrient-related constraints, farmers strongly endorsed the wider adoption of KAU Sampoorna Multimix, particularly in cowpea but also in other vegetable crops grown under similar soil conditions.

Spread of technology:

The spread of KAU Sampoorna Vegetable technology in Kollam district clearly demonstrates a progressive adoption pattern over the years, highlighting its increasing popularity and acceptance among farming communities. In 2018–19, the technology was introduced on a modest scale, covering 130.42 hectares. This was followed by a steady rise to 177.62 hectares in 2019–20, reflecting initial farmer confidence in the technology’s benefits. During 2020 and 2021, however, the coverage slightly dipped to 172.42 hectares and 161.93 hectares, respectively, largely due to external factors such as unfavorable weather conditions and disruptions caused by the pandemic, which temporarily slowed down technology dissemination and adoption. Despite this short-term setback, the resilience of the technology was evident in the years that followed.

By 2022, the adoption expanded significantly to 238.88 hectares, as more farmers recognized the effectiveness of KAU Sampoorna Multimix in addressing critical soil-related issues, particularly in the midland laterite areas where acidity, nutrient deficiencies, and toxicities are prevalent. The area under adoption remained relatively stable at 235.19 hectares in 2023, indicating a consolidation phase where farmers continued to use the technology with confidence. The most remarkable growth occurred in 2024, when the adoption area surged to 666.43 hectares, representing nearly a threefold increase within a year. This sharp jump highlights the strong farmer-to-farmer diffusion of the technology and the visible impact it created in terms of better crop vigour, higher yields, and improved profitability.

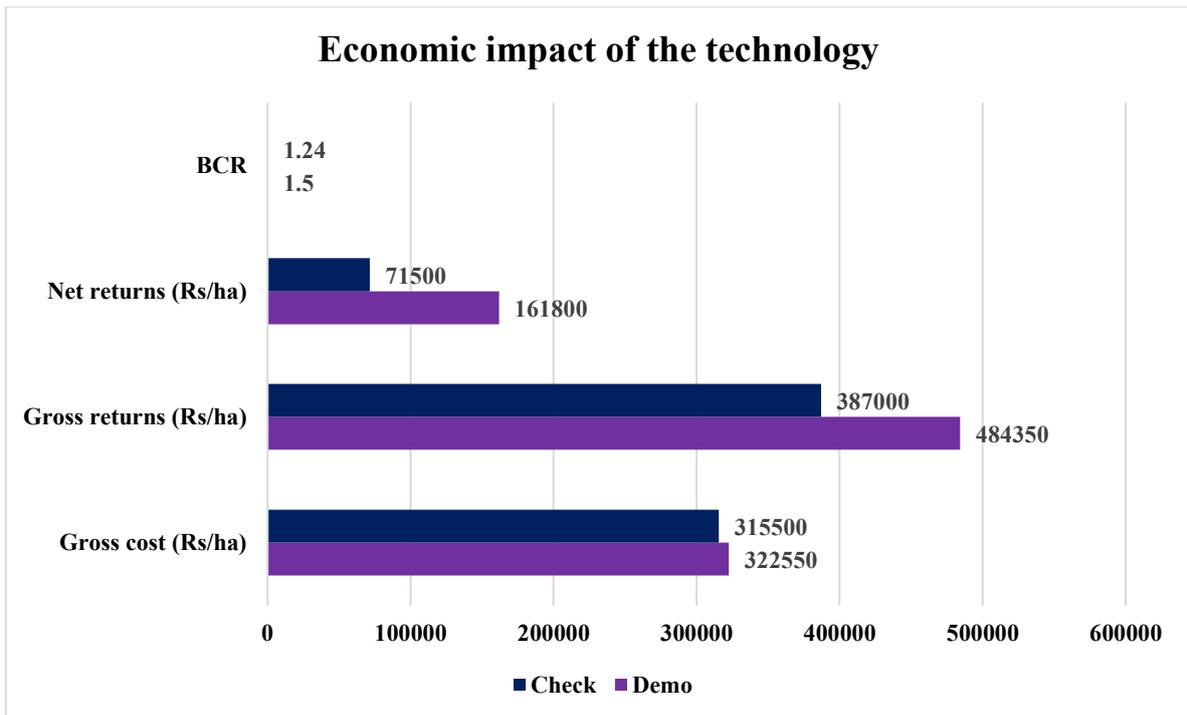
Overall, this upward trend reflects the growing confidence of farmers in KAU Sampoorna Multimix, underscoring its relevance as a sustainable, economically viable solution for vegetable production in Kollam district and beyond.



Economic impact of technology:

The economic impact of KAU Sampoorna Multimix was clearly demonstrated through the frontline demonstrations, where a comparative analysis between the improved practice (Demo) and the existing farmer's practice (Check) revealed significant advantages. Although the gross cost of cultivation in the Demo plot (₹3,22,550/ha) was marginally higher than in the Check (₹3,15,500/ha), the additional investment proved highly beneficial. The gross returns achieved in the Demo were substantially higher at ₹4,84,350/ha compared to only ₹3,87,000/ha in the Check, showcasing the positive influence of balanced nutrient management and efficient foliar feeding through KAU Sampoorna Multimix. This improvement in returns translated into a remarkable increase in net returns, with Demo plots recording ₹1,61,800/ha, more than double the ₹71,500/ha achieved under the farmer's practice.

The profitability of the technology was further validated through the Benefit–Cost Ratio (BCR), which stood at 1.50 in the Demo against 1.24 in the Check. This clear advantage highlights the superior economic efficiency and sustainability of the improved practice, even with slightly higher cultivation costs. Farmers benefitted not only from increased yield but also from reduced dependency on indiscriminate fertilizer use, leading to better resource utilization and improved soil health in the long run. The results underline that the adoption of KAU Sampoorna Multimix is both economically viable and profitable, offering farmers a reliable means to bridge yield gaps, enhance income, and ensure sustainability in vegetable cultivation. Thus, the demonstrations strongly established the technology's potential for wider adoption among farming community of Kollam.

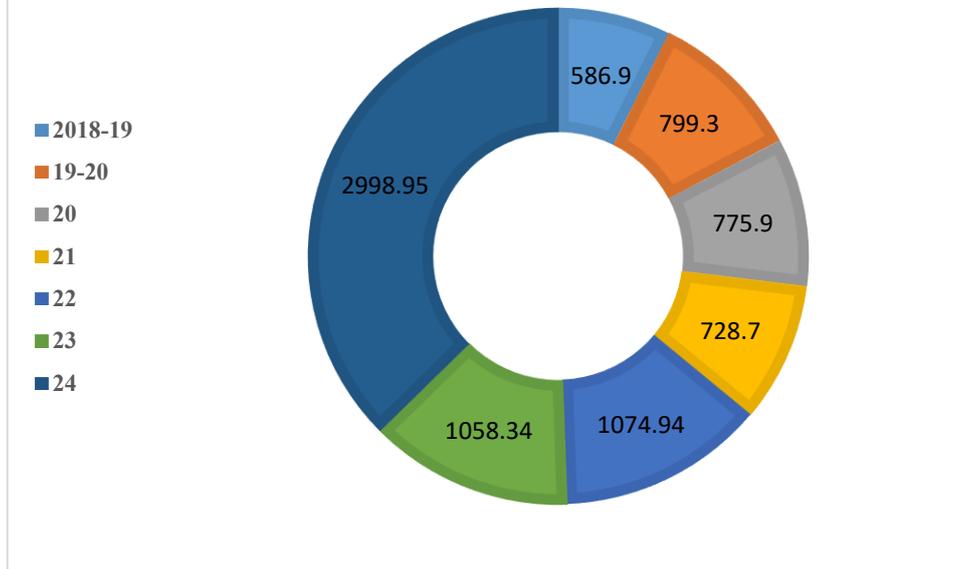


Horizontal spread of the technology:

KAU Sampoorana has emerged as one of the most effective and widely accepted nutrient management interventions for vegetable cultivation in Kollam district, owing to its proven efficiency in correcting soil-related nutrient deficiencies and enhancing crop productivity. The technology was initially procured from the Regional Agricultural Research Station, Pattambi, Kerala Agricultural University, and introduced to farmers in Kollam through the efforts of KVK. In view of the steadily rising demand from farmers and the need for timely availability of the input, KVK Kollam established its own production unit under the Revolving Fund programme. This step ensured self-sufficiency in production, reduced dependence on external supply, and facilitated easy access for farmers, thereby contributing to the faster and wider adoption of the technology across the district.

The production of KAU Sampoorana Multimix at KVK Kollam has shown a generally upward trend over the years, reflecting both increasing demand and the impact of systematic extension efforts. Starting with 586.9 kg in 2018–19, production rose to 799.3 kg in 2019–20. Although a slight dip was recorded in 2020 (775.9 kg) and 2021 (728.7 kg), this was followed by a strong recovery in the subsequent years. Production crossed the one-tonne mark in 2022 with 1074.94 kg and remained steady at 1058.34 kg in 2023. The most remarkable achievement came in 2024, when production reached an impressive 2998.95 kg, showing nearly a threefold increase over the previous year. This sharp growth was directly linked to higher farmer demand, successful frontline demonstrations, and extensive outreach activities led by KVK Kollam. The expansion in production not only underlines the growing popularity of KAU Sampoorana Multimix but also highlights its economic impact and sustainability, reinforcing KVK Kollam’s pivotal role in scaling up this KAU innovation for the benefit of the farming community.

PRODUCTION OF KAU SAMPOORNA MULTIMIX (KG)



Summary

The introduction of KAU Sampoorna Multimix by KVK Kollam effectively addressed the yield gap in cowpea cultivation caused by soil acidity, nutrient deficiencies, and indiscriminate fertilizer use, enabling farmers to achieve improved crop vigour, longer pods, and an average yield increase of 3.25 t/ha, which translated into higher income and reduced input costs. Adoption steadily expanded from 130.42 ha in 2018–19 to 666.43 ha in 2024, supported by the establishment of a production unit under the Revolving Fund that scaled up production from 586.9 Kg to 2998.95 Kg over the same period. Economic analysis further demonstrated the impact, with net returns of ₹1,61,800/ha in Demo compared to ₹71,500/ha in Check, and a higher Benefit–Cost Ratio (1.50 vs. 1.24). These outcomes highlight the strong economic viability, sustainability, and wide farmer acceptance of KAU Sampoorna Multimix as a key nutrient management intervention for vegetable cultivation in Kollam district.

Enhancing Farmers' Income through Mushroom Cultivation: Initiatives by KVK, Trivandrum

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Introduction

ICAR-Krishi Vigyan Kendra, Mitraniketan, Trivandrum has been at the forefront of promoting mushroom cultivation in Kerala. Recognizing its potential as a low-investment, high-return enterprise, particularly well-suited for small and marginal farmers, the KVK has actively advanced this sector through a holistic approach. This includes capacity building, input support, and practical field-level interventions. By regularly producing and supplying quality mushroom spawn, establishing demonstration units, and offering vocational training, the KVK has enabled farmers, farm women, and rural youth to adopt mushroom cultivation as a sustainable and viable source of income.



Major Problem Identified

Despite the growing demand and nutritional importance of mushrooms, several challenges limit its widespread adoption:

- Lack of technical knowledge in mushroom production and spawn handling.
- Capital constraints and difficulty in accessing credit.

- Input unavailability, particularly quality spawn and infrastructure.
- Labour shortage for sustained operations.
- Marketing issues: limited local demand, perishability, low prices, and high transportation costs.
- Low volume of production, making market presence difficult and less profitable.

Intervention of KVK to Address the Problem:

KVK implemented a range of strategic interventions to overcome these barriers:

- **Training Programs**
- **Demonstration Units**
- **Spawn Production**
- **On-Farm Trials (OFTs) and Front Line Demonstrations (FLDs)** to introduce improved techniques.
- **Vocational Training:** Special focus on spawn production training for skill development.
- **Field Visits & Consultations:** Continuous handholding and free advisory services.
- **Method Demonstrations & Entrepreneurship Development programs.**
- **Extension literature**
- **Telecast of successful entrepreneurs**

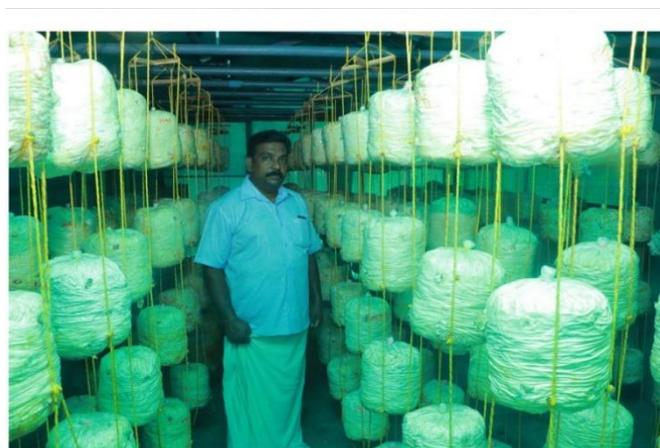
To address the multifaceted challenges faced by mushroom cultivators, the KVK adopted a strategic and holistic approach through a range of targeted interventions. Recognizing the need for skill development and hands-on experience, KVK organized regular training programs, each engaging an average of 30 farmers per batch. These sessions not only built technical know-how but also instilled confidence among participants. To bridge the gap between theory and practice, low-cost mushroom cultivation demonstration units were established, allowing farmers to gain practical exposure. A significant boost came from the establishment of an in-house spawn production unit, capable of producing over 1,000 spawns per month, ensuring timely and accessible input supply for local entrepreneurs. On-Farm Trials (OFTs) and Front Line Demonstrations (FLDs), which introduced and validated improved cultivation techniques under real-world conditions. Further, vocational training programs were tailored specifically for spawn production, equipping rural youth and women with valuable entrepreneurial skills. Continuous support was provided through field visits and personalized consultations, offering

farmers free advisory services and technical assistance. Additionally, method demonstrations and entrepreneurship development programs were conducted to nurture agripreneurs and enhance business readiness. To reinforce learning and extend outreach, extension literature was distributed widely, complemented by the telecast of success stories of progressive entrepreneurs, serving as a powerful motivational tool for the farming community. Through this integrated and farmer-centric approach, KVK effectively empowered local communities to adopt mushroom cultivation as a viable and sustainable livelihood option.



Feedback of Technology

- Farmers found the technology practical, affordable, and replicable even with minimal space.
- High appreciation for ease of adoption, particularly by women and landless farmers.
- Entrepreneurs commended the availability of quality spawn and regular technical guidance.
- Some farmers reported challenges in managing environmental conditions, but these were addressed through KVK advisory support.

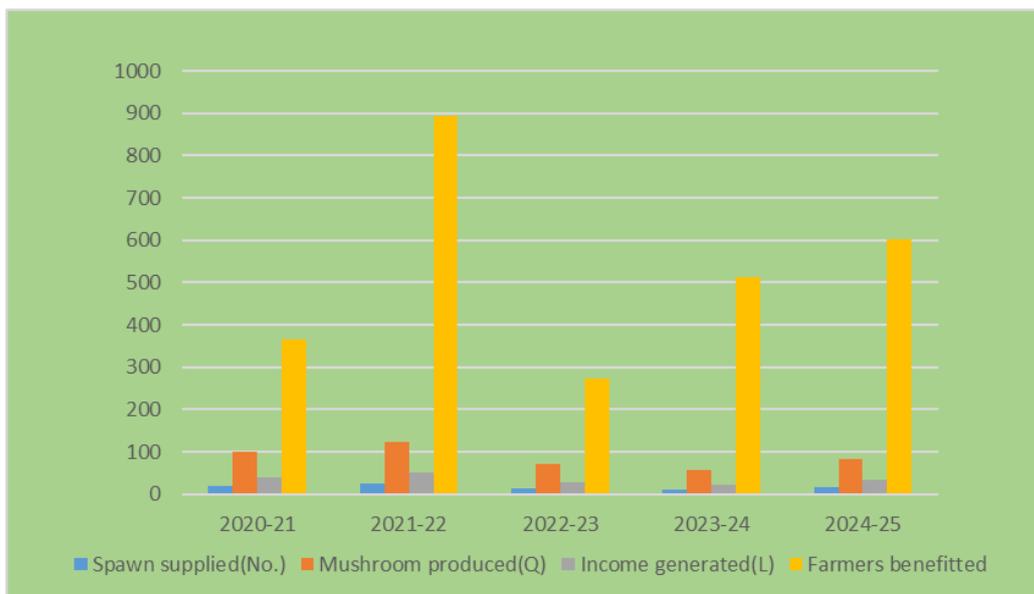


Spread of Technology

- Over time, 54 small-scale and 24 large-scale mushroom production units were established.
- Mushroom-based enterprises gained traction as alternative income streams in both rural and peri-urban areas.
- Awareness and skill-building efforts significantly improved the uptake among youth and women.

Economic Impact of Technology

Year	Spawn supplied(No.)	Mushroom produced(Q)	Income generated(L)	Farmers benefitted
2020-21	20.25	101.25	40.5	365
2021-22	24.94	124.695	49.88	893
2022-23	14.16	70.845	28.34	274
2023-24	11.23	56.13	22.45	514
2024-25	16.49	82.44	32.97	603
Total	87.07	435.36	174.14	2649



Over 5 years, 174.14 Lakhs was generated in additional income for 2649 farmers.

The initiative not only improved household income but also provided sustainable employment, especially for women and youth.



Other Beneficial Effects of Technology

- **Nutritional security:** Mushroom consumption enriched diets with high-quality proteins and vitamins.
- **Health benefits:** Low calorie, high-fiber, cholesterol-free mushrooms were especially beneficial for diabetics and hypertensive patients.
- **Women empowerment:** A large number of units are operated by women self-help groups and housewives.
- **Employment generation:** Spawn production and value-added mushroom products created micro-enterprises.
- **Skill enhancement:** Vocational training enabled youth to take up agripreneurship.

Horizontal Spread of Technology

- Trained farmers have become resource persons, extending support and mentoring to new growers.
- KVK-facilitated linkages with other institutions and markets helped expand the practice.

Extent of Area Coverage

While mushroom cultivation is not land-intensive, its household-based model ensured wider coverage. More than 78 production units were supported across multiple Panchayats. Spread is not in acreage but in number of production households, making it highly inclusive.

Summary

KVK's focused approach in promoting mushroom cultivation has significantly contributed to rural livelihood development in Trivandrum district. With a holistic package of training,

technical support, spawn supply, and entrepreneurship development, over 1,800 farmers have gained economically, generating an additional income of ₹174.14 Lakhs over four years. This model of low-cost, nutrition-rich, and space-efficient agriculture stands as a replicable success story in addressing rural unemployment and malnutrition, particularly in regions with marginal or no land holdings.

Backyard freshwater ornamental fish culture using low investment technologies (KVK, Kozhikode)

Introduction:

Ornamental fish keeping is considered to be the second most popular hobby globally after photography. This passion for ornamental fishes in global market gives aqua farmers in India a source of livelihood and export earnings for the country. India is considered as a sleeping giant with contribution of less than 1% to global trade despite having ideal environmental condition for culturing these tropical fishes. The favorable agro-climatic conditions prevailing in the state of Kerala offers significant scope for promoting this activity as a source of supplementary farm income. With the interventions of Government instructions and private entrepreneurs the sector is gaining importance and it has become an additional component for farm income generation in Kerala, where small size of operational holdings and low investment capacity hamper large scale agricultural enterprises.

Major problem identifies

- Non utilization of smaller ponds and backyard area for ornamental fish culture due to lack of knowledge on potential of freshwater ornamental fish farming techniques and as an income generating enterprise among rural women and youth in Kerala.
- High rate of disease incidence in fish that are brought to ornamental fish shops from other states hampering domestic market and quality of fish in farms.
- Poor water quality in culture tanks due to higher stocking density and lack of knowledge among farmers regarding water remediators, bio filtration systems and water quality management practices.
- Poor quality feed: Ornamental fishes that are often cultured in indoor tanks and aquariums have poor colouration, growth and are often susceptible to diseases. This lowers the profit margin of ornamental fish farmers.

Intervention of the KVK to address the problem

The Krishi Vigyan Kendra, Kozhikode under ICAR- Indian Institute of Spices Research has taken many steps to strengthen freshwater ornamental fish sector in the State. It has developed a low investment ornamental fish culture technique for culturing freshwater ornamental fishes at backyard to give additional income for farmers. This technique involves production of ornamental fishes in pools holding less than 1000 liter water and used refrigerator/ fridge containers with 100-200 l capacity. The pools can also be set up using used

flex or silpaulin sheets. The ideal dimension of a small size pools for culturing live bearer fishes is 1.5 m x 0.8 m x 0.4 m (length x breadth x depth or 2.5 m x 1.5 m x 0.4 m set up using 9 ft x 6 ft or 12 ft x 9 ft silpaulin /flex sheet (minimum 120 gsm thickness) respectively. These pools need to be constructed on an elevated area or at a higher terrain so as to enable bottom water exchange by gravity. The pools can also be erected on roof top of house employing wooden frames or at backyard using bricks/ laterite stones. Used fridge boxes which are often discarded as scrap after removal of metal part can also be used for culturing and breeding ornamental fishes. The holes in the rigid foam/plastic (poly urethane/ poly styrene) can be easily sealed with commercial adhesives or by plastering with cement. At weekly interval 20 % of bottom water is exchanged and this water is used for irrigating plants. This integrated farming approach uses more crops per drop of water.

Various varieties of freshwater live bearer fishes like pure strains of guppy (*Poecilia reticulata*), Platy (*Xiphophorus sp.*), Molly (*Poecilia latipinna*) or Swordtail (*Xiphophorus helleri*), which belong to the family poecillidae are cultured. These small size fishes with less than 10 cm length reach marketable size in four months and give assured income to farmers on monthly basis. Even egg laying fishes like gold fishes, small carps, angel fish, oscars etc. can be cultured in these tanks. In case of higher stocking density addition filtration or water remediators can be used.

KVK has provided institutional hand holding of rural youth and women to undertake ornamental fish culture. End to end support including training, technical advisory service, water quality analysis, mobilize input support such as quality fish, feed including live feed, aquarium accessories and marketing support are provided.

KVK Kozhikode has been promoting freshwater ornamental fish culture in Kerala through capacity building programmes (on and off campus) and has been catering to the needs of the sectors through other interventions such as OFT, FLD programme to benefit ornamental fish farmers. It has implemented two external funded projects of Dept of Biotechnology (DBT) New Delhi and NABARD to strengthen the sector. Many programmes have also been implemented with the linkage NGOs. KVK has an ornamental fish and aquatic plant demonstration unit apart from a marketing unit for ornamental fishes where farmers can sell their produce.

KVK has developed an ornamental fish feed which contains carotenoids (marigold petal, spirulina) for colour enhancement; spices (turmeric, garlic), probiotics,

immunostimulants (yeast), vitamins, minerals for growth and disease resistance apart from standard fish feed ingredients. The feed was standardized and evaluated and it was released by the brand name “Peruma” in 2018.

The marketing facility at KVK has been opened to the farmers through Fish Rearers Association North Kozhikode (FRANK) a ornamental fish farmers society which was formed by KVK. The farmer benefits from the extensive market linkage of KVK and the sale proceeds are credited to the farmer. The hassle-free marketing support is provided at nominal charges.

 <p>Backyard ornamental fish unit of Mrs Sibitha establishes using scrap fridge boxes and used drums</p>	 <p>Dr. V Venkatasubramanian, ICAR Director ATARI Zone XI visiting ornamental fish unit of Mrs Sali of Kozhikode</p>	 <p>High density ornamental fish farming unit of FRANK supported by NABARD</p>
 <p>Advance fish breeding units of Mr. Sonu</p>	 <p>Ornamental fish unit of Mr. Sumesh setup using fridge boxes and silpaulin sheets</p>	 <p>FRANK society members selling fish from ornamental fish marketing unit of KVK</p>

Feedback of the Technology

The small scale units which are set up using low investment techniques can be easily run as a part time activity. This means that this activity can be taken up as a subsidiary activity by almost anyone. The outcomes from a project on ornamental fish farming, funded by DBT implemented by KVK, Kozhikode, indicated that women beneficiaries who were new to ornamental fish keeping could earn an average monthly income of Rs. 3000 by spending 1-2

hrs/day. The beneficiaries undertook breeding and rearing of live bearer fishes which could be sold within four months of culture. The average production cost was less than Rs 3 per fish and the average sale price was Rs. 5 to 10 depending on the size and variety. The farm business income from ornamental fish farming can be further enhanced by adopting high density farming practices.

Committed full-time farmers completely engaged in ornamental fish farming are easily earning a monthly income above Rs.50,000 through the sale of ornamental fishes and aquatic plants.

The usage of Peruma fish feed developed by KVK was found to enhance the colouration, growth and disease resistance in ornamental fishes. It showed 5 -10% increase in growth, coloration and gave 35 % increase in value per fish over the conventional feeds. Other technological interventions like use of live feed for rearing fishes and using water quality management practices like biofilters and water remediators have enhance farm production and farm income by 15-25 %.

Spread of the technology

More than 200 small backyard units have been established in Kozhikode district by rural women and youth. Twenty two of them have upgraded to large scale units with infrastructure above 10 lakhs. Farmers from other districts in Kerala also come to KVK for capacity building programmes and for support services. KVK has formed a society of ornamental fish farmers in Kozhikode named FRANK which has 106 members. The marketing facility at KVK is also used by them for marketing fishes and aquatic plants.

Other Beneficial Effects of the technology

The low investment technology developed enables farmers to start the unit with a minimum investment for Rs. 500. Nearly 70% of the trainees have fancied fish culture after attaining training at KVK due to its low investment nature. The used fridge boxes are very handy which can be procured from scrape market for less than Rs.150. It can be sealed with adhesives to make it water tight. At any instance if the farmer decides to windup the activity he can sell it back as scrap. The usage of Peruma feed has improve the quality, health and reproductive efficiency of ornamental fish.

Horizontal Spread of the technology

Farmers from all over Kerala attend the capacity building programmes at KVK Peruvannamuzhi. The ornamental fish demonstration and marketing units help the farmers to see, learn and believe in the technology. The technological inputs like quality ornamental fishes, feed, live feed aquatic plants, fish medicines and accessories has helped many farmers outside district and State to venture into ornamental fish farming.

Extent of area coverage

The technology has spread throughout Kerala and other states like Tamilnadu which itself is the hub of ornamental fish trade in South India. The technologies and efforts of KVK Kozhikode has gained wider reach with the advent of social and print media by which the success stories of KVK trained successful farmers are being documented and popularized.

Summary

Market driven ornamental fish farming has immense scope in a state like Kerala. Presently, nearly 80 per cent of the ornamental fish sold through wholesalers and retail outlets in Kerala are sourced from other states. The bulk of these fishes include low value fishes. The production cost of fish largely depends on the type of water body where it's been cultured. Hence if we effectively utilize the available water bodies and culture fishes according to their requirements, ornamental fish farming can be a lucrative venture even for beginners. There are also allied areas such as farming of aquatic plants suited for aquariums and aquascaping which are highly profitable. These untapped areas along with breeding and culture of ornamental fishes can enhance the income of households. Through active handholding and creation of viable farmer collectives, the state can slowly target export markets and emerge as a major player in ornamental fish farming value chain at the global level.

LARGE-SCALE ADOPTION OF CAGE FISH FARMING: DRIVING AQUA ENTREPRENEURSHIP AMONG RURAL YOUTH (KVK, ERNAKULAM)

Introduction

Rural development relies on implementing sustainable, location-specific models that effectively utilize local ecosystem resources while ensuring active community participation. One of the most impactful outcomes of rural development initiatives is sustainable income generation, which strengthens the rural economy and enhances community well-being. Globally, poverty alleviation through employment generation and small-scale enterprise development has emerged as a proven strategy, particularly in rural settings.

Aquaculture stands out as an ideal enterprise for coastal and inland regions with abundant water resources. Traditionally, small-scale aquaculture in rural areas has primarily catered to domestic needs, contributing little to the broader market or export income. However, the potential of aquaculture goes beyond economic gains. It plays a crucial role in food and nutritional security by supplying high-quality protein and essential micronutrients, particularly benefiting nutritionally vulnerable groups such as pregnant women, lactating mothers, infants, and pre-school children. Moreover, it offers a low-cost source of protein accessible to poorer sections of society.

Developing aquaculture enterprises for marginalized communities with limited landholding often faces challenges due to scale and investment constraints. In this context, utilizing public water bodies for aquaculture through community participation offers a promising opportunity. Cage fish farming is a proven technology that addresses these challenges, enabling landless and rural youth to undertake profitable ventures without heavy capital investment. Over the past decade, several estuaries and backwaters in Kerala have been successfully utilized for cage farming, demonstrating its scalability, profitability, and potential to drive aqua entrepreneurship on a large scale.

Major Constraints in the sector

- High rate of unemployment and low income among youth of coastal area and an efficient and meaningful way of involving them in aquaculture entrepreneurship is through cage fish farming.
- Inadequate Continuous technology support to manage the cage fish farming in different agro climatic conditions.
- Granting of necessary permissions to cage culture in public brackish water bodies
- Lack of Organised marketing to fetch remunerative prices for the produce from cages
- Damage from the biofouling menace *Mytellastrigata* in brackish water cages.
- The diffidence of cooperative banks and gramapachayath to support the cage fish farmers due to fear of failure.

Interventions from KVK to address the constraints

Efforts to tackle the unemployment and low income of coastal rural youth – Most of the coastal rural youth are unemployed and they have interest in the fishing sector. Due to financial issues and lack of banking support they are not confident to start new enterprises like cage fish farming. KVK has conducted a series of group meetings with these youth and imparted

technical know how to them on cage aquaculture. KVK has been instrumental in exposing them to cooperative societies and appraising grama panchayath authorities about their skill sets and interests.

Continuous Technology Support by KVK - KVK has done significant efforts from 2018 onwards for training the rural youth for developing skill in aquaculture and cage fish farming. KVK has conducted two ASCI courses on Aquaculture technician and aquaculture worker where 40 unemployed youth were trained for 200 Hours each for both course, thereby imparting skills on all aspects of aquaculture and cage fish farming.

About the technology- Ezhikkara is a coastal village surrounded by brackish water creeks and Pokkali paddy-shrimp fields located in Paravur taluk of Ernakulam district, Kerala, India. Veerampuzha canal, the main water resource in the area is an extension of Vembanad Lake. Ezhikkara is rich in biodiversity including various mangrove species and more than 32 species of euryhaline fishes such as Pearlsplit, Mullet, Asian seabass, Red snapper, Giant trevally, Shrimps, Milkfish, etc. The average water depth in the area ranges from 1.2-6.0 m with a variation of 0.3 to 1.0 m depending on tidal fluctuations. The seawater intrusion from the Arabian sea and freshwater from the Periyar river maintains the salinity of the area in the range of 0-28 ppt with freshwater conditions during monsoon. The total population in Ezhikkara is 17,201 with a population density of 1,126/km². The literacy rate of Ezhikkara is 95.49 percent and 4303 numbers engaged in various works of which 46 were cultivators and 75 agricultural laborers. The cost incurred per single cage unit was Rs. 1.6 lakh in which the bank provided 1 lakh as a loan towards cage installation (Rs.60,000/-), seed procurement (Rs.30,000/-), and feed cost (Rs.10,000/-). The rest of the amount was contributed by the farmers. The bank provided a 3 percent reduction in the interest of agriculture loans and also provided start-up capital at the rate of 4 percent. Floating fish cages 22 in numbers each of size 4m×4m×2m size were fabricated locally as per the design of KVK and installed in the initial years. Asian Seabass fingerlings 500 to 650 numbers stocked in each cage and fed during dawn and dusk. The salinity was monitored by a handheld refractometer (Erma, India). Average survival percentage and growth rate were observed and periodical grading was done. Periodical review meetings were also conducted and technology backstopping extended from KVK.

Aquaculture enterprise development for marginalized communities living in small landholdings is challenging due to the economic scale of operation. However, aquaculture ventures in public water bodies with community participation possess a ray of hope. Cage fish culture is a proven technology that can be taken up in public water bodies by rural and landless poor without any huge investment and is field-tested and proved in Kerala. Several estuaries and backwaters in Kerala have been used for Aquaculture during the last decade. The Kadamakkudy Grama panchayath in Ernakulam district of Kerala during the year 2013-14 accorded permission for Cage fish culture in Veerampuzha backwaters under their jurisdiction with the technology support of KVK Ernakulam.

KVKs assistance to the groups in getting necessary permissions for cage culture- The Palliyakkal service co-operative bank ltd. (PSCB), a local finance organization established in 1943 plays a significant role in creating livelihood for residents through the promotion of rural enterprises including farming in Ezhikkara. They form farmer groups, provide finance and facilitate farm produce marketing. The Ernakulam KVK has identified many location-specific farming technologies for Ezhikkara and cage fish farming is one among these and took initiatives to introduce the rural youth groups to cooperative society authorities to facilitate the financing for their activities. The Ezhikkara Grama panchayath is the local administrative unit that is also working towards the upliftment of the social and economic status of the area. They

are responsible for according permissions and licenses for the enterprises in the said area. Due to KVKs involvement, a committee constituted by Ezhikkaragrama panchayath (EGP) made necessary inspections and issued a license to take up cage farming in the Veerampuzha river that is a public water body.

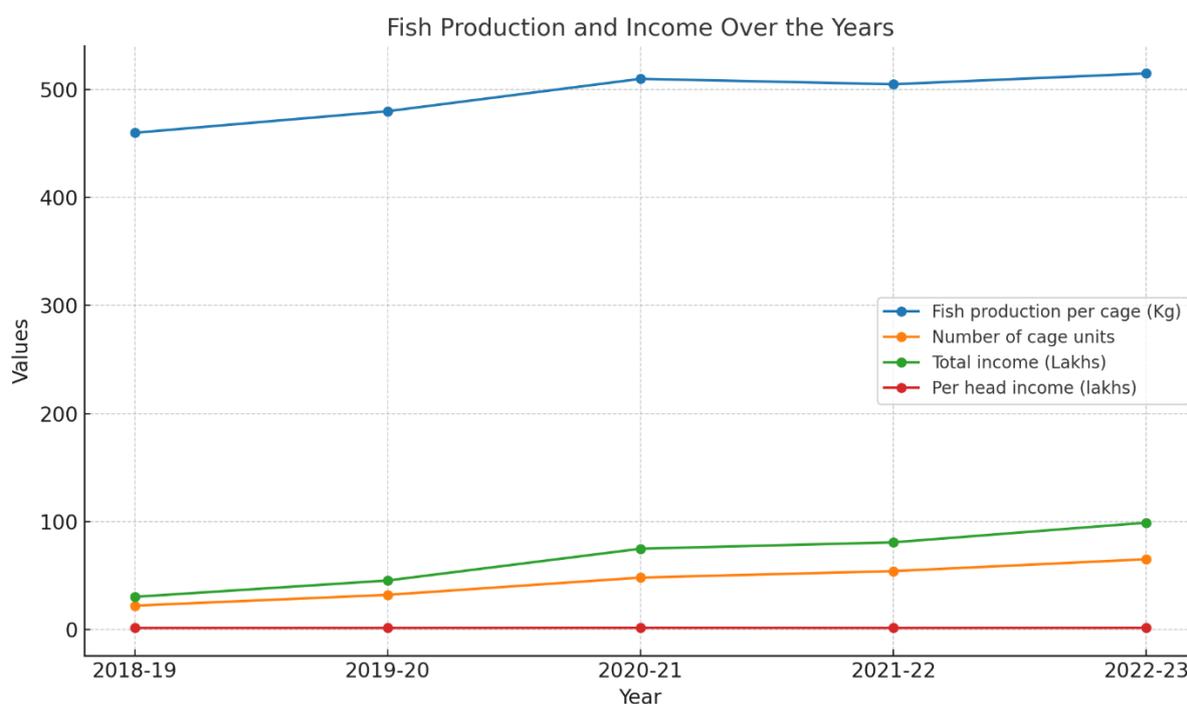
KVKs Introduction of new marketing strategies for cage fish farmers-

The fish produced at Ezhikkara is traditionally being supplied to Paravoor market where the price is fixed by auction agents that vary depending on the product abundance and demand. Excess products lead to a reduction in price and vice versa. Abundance counts the price than quality. The farmers need to spend on ice, vehicle hire, and auction commission of 10 to 20 percent to sell through this system.

In order to bypass this marketing system, the KVK introduced *Farmgate markets* wherein farmers sell their produce live directly at the farm gate by attracting consumers to farms through advertisements floated by KVK . Consumers get the opportunity to see the farm, farming method, and source live fish. The main advantage of this method is that farmer gets 35 percent additional income by avoiding the middleman and other post-harvest expenses. Proper planning to attract the attention of the consumers via publicity through media and facilities for doing live fish marketing was provided by the bank. A fish food festival was also organized. Various methods used to popularise the sales mela- [The data on production and income realized during the three-year period is summarised in Table 1.](#)

Table 1. Year-wise income

Year	Fish production per cage (Kg)	Number of cage units	Total income (Lakhs)	Per head income (lakhs)
2018-19	460	22	30.14	1.37
2019-20	480	32	45.30	1.42
2020-21	510	48	74.73	1.56
2021-22	505	54	80.65	1.41
2022-23	515	65	98.87	1.52



KVK-PalliakkalSCB Collaboration to Boost Cage Fish Farming in Ezhikkara, Ernakulam-

On 7th October 2024, the Palliakkal Service Cooperative Bank (SCB), in partnership with Krishi Vigyan Kendra (KVK), organized a Farmers Refreshment Programme aimed at advancing the skills of 19 cage fish farmers from Ezhikkara, Ernakulam. This longstanding collaboration, which began in 2018, has played a crucial role in the development of local cage fish farming by combining the financial support of the bank with the technical expertise of KVK. Dr. P.A. Vikas from KVK, who has been actively involved with these farmers since the start of their journey, led the technical orientation session. He addressed critical challenges such as the management of invasive black mussel infestations and ongoing fish mortality issues, offering practical solutions to improve farm efficiency and productivity.

As part of this joint effort, KVK introduced integrated farming systems such as Mud Crab fattening and Green Mussel culture, offering farmers new opportunities to diversify their income and enhance the sustainability of their operations. The Palliakkal Service Cooperative Bank also proposed organizing a live fish marketing mela in partnership with KVK. This event would serve as a platform for farmers to showcase their produce, connect directly with local consumers, and tap into new market opportunities. KVK has supported this initiative, highlighting its potential to raise public awareness and foster greater community engagement in promoting locally farmed fish.



Cage fish farminghands on training



Cage fish farming – Inauguration of live fish harvest and marketing programme



Photo

Training on Cage fish farming

Photo

Title



Fish stocking ceremony at Newly established fish farm



Floating fish growing cages in Veerampuzha river



Live fish sales mela inauguration



SHG member with harvested Asian Seabass	Live fish transportation unit
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Feedback of the Technology

Cage fish culture is an appropriate technology towards creating livelihood for landless poor by utilizing public water bodies provided appropriate technical skills are imparted and produce marketing accomplished by avoiding middlemen. The lessons learned are:

- 1) Ideal season for taking up cage culture in Veerampuzha backwater is September to May
- 2) direct marketing by the farmers is as important as farming to realize a viable profit.
- 3) Uniform pricing needs to be arrived at to avoid competition between farmers.

The success of farming primarily depends on technology backstopping for production and marketing support. The success of community farming depends on the teamwork and the confidence level of the partner farmers. Quality inputs including seeds and feed need to be made ready at the commencement of farming. Fish being sensitive, the water quality needs to be periodically monitored. Periodical cleaning of the cages to ensure sufficient water flow and oxygen availability are also key factors.

Technology Impact of ICAR-ARYA Training Programme (KVK, Malappuram)

Introduction

The ICAR-ARYA (Attracting and Retaining Youth in Agriculture) programme implemented by Krishi Vigyan Kendra (KVK), Malappuram, has played a pivotal role in empowering rural youth by equipping them with advanced skills, technological support, and entrepreneurial competencies. The programme primarily focuses on promoting enterprises in Nursery Management and Value Addition of Fruits and Vegetables, thereby enhancing livelihood opportunities and ensuring the sustainability of agriculture in the district.

Number of Youth Trained

Since its inception in 2019, the ARYA programme has imparted training to a significant number of youths:

- Nursery Management: 436
- Value Addition of Fruits and Vegetables: 396

KVK's Interventions

Capacity building programmes

KVK Malappuram designed structured and comprehensive capacity building programmes to strengthen entrepreneurship

A. Nursery Management

- Nursery layout and establishment
- Soil and nutrient management
- Composting and waste utilization
- Vegetative propagation techniques (grafting, budding, layering, cuttings)
- Bonsai cultivation and landscaping
- Protected cultivation (shade net, greenhouse, rain shelters)
- Preparation of bio-pesticides and botanicals
- Packaging, transportation, and online marketing of nursery products
- Exposure visits

B. Processing and Value Addition

- Processing techniques: jams, jellies, squashes, sauces, pickles, spice powders, dehydrated products, beverages
- Advanced dehydration methods (solar, cabinet, modern dryers)
- Value addition in banana and jackfruit
- Food safety standards and FSSAI regulations
- Branding, packaging, and labelling for market competitiveness
- Entrepreneurship development and government schemes
- Exposure visits to various fruit and vegetable processing units and incubation centres of KAU like Agri business Incubator, Banana Research Centre, Cocoa Research Station, Cashew Research Station)

Methodology Adopted

- ❖ Classroom lectures by experts from KVK, KAU, and allied institutions
- ❖ Practical demonstrations and hands-on training
- ❖ Exposure visits for experiential learning
- ❖ ICT-based support through WhatsApp groups, online sessions, and resource sharing

Impact of Training Modules

- ✓ Skill Development: Over 800 rural youth gained technical proficiency in nursery and processing technologies.
- ✓ Enterprise Establishment: More than 32 entrepreneurial units successfully initiated.
- ✓ Economic Empowerment: Income generation ranging from ₹75,000 to ₹7.5 lakh per unit annually.
- ✓ Qualitative Benefits: Enhanced self-confidence, greater social recognition, and active participation of women and youth in agripreneurship.

Technologies Introduced

- Nursery Management: IISR technologies such as black pepper rapid multiplication, vertical column method, and bush pepper cultivation.
- Value Addition: KAU technologies for banana, jackfruit, and multi-fruit processing (chips, halwa, flours, beverages, squash, jams).

Institutional Linkages

- KVK Malappuram ensured convergence with multiple agencies for capacity building, financial support, and marketing facilitation:
- Kerala Agricultural University (KAU): Technical backstopping
- Department of Agriculture & Kudumbashree Mission: Selection of participants and group formation
- NABARD & ATMA: Financial support and capacity development
- District Industries Centre (DIC): Licensing and project facilitation
- VFPCCK: Marketing support and awareness creation

Qualitative Benefits

- Empowerment of youth through hands-on entrepreneurial training
- Enhanced confidence, leadership, and social recognition
- Improved awareness on branding, packaging, and market access
- Increased involvement of women and rural youth in agribusiness ventures

Beneficial Effects of Technology

- ❖ Adoption of scientific nursery practices improved plant survival rates and reduced production costs.
- ❖ Value addition reduced post-harvest losses, enhanced shelf-life, and improved market opportunities.
- ❖ Simple, adaptable technologies enabled youth- and women-led enterprises to thrive in rural areas.

Economic Impact of Enterprises

- **Nursery Management Units**
 - Annual net income ranged from ₹75,000 to ₹5.35 lakh per unit.
 - Average profit per enterprise ₹42,000/year.
 - Employment generated: 100–280 days per year.
- **Value Addition Units**
 - Annual net income ranged from ₹43,200 to ₹7.5 lakh per unit.
 - Average profit per enterprise ₹50,000/year.
 - Employment generated: 80–200 days per year.
 - Development of branded products.

Spread of Technology

- ✓ Adoption primarily among trained youth and groups.
- ✓ Wider dissemination supported by exposure visits, WhatsApp groups, and media coverage.
- ✓ Limited scope for horizontal spread indicating need for expansion.

Extent of Area Coverage

- ❖ Nursery Units: Operating in land areas of 7–50 cents per entrepreneur.
- ❖ Processing Units: Capacity ranges from 80 kg/week to 100 kg/week and 0.5 to 1.5 lakh bottles/year
- ❖ Present coverage limited to villages of Malappuram district, with potential for scaling.

Summary

The ICAR-ARYA programme at KVK Malappuram has significantly contributed to the empowerment of youth through capacity building, enterprise establishment, and income generation. With more than 800 youth trained and 32 enterprises established, the programme has demonstrated measurable socio-economic impact. The programme has strengthened entrepreneurship, created branded products, and ensured institutional support. Moving forward, emphasis should be placed on:

- ❖ Promoting branding and certification of more products
- ❖ Strengthening marketing linkages and value chains
- ❖ Ensuring long-term sustainability of youth enterprises

From Training to Triumph: Women’s Entrepreneurship through Value Addition (KVK, Thrissur)

Role of KVK Thrissur in Empowering Women through Value Addition

Krishi Vigyan Kendra (KVK), Thrissur has been at the forefront of transforming farm women into agri-entrepreneurs. Its role goes far beyond training — it nurtures ideas, provides technical handholding, and links women to markets. The focus has been on value addition and processing of locally available agricultural produce, enabling women to transform traditional knowledge into sustainable enterprises.

Key Contributions of KVK Thrissur:

- **Capacity Building:** Organized hands-on training programmes in value addition, food processing, and product diversification tailored for women.
- **Infrastructure Support:** Offered processing equipment, incubation units, and lab validation to help entrepreneurs develop and scale their products.
- **Mentorship & Handholding:** Provided continuous guidance, troubleshooting, and motivation, enabling women to gain confidence in managing enterprises.
- **Financial Linkages:** Assisted in accessing loans, subsidies, and funding schemes through banks, Kudumbashree, and government programmes.
- **Market Linkages:** Supported entrepreneurs to participate in exhibitions, trade fairs, and buyer–seller meets, creating visibility and networks.
- **Product Diversification:** Encouraged innovation in moringa, jackfruit, papaya, traditional rice, millet blends, oils, and herbal products, ensuring resilience and demand.
- **Sustainability & Replication:** Developed models like Jaitri Foods that could be scaled and replicated across Kerala.

Through these interventions, KVK Thrissur has become a catalyst of change, demonstrating how women’s collectives and individuals can build viable enterprises rooted in local resources, nutrition, and tradition.

The following case studies highlight successful models of women-led enterprises nurtured by KVK Thrissur, showcasing replicable pathways for rural entrepreneurship in agriculture and food processing.

Jaitri Foods: A Journey Towards Empowerment and Prosperity

Background/Problem

Farm women in Pananchery Grama Panchayath, Thrissur, were primarily engaged in cultivation of fruits and vegetables. Despite their hard work, they faced low income due to several challenges:

- High perishability of produce.
- Limited local storage and processing facilities.
- Dependence on middlemen and fluctuating market prices.
- Lack of exposure to value addition techniques and food safety standards.
- Weak entrepreneurial confidence and absence of branding/marketing skills.

Although women possessed traditional knowledge of pickling, dehydration and preservation, the correct techniques were not standardized for commercial sale. There was a clear need to organize women into groups, provide capacity building, and create infrastructure and market support to help them move from subsistence farming to sustainable agripreneurship.

KVK Intervention (5Ps Framework)

Prepare

- KVK Thrissur identified 30 farmers (majority women) and introduced them to the concept of value addition in fruits and vegetables.
- Awareness programmes highlighted the market scope of processed foods.
- Exposure visits to successful units allowed the women to “see and feel” entrepreneurial possibilities.
- Group discussions and leadership exercises motivated women to work collectively.

Provide

- Conducted a 10-day vocational training on *Value Addition of Fruits and Vegetables*.
- Topics covered: drying & dehydration, pickling, low temperature storage, heat processing, semi-moisture foods, beverage preparation, bakery & confectionaries, branding, packaging and labelling, food safety and quality standards, hygiene, marketing techniques, office management and record keeping.
- Introduced financial literacy sessions to enhance entrepreneurial orientation.
- Facilitated access to SCSP financial support for procurement of processing equipment.

Promote

- KVK hand-held the group to establish the Peechi Agri-Industrial Park, ensuring:
 - Incubation facilities.
 - Mechanized packaging units.
 - Food safety certification and infrastructure support.
- Conducted pilot product trials at KVK’s food lab before commercialization.
- Linked farmer clusters to ensure raw material supply.

Position

- Supported branding under the name “*Jaitri Foods*” (meaning *Victorious*).
- Developed attractive packaging suited for consumer markets.
- Facilitated participation in state/national exhibitions and buyer–seller meets.
- Promoted visibility through cooperative society networks and social media.

Prosper

- Jaitri Foods diversified into fried snacks, powders, pickles, and beverages.
- Within two years, turnover rose from **₹10 lakh (2022)** to **₹75 lakh (2024)**.
- Created direct employment for 15 women (processing) and 4 men (marketing).
- Supported 10 additional women-led units in primary processing.
- Integrated over 500 farmers into the supply chain, ensuring fair farm-gate prices.
- Reached the break-even point within two years.

Evaluative feedback of the entrepreneurship development program

Outputs/Adoption

Parameter	Details
Location	Pananchery, Thrissur
Products	Fried items, dehydrated powders, pickles, beverages

Parameter	Details
Certification	FSSAI certified
Branding	Jaitri Foods
Turnover	₹75 lakh annually
Employment	15 women (processing), 4 men (marketing), 10 women-led units linked

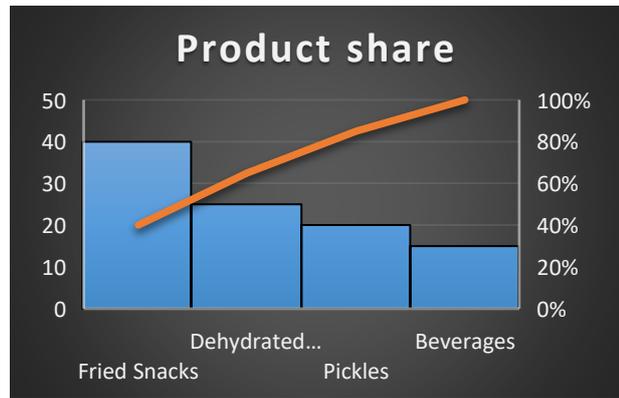
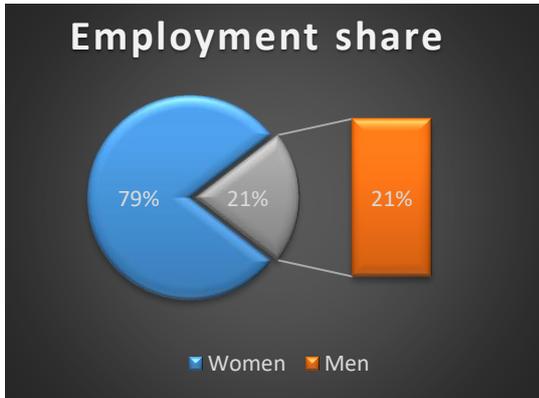
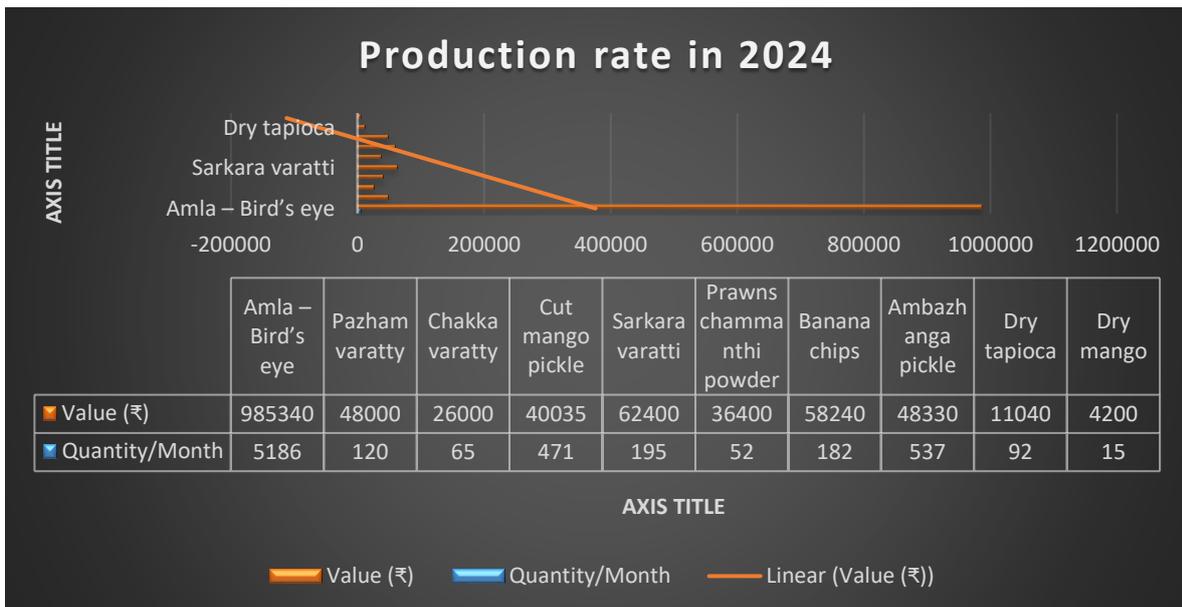


Fig 1. Employment Distribution

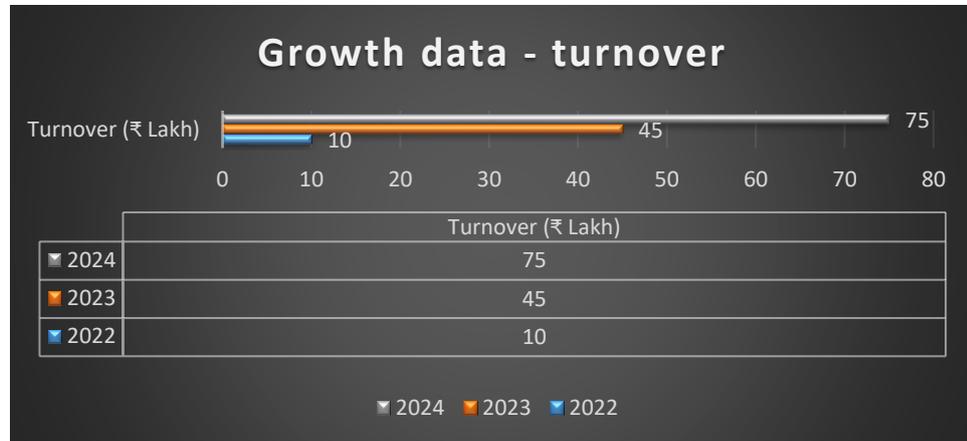
Fig 2. Product Line Share



Outcomes/Impact

- **Economic Empowerment:**
 - Annual turnover reached ₹75 lakh.
 - Direct employment for 19 individuals.
 - 500+ farmers benefited from assured procurement.
- **Social Empowerment:**
 - Women entrepreneurs gained leadership confidence.
 - Emerged as role models inspiring other women in the Panchayath.

- Enhanced social status and decision-making power.
- **Institutional Impact:**
 - The Pananchery Cooperative Society became a hub for women-led processing.
 - Demonstrated how KVK mentoring and cooperative models can create scalable enterprises.



Spread of technologies through entrepreneur-led trainings:

- **Farmer Cluster Linkages:** Connected with **10 farmer clusters (>500 farmers)**, providing them steady market and knowledge on primary processing.
- **Hands-on Trainings and consultancy services:** The women workforce trained by KVK is now **training other women farmers** in fruit & vegetable value addition (pickles, fried snacks, powders). Over 1500 farmers have been trained so far.
- **Demonstration Effect:** Participation in **exhibitions and fairs** has motivated many small groups to replicate the model in nearby panchayats.
- **Incubation Sharing:** The Peechi Agri-Industrial Park facility is being used by smaller entrepreneurs for **secondary processing**, thereby multiplying the reach.

Lessons/Way forward

- Structured handholding is essential — training alone is insufficient without mentoring and incubation.
- Branding and market positioning are critical for consumer acceptance.
- Farmer–entrepreneur linkages ensure raw material security and fair pricing.
- Future opportunities include:
 - Expanding through e-commerce and online retailing.
 - Diversification into ready-to-eat, functional, and export-oriented products.
 - Replication of this cooperative–KVK model in other Panchayaths of Kerala.



Kariat Dry Foods - Pioneering Nutraceutical Value Addition with Moringa and Millets

Background/Problem

While Thrissur is known for its rich diversity of fruits and vegetables, another untapped potential lay in moringa, millets, and other traditional grains. These crops have high nutritional value but are generally underutilized due to lack of modern processing, standardization, and consumer awareness.

Recognizing this, Ambika Somasundaran transitioned from a banking career to set up Kariat Dry Foods in 2017, aiming to transform local crops into health-oriented value-added products such as moringa capsules, millet-based mixes, and ragi powders.

KVK Intervention (5Ps)

Prepare – KVK Thrissur conducted specialized training on nutraceutical applications of moringa, millet-based product development, and hygienic processing methods.

Provide – Technical support included usage of capsule-filling units, dryers, and grinders, financed through the Agri Infrastructure Fund and institutional credit.

Promote – Guidance was provided for FSSAI, ISO and other certifications, packaging innovations for powders and capsules, and quality testing to meet nutraceutical standards.

Position – Products were marketed under the “**Kariat Dry Foods**” brand, with direct participation in trade fairs across India. Initially 4 women Staff. Now 8 women in Production unit and 3 managers. Agriculture department started Thrissur district millet cafe. Unit in industrial park - as part of expansion. The enterprise also explored export potential for moringa capsules and created visibility through health expos and niche organic stores.

Prosper – By diversifying into moringa-based capsules, millet powders, ragi blends, and functional mixes, the enterprise tapped into the rising demand for health foods. Despite COVID disruptions, the unit revived and sustained monthly sales of ~₹2 lakh, providing employment to 8 people. Today she produces nearly 10 products from Moringa leaves viz. Powder, capsules, soup mix, chutney powder, rasam powder, Moringa millet, Moringa leaf powder, Various food supplements from millet Special powders, Carrot powder, Beetroot powder, Jackfruit powder, Jackfruit seed powder, Corn powder, Ragi powder, Millet powder etc.

Evaluative feedback of the entrepreneurship development program

Outputs/Adoption

Parameter	Details
Location	Marottichal, Thrissur
Products	Moringa capsules, millet flours, ragi powders, functional mixes
Certification	FSSAI certified, nutraceutical focus, ISO certificate, Import export license
Branding	Kariat Dry Foods
Turnover	₹2 lakh/month (pre-COVID) → ₹0.5 lakh (COVID) → ₹2.2 lakh/month (2024)
Employment	8 women, 3 men

Outcomes/Impact

- **Economic:** Opened a new market segment for nutraceutical foods, sustaining post-COVID recovery with ~₹2 lakh turnover/month. Main Products – 40, Barcode for 28 products, Keralagro Trademark for 30 products. Sells around 200-500kg of products on a daily basis.
- **Social:** Created skilled employment for 8 women, building confidence in women-led nutraceutical businesses.
- **Health impact:** Brought moringa-based nutrition and millet foods into mainstream households.
- **Institutional:** Strong linkage with KVK Thrissur for technical guidance and financial institutions for credit support.
- **Awards:** 2021-Atma-District Level Value Addition
2021-22- Vyapaari Vyasayi Ekopan Samiti Thrissur District Women Entrepreneur Award
22-23 -Institutional Award - Krishikkoottam Value Addition
2022- 3rd prize in Manorama News Female Star Program
2023-24 Thrissur Management Association 1st Prize

Spread of technologies through entrepreneur-led trainings:

- **Technology Transfer in Moringa & Millets:** By developing and marketing **moringa-based powders, snacks, and millet products**, the enterprise has popularized these **nutrition-focused technologies** among households.
- **Community Training:** As master trainers, conducted **regular training and exposure visits** (with KVK support), enabling local women to start small-scale processing.
- **Product Awareness:** Introduced consumers to **dried, ready-to-cook/eat healthy products**, shifting dietary preferences and showing the feasibility of small-scale dehydration.
- **Role Model Effect:** As a steadily growing women-led enterprise, Kariat's progress is motivating other Kudumbasree units and self-help groups to replicate the model.

Lessons/Way Forward

- Focused branding in nutraceuticals can differentiate women-led units from conventional food processing ventures.
- Strong scope for exports of moringa capsules and powders.
- Expansion into digital marketing, e-commerce, and urban organic stores will increase visibility and sales.
- Collaborative farmer clusters for moringa and millet cultivation can ensure a steady supply of raw materials are lower cost.



Pradhani Son's Nutri Lifa Food Products – Resilience and Reinvention

Background/Problem

In 2013, Shameela Abdulkhadar, a 63-year-old orthodox Muslim woman from Thrissur, ventured into business with a cattle feed unit. The enterprise, however, turned into a huge financial failure, leaving her in deep debt and with no employees.

For nearly a decade, Shameela struggled with the weight of the loss. But in 2022, she secured a small loan from her Kudumbasree unit and decided to restart her entrepreneurial journey. This time, she shifted her focus to value-added food products, particularly moringa and jackfruit, crops with strong nutritional value and growing demand.

KVK Intervention (5Ps)

Prepare – In 2022, Shameela attended a training programme at KVK Thrissur. The exposure to modern infrastructure, scientific processing methods, and successful enterprise models inspired her to re-enter entrepreneurship.

Provide – KVK extended technical guidance for formulating products like jackfruit-based Nutrilifa and moringa nutraceuticals. She also received minimal financial assistance from KVK to test and refine her products.

Promote – With support from KVK, she improved product design, packaging, and nutritional value, enabling her to position Nutri Lifa products in exhibitions and local markets.

Position – Financially, she accessed a ₹17 lakh loan from Punjab National Bank and Agricultural Department along with ₹1 lakh from Kudumbasree, to invest in production and machinery.

Prosper – Despite the earlier collapse of her cattle feed business, Shameela successfully re-established Nutri Lifa, now producing moringa and jackfruit-based products and also expanded into traditional fried snacks and pickles with scientific knowledge acquired from the experts of KVK. The unit today employs 3–5 workers and achieves a monthly turnover of ₹50,000–70,000.

Evaluative feedback of the entrepreneurship development program

Outputs/Adoption

Parameter	Details
Location	Thrissur District
Founder	Shameela Abdulkhadar , 63-year-old orthodox Muslim woman
Initial Attempt	2013 – cattle feed unit (failed, heavy financial loss)
Re-entry	2022 – food products with Kudumbasree loan
Focus Crops	Moringa and Jackfruit
Products	Moringa based mixes, moringa powders, jackfruit flour, Nutrilifa mix
Financials	Loans: ₹17 lakh (PNB & Agricultural department) + ₹1 lakh (Kudumbasree)
Turnover	₹50,000–70,000/month (2023–24)
Employment	3–5 workers

Outcomes/Impact

- **Economic:** Revived from a failed cattle feed venture into a viable food processing unit with steady turnover.
- **Social:** Her journey demonstrates the resilience of a 63-year-old orthodox Muslim woman entrepreneur, inspiring other women in conservative communities.
- **Institutional linkages:** Access to Kudumbasree loans, bank credit, and KVK support has been critical in her comeback.
- **Employment:** Provided livelihood to 3–5 workers despite starting over after a major loss.

Lessons/Way Forward

- Failures can be stepping stones: Shameela’s shift from cattle feed to food value addition demonstrates adaptive entrepreneurship.

- Jackfruit and moringa are high-potential crops for both health foods and nutraceutical markets.
- Stronger market linkages and e-commerce channels could help Nutri Lifa expand beyond local reach.
- Structured debt support is essential for small entrepreneurs burdened with loans.



Vincy's Foods – Diversifying Value Addition from Fruits & Vegetables to Herbal Wellness

Background/Problem

Fruits like Red Lady Papaya, Mango, and Jackfruit are abundantly grown in Kerala, but their marketing has always been hindered by short shelf life, seasonal price fluctuations, and post-harvest losses. At the same time, indigenous knowledge of plant-based hair oils and natural wellness products was not being tapped commercially.

Vincy, a simple rural woman entrepreneur from Anthikkad, Thrissur, just with a school level education recognized this gap and began exploring both fruit-based food products and herbal wellness products. Her journey reflects innovation, diversification, and consumer trust.

KVK Intervention (5Ps)

- **Prepare** – Vincy underwent KVK Thrissur's training programmes on fruit processing, papaya flour preparation, mango-based products, and soap-making. She learned how to convert traditional knowledge into scientifically backed products.
- **Provide** – KVK offered technical guidance and incubation facilities, enabling her to experiment with the locally available resources into various products. papaya based products, mango pickles/jams, jackfruit mixes, and herbal oils such as Dandabana oil and Changalamperanda oil, cosmetics like herbal soaps and washes .
- **Promote** – With KVK support, she accessed FSSAI certification, product standardization, and attractive packaging, which allowed her to confidently sell her products to wider audiences.

- **Position** – Participation in KVK exhibitions, food festivals, and awareness fairs helped Vincy connect directly with consumers. She built a reputation for on-demand customized production, taking orders from households who trusted her brand.
- **Prosper** – Today, Vincy’s Foods has a diverse portfolio: papaya flour, mango pickles, mango jams, jackfruit flour/snacks, Dandabana oil, Changalamperanda oil, and plant-based soaps. Her venture has plans to employ women from her locality, generates a regular monthly turnover, and has earned her multiple awards.

Evaluative feedback of the entrepreneurship development program

Outputs/Adoption

Parameter	Details
Location	Anthikkad, Thrissur
Founder	Vincy
Focus Products	Red Lady Papaya, Mango, Jackfruit
Diversification	Papaya products, mango pickles/jams, jackfruit flour, herbal oils, soaps
Specialty Oils	Dandabana oil, changalamperanda oil
Business Model	On-demand customized orders
Certification	FSSAI certified, award-winning entrepreneur
Employment	5–7 women (envisioned)
Recognition	Multiple awards for innovation in food and herbal product development

Outcomes/Impact

- **Economic:** Achieved a sustainable income through diversified food and wellness products.
- **Social:** Created employment for rural women and inspired others to explore diversification.
- **Nutritional & Wellness:** Promoted papaya products, mango products, and jackfruit as healthy foods; revived indigenous knowledge of plant-based hair oils and soaps.
- **Recognition:** Awards elevated Vincy as a role model for innovative, women-led enterprises in Thrissur.

Lessons/Way Forward

- **Diversification ensures resilience:** By venturing into both food and herbal wellness, Vincy reduced dependence on any one crop or market.
- **On-demand production** builds consumer trust and repeat orders.
- **Scaling potential:** Organic fruit products, cosmetics and herbal oils have strong prospects for digital marketing and exports.
- Continued technical and financial support can help Vincy expand production capacity and reach.



Jyothy Prakash's Natural Agri products – Reviving Traditional Rice through Nutrition-Sensitive Value Addition

Background/Problem

Traditional rice varieties of Kerala, once central to household diets, were steadily losing ground to commercial hybrids. At the same time, families faced nutritional gaps, especially women and children, due to limited access to affordable, nutrient-rich, ready-to-use foods.

Jyothy Prakash, a woman entrepreneur from Thrissur, recognized the opportunity to address both challenges. By focusing on value addition of indigenous rice varieties and diversifying into millet mixes, fortified flours, and vegetable powders, she created products that combined heritage, nutrition, and convenience.

KVK Intervention (5Ps)

- **Prepare** – Jyothy underwent KVK Thrissur's capacity-building programmes, learning scientific processing of traditional rice varieties, millets, and vegetables. She gained skills in recipe formulation, preservation, and hygienic preparation of products produced from her own fields.
- **Provide** – KVK offered technical guidance, incubation facilities, and small-scale equipment support. With expert validation, she developed products such as rice powders, payasam mixes, millet flours, and child nutrition blends.
- **Promote** – Through demonstrations, fairs, and women's collectives, KVK helped her showcase products like rice-based nutriflours, vegetable powders, and herbal blends, highlighting their health benefits to local communities.
- **Position** – Jyothy strategically positioned her brand as one that delivers heritage-based, nutrition-sensitive foods. By linking with schools, Kudumbashree units, and SHG outlets, she created a niche market around healthy traditional foods.
- **Prosper** – Her venture is now a growing micro-enterprise, employing 4–5 rural women, generating steady monthly income, and gaining recognition for reviving heritage rice through modern processing.

Evaluative feedback of the entrepreneurship development program

Outputs/Adoption

Parameter	Details
Location	Thrissur
Founder	Jyothy Prakash
Focus	Value addition from traditional rice varieties with diversification
Products	Rice powders, payasam mixes, millet flours, vegetable powders, herbal blends
Business Model	Local demand-based micro-enterprise, linked to SHGs and schools
Employment	4–5 women
Recognition	Known for reviving traditional rice foods with nutritional innovation

Outcomes/Impact

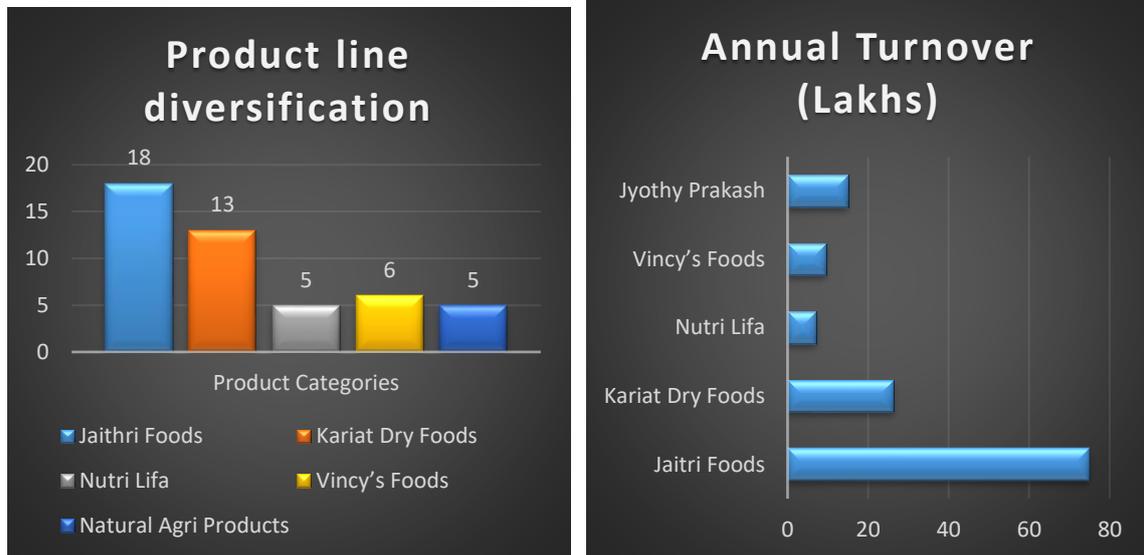
- **Economic:** Generated sustainable supplementary income while supporting women employees.
- **Nutritional:** Improved access to healthy, heritage-based foods for families, especially women and children.
- **Cultural:** Preserved indigenous rice varieties through modernized product forms.
- **Social:** Strengthened women’s empowerment and inspired others to explore nutrition-driven enterprises.



Lessons/Way Forward

- **Heritage foods as enterprise:** Traditional rice and millets can serve as both cultural identity and business opportunity.
- **Diversification builds resilience:** Combining rice-based products with millets, vegetable powders, and herbal blends ensures year-round demand.

- **Scaling potential:** With improved branding, packaging, and certification, Jyothy's products can expand into health-conscious urban markets.
- **Role of KVK:** Continued support from KVK Thrissur in innovation, standardization, and outreach will help her scale further.



Comparative analysis of the cases

Conclusion

The cases of Jaitri Foods, Kariat Dry Foods, Nutri Lifa, Vincy's Foods, and Jyothy Prakash's Natural Agri Products enterprise clearly illustrate that value addition and processing are not merely business activities, but pathways to empowerment for rural women. Each venture began with constraints—financial, social, or technical—but found resilience and growth through targeted support.

The **role of KVK Thrissur** has been central in this transformation. By offering training, incubation, mentorship, market exposure, and technical backstopping, KVK has turned challenges into opportunities. The radar of KVK's contributions—spanning skill building, infrastructure, financial linkages, and market access—shows how a holistic ecosystem is essential for women-led enterprises to thrive.

The growth trajectories show different patterns:

- **Jaitri Foods** has scaled up rapidly with a cooperative model.
- **Kariat Dry Foods** demonstrates persistence and product diversification.
- **Nutri Lifa** represents resilience, showing how failure can transform into new opportunity.
- **Vincy's Foods** exemplifies innovation in diversifying into plant-based oils and soaps.
- **Natural Agri Products** highlights cultural and nutritional preservation through traditional rice varieties.

Together, these cases demonstrate that **value addition is the key to rural women’s entrepreneurship**—it not only enhances income but also builds identity, confidence, and sustainable livelihoods. Today they act as **“technology multipliers”**: instead of the KVK alone training farmers, these women-led enterprises are now **carrying the message, methods, and market confidence to wider circles**. The replicable nature of these models provides a roadmap for scaling women’s entrepreneurship across Kerala and beyond.

WOMEN SELF-EMPLOYMENT THROUGH CHILDREN'S NUTRITION — AMRUTHAM NUTRIMIX (KVK, KASARAGOD)

Introduction

Food security is incomplete without nutritional security. In India, nearly 43% of children under five years are underweight, while 48% (around 61 million children) suffer from stunting due to chronic undernutrition. Even in Kerala, the *National Family Health Survey* revealed that over 75% of children face mild to moderate malnutrition. This highlights the urgent need for affordable, nutritious, and easily accessible food supplements for children. At the same time, farm women play a pivotal role in strengthening household nutrition security. By contributing to food production, improving dietary quality, and diversifying food consumption, they can directly influence the nutritional well-being of families.

Recognizing these challenges and opportunities, ICAR–Krishi Vigyan Kendra (KVK), Kasaragod developed and popularized *Amrutham Nutrimix*—a low-cost, pre-cooked, ready-to-eat supplementary food formulated from locally available grains and greens. This innovation not only addressed malnutrition among children, particularly those attending Anganwadis, but also created a sustainable pathway for women's self-employment, income generation, and social up-liftment through Kudumbashree based enterprises. Over the years, the Nutrimix programme has emerged as a model of large-scale technology application, effectively linking child nutrition with women empowerment.

Major Problem Identified

Malnutrition among preschool children continues to be a serious challenge, with many of them lacking access to a balanced diet during their formative years. The food traditionally provided in Anganwadis, such as rice gruel and green gram, was nutritionally inadequate, monotonous, and often failed to meet the dietary requirements of growing children. Another critical issue was the absence of properly packaged, convenient supplementary nutritional food that could be easily prepared and distributed in Anganwadis, particularly in remote and rural areas. This limited the effectiveness of government nutrition programmes aimed at young children. At the same time, women self-help groups (WSHG) in the region had very few avenues for stable income generation. Most women were engaged in low-paid daily wage or beedi work, which provided little financial security or long-term empowerment. This economic dependency not only affected women's livelihoods but also limited their role in household decision-making,

perpetuating gender inequality within families. The situation clearly called for an intervention that could address both nutritional security for children and economic empowerment of rural women.

Interaction of the KVK to Address the Problem

To address the dual challenge of malnutrition among children and lack of livelihood opportunities for rural women, ICAR–Krishi Vigyan Kendra, Kasaragod initiated a series of strategic interventions that eventually evolved into the successful *Amrutham Nutrimix* enterprise. The process began with on-farm testing of different supplementary food formulations among Anganwadi children under the ICDS project, supported by organoleptic and consumer preference tests involving teachers, doctors, and self-help group members. A refined pre-cooked blend of wheat, soya chunks, groundnut, Bengal gram, and jaggery was identified as nutritious, palatable, and convenient for preschool children. Based on this success, frontline demonstrations were conducted in selected Panchayats to showcase standardized methods of roasting, pulverising, mixing, and packaging. Alongside these, practical training programmes, group meetings, nutrition awareness campaigns, and exhibitions were organized to popularize the product and empower women with production and marketing skills. Self-help groups were further trained to diversify Nutrimix into value-added products such as ladoo, burfi, steam cake, and upma, creating additional avenues for income. The technology gained momentum when Kudumbashree, the state-wide women’s SHG network, partnered with KVK to upscale the initiative, designating the Keerthi Nutrimix Unit at Bedadka as a Master Training Centre to impart production and quality assurance skills to women from across Kerala. This collaborative approach ensured that Nutrimix reached even the remotest Anganwadis while simultaneously transforming rural women into entrepreneurs, enabling them to earn a stable income, gain confidence, and achieve greater participation in household decisions –there by contributing to gender equality and social upliftment within families and communities.



Feedback of the Technology

The Amrutham Nutrimix initiative proved highly effective, as feedback from Anganwadi teachers and health staff confirmed improved health, weight gain, and acceptability among children. Mothers appreciated its taste, easy preparation, and nutritional value. The technology also transformed women's lives -241 Nutrimix units now employ 1,584 women, each earning ₹10,000–12,000 monthly. With an annual production of 18,000 MT benefitting over 5.5 lakh children, the programme has not only addressed malnutrition but also strengthened women's economic independence and family status.



Spread of the Technology

After its initial success in Kasaragod, *Amrutham Nutrimix* was scaled up across Kerala through Kudumbashree, becoming one of the most successful women-led nutrition enterprises. At present, 241 units operate across the state, producing about 18,000 MT annually and reaching more than 5.5 lakh children. Malappuram leads with 53 units producing 200 tonnes per month, followed by Kozhikode (50 units) and Kannur (30 units). The district-wise distribution of Nutrimix units and their monthly output is shown in the figure below.



Economic impact of the Technology

The Nutrimix enterprise is highly profitable and sustainable. For a monthly production of 2,500 kg, the total cost is about ₹66,500, including labour, raw materials, fuel, packaging, electricity, rent, and transport. With a production cost of ₹26.62 per kg and a realized price of ₹56 per kg, the net profit is ₹29.38 per kg, giving a B:C ratio of 2.1. This ensures steady monthly income for women SHG members, replacing uncertain wage labour with dignified entrepreneurship. Surpluses are often pooled for reinvestment and member loans, creating long-term financial security. Thus, the technology delivers a double dividend - improved child health and economic empowerment of women.



Other Beneficial Effect of the Technology

Beyond nutritional security and income generation, the Amrutham Nutrimix initiative has created lasting social benefits for rural women and their families. Women who were earlier confined to low-paid beedi work or daily wage labour now earn a dignified and steady income, which has improved household stability and allowed them to independently meet educational and daily expenses. By pooling surplus earnings and extending interest-free loans within their groups, SHGs have fostered financial resilience. Most importantly, this empowerment has enhanced women’s confidence, decision-making power, and social dignity, thereby setting the foundation for greater gender equality within families and communities.

Horizontal Spread of the Technology

The spread of Amrutham Nutrimix started with KVK Kasaragod’s trials and SHG-led units like Kandamkuttichal, Keerthi, Akshaya, and Sanjeevani, which gained quick acceptance through Anganwadis, retail shops, and door-to-door sales. With Kudumbashree’s support, the Keerthi Unit at Bedadka became a Master Training Centre, training nearly 900 women and facilitating statewide adoption. Today, 241 units across Kerala produce 18,000 MT annually, reaching 5.5 lakh children and employing 1,584 women who earn ₹5,000–6,000 per month. The Sanjeevani Amrutham Nutrimix Unit of Thazhekkode, Malapuram has fully automatic machines producing tonnes of Amrutham nutrimix monthly.



Summary

The *Amrutham Nutrimix* initiative by ICAR–KVK Kasaragod was developed to address the persistent problem of child malnutrition in Kerala and the limited livelihood options for rural women. The major issue identified was the absence of convenient, nutritious supplementary food in Anganwadis, alongside women’s dependence on low-paid daily wage or beedi work. KVK intervened through on-farm testing, frontline demonstrations, and intensive training of self-help groups, refining a pre-cooked blend of cereals, pulses, and jaggery into a widely accepted product. Feedback from Anganwadi teachers, mothers, and health staff confirmed its health benefits and easy acceptance among children. With Kudumbashree’s support, the technology spread rapidly across the state, and today 241 units in Kerala produce about 18,000 MT annually, reaching more than 5.5 lakh children. Economic analysis showed a B:C ratio of 2.1, with women earning steady incomes of ₹5,000–6,000 per month. Beyond income, the enterprise improved household stability, promoted gender equality, and elevated women’s role in family decision-making. Rooted in Kerala’s social fabric, Nutrimix now stands as a model of large-scale technology adoption, combining nutritional security for children with empowerment of women self-help groups.



The Kerala Kudumbashree has received Glenmark Nutrition Award (UN world food programme 2022) for reaching 5 lakhs children with the Amruthum nutrimum. Many entrepreneurs from Mumbai, Karnataka and a team from Srilanka and South Africa visited KVK and Nutrimum Master training centre in Bedadka, to learn about the success of the Nutrimum enterprises.