EMPOWERING FARMERS THROUGH CLIMATE-SMART PRACTICES IN NORTHEAST INDIA: INNOVATIVE APPROACHES UNDER NICRA (COMPILATION OF SUCCESS STORIES)

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PREFACE

Greetings from Team ICAR-ATARI, Umiam!

It is with immense pride and a deep sense of satisfaction that I present the success stories of farmers under the National Innovations in Climate Resilient Agriculture (NICRA) project. These stories are a testament to the hard work, resilience, and innovative spirit of our farmers, scientists, researchers, and all stakeholders who have contributed tirelessly to enhancing climate resilience in agriculture.

Since its inception, the NICRA journey has been both challenging and inspiring. Agriculture and food security have faced severe threats due to the unpredictable impacts of climate change. In response, NICRA has focused on empowering farmers with climate-resilient practices, technologies, and innovative approaches that enable them to adapt and thrive in a rapidly changing environment. These success stories illustrate how our efforts have translated into tangible benefits for farmers, securing their livelihoods and ensuring sustainable agricultural practices.

I extend my heartfelt gratitude to **Dr. Amrutha T. (Scientist) and Ms. A. Tovinoli Shohe (SRF, NICRA)** for their exceptional dedication to this project. I also acknowledge the entire staff of the implementing KVKs, including administrative and support staff, SRFs, YPs, and DEOs, who have played an instrumental role in documenting and compiling these success stories within the given timeframe.

I am equally grateful to the farming community for their unwavering resilience and commitment to adopting climate-smart practices. The cooperation of government partners and support from our financial agencies has been invaluable in making NICRA a success. These combined efforts have created a positive ripple effect in the agricultural sector, and the results of these endeavors will inspire further achievements in the future.

This publication serves as a reminder of what we can achieve when we work together with a shared vision of building a climate-resilient agricultural future.

Place: Umiam, Meghalaya
Date: November, 2024

(Dr. A. K. Mohanty)
Director

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Authors

CONTRIBUTORS

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Chapter 1

Background and Guidelines

1. Introduction

The National Innovations in Climate Resilient Agriculture (NICRA) program, initiated by the Indian Council of Agricultural Research (ICAR) in February 2011, addresses the pressing challenges posed by climate change to India's agricultural sector. This initiative holds immense importance, as agriculture forms the backbone of the Indian economy, supporting millions of livelihoods. However, rising temperatures, erratic rainfall patterns, and increasingly frequent extreme weather events have placed the sector under considerable strain, threatening productivity, food security, and rural well-being.

The NICRA project, implemented during the 2023-2024 period, focuses on bolstering the resilience of agricultural systems through the integration of innovative practices and technologies. This report highlights the remarkable achievements of the Krishi Vigyan Kendras (KVKs) under ICAR-ATARI, Zone-VII, Umiam, which span the five Northeastern states of Manipur, Mizoram, Meghalaya, Nagaland, and Tripura. Through a collection of success stories from these regions, the report demonstrates NICRA's tangible impact on farmers' livelihoods and the sustainability of agriculture in the face of climate change.

In India, where agriculture predominantly relies on rain-fed systems, climate variability exerts a profound influence on crop yields, planting schedules, and water resources. The increased incidence of droughts, floods, and unseasonal rainfall has disrupted agricultural activities, leading to economic losses and heightened vulnerability for farming communities. This precarious situation necessitates urgent action to develop adaptive strategies and implement sustainable practices that mitigate the adverse impacts of climate change on agriculture nationwide. The NICRA project plays a crucial role in addressing these challenges by equipping farmers with innovative tools to enhance their adaptability to the changing climate.

The impact of climate change on agriculture is particularly pronounced in Northeast India, a region characterized by its distinct geography, hilly terrain, and traditional farming practices. The unique topography, coupled with shifting monsoon patterns, has led to increased soil erosion, pest infestations, and water management

challenges, exacerbating the difficulties faced by smallholder farmers. These climate stresses threaten food security and livelihoods, further highlighting the need for tailored interventions. The NICRA program addresses these regional challenges by promoting climate-smart agricultural practices that empower farmers to navigate the evolving risks posed by climate change.

At its core, NICRA seeks to enhance the resilience of Indian agriculture by focusing on four key objectives. These include the development of climate-resilient practices across sectors such as crops, livestock, and fisheries, and the demonstration of site-specific technologies that cater to the unique challenges faced by local farming communities. Additionally, the project emphasizes capacity building for scientists, extension workers, and farmers to ensure the effective adoption of climate-smart practices. NICRA also provides policy support, facilitating the integration of climate-resilient agriculture into developmental strategies and ensuring that the lessons learned from field-level interventions can inform national and regional policies.

The NICRA program is structured around four essential components: strategic research, technology demonstration, capacity building, and policy support. Strategic research focuses on developing new technologies and management practices to address the specific climate risks faced by farmers. Technology demonstration involves testing and showcasing successful interventions in real-world farming scenarios to encourage wider adoption. Capacity building seeks to enhance the knowledge and skills of stakeholders through targeted training programs, equipping farmers with the tools they need to adapt to climate challenges. Lastly, policy support ensures that evidence-based recommendations from NICRA are integrated into broader developmental frameworks, reinforcing the long-term resilience of Indian agriculture.

Through its multi-faceted approach, NICRA has introduced innovative strategies designed to address the unique challenges of Northeast India. These strategies include water conservation techniques, crop diversification, integrated farming systems, and capacity-building efforts that aim to bolster the resilience of farming communities to climatic stresses. By equipping farmers with cutting-edge technologies and sustainable practices, NICRA not only mitigates the impacts of climate change but also improves food security and strengthens the livelihoods of smallholder farmers in vulnerable regions.

Ultimately, NICRA's strategic initiatives empower farmers to adapt, thrive, and contribute to sustainable agricultural development in a rapidly changing climate. This paper will explore the various climate-smart practices introduced by NICRA

in Northeast India, highlighting their impact and potential for scaling across other vulnerable regions. Through its comprehensive approach, NICRA demonstrates its critical role in building a resilient agricultural system capable of withstanding the growing challenges of climate variability.

2. Project objectives

- To improve the resilience of Indian agriculture including crops, livestock, and fisheries against climate variability and change by developing and implementing enhanced production and risk management technologies.
- To demonstrate tailored technology packages on farmers' fields that address current climate-related risks.
- To strengthen the capacity building of scientists and other stakeholders in conducting climate-resilient agricultural research and applying its findings.

3. Selection of KVKs

The selection of these districts is based on several criteria in addition to the capabilities of the KVKs:

- Drought susceptibility determined by analyzing 30 years of rainfall data from the Indian Meteorological Department (IMD).
- Cyclone vulnerability, assessed by the frequency recorded by IMD and State Disaster Management agencies.
- Flood risk evaluated using data from IMD and National Disaster Management Authority (NDMA) maps.
- Susceptibility to heat and cold waves, based on temperature data from IMD grids.
- Historical occurrences of floods and droughts, as documented by All India Coordinated Research Project on Agrometeorology (AICRPAM) centers.

Interventions are identified through a participatory process led by the Village Climate Risk Management Committee (VCRMC). This process employs Participatory Rural Appraisal (PRA) methods to assess climate-related challenges within the village and carry out a baseline survey. The program was officially launched in all villages, with active involvement from state department officials and local panchayat leaders. This approach fosters local ownership of the project from the beginning and promotes the integration of ongoing schemes within the panchayat.

4. Responsibilities of KVKs in NICRA Implementation

Once selected, KVKs undertake various responsibilities to ensure the program's success. These include:

i) Technology Demonstration and Transfer

- KVKs act as the primary centers for demonstrating climate-resilient technologies. This includes introducing drought-resistant crop varieties, efficient water management techniques, integrated pest management, and soil health practices to local farmers.
- Demonstration farms are set up at the KVKs, where farmers can observe the benefits of these innovations firsthand.

ii) Farmer Training and Capacity Building

- Training programs and workshops are organized by the KVKs to educate farmers on adopting climate-smart practices. These sessions cover topics like crop diversification, improved water-use efficiency, and best practices in soil health management.
- Farmers are also trained in the use of weather-based advisories, enabling them to make informed agricultural decisions.

iii) Monitoring and Data Collection

- KVKs monitor the outcomes of NICRA interventions and collect data on crop performance, water usage, and soil health. This data is essential for assessing the effectiveness of the program and for continuous improvement.
- The collected data helps in understanding region-specific impacts and provides insights into how different climate-resilient practices perform across varied environments.

iv) Community Mobilization and Engagement

- KVKs work to create community-level awareness and mobilize farmer groups, fostering a collaborative approach to climate-resilient agriculture. By engaging with farmer groups, KVKs encourage collective action and knowledge-sharing within the farming community.

v) Feedback and Reporting to NICRA Headquarters

- Regular feedback and progress reports are sent from the KVKs to NICRA headquarters. These reports document success stories, challenges faced, and lessons learned, helping NICRA to refine its approaches and adapt strategies based on field experiences.

5. Impact of KVKs in NICRA

KVKs play a vital role in implementing climate-resilient agriculture by introducing sustainable practices that improve productivity, reduce environmental impact, and build community resilience. Through hands-on training, they help farmers adopt drought-resistant crops, efficient water-use techniques, and integrated pest management, leading to higher yields and reduced costs. KVKs encourage soil health improvements and crop diversification, which foster long-term sustainability and biodiversity.

By forming farmer groups and offering weather-based advisories, KVKs strengthen local knowledge-sharing and climate preparedness. Their localized, adaptive solutions have improved rural incomes, reduced migration, and supported better nutrition in farming communities. Additionally, the insights gained from KVKs contribute to policy and research developments, creating a feedback loop that continually refines climate-resilient practices across regions. This grassroots involvement makes KVKs essential to NICRA's mission of fostering resilient and sustainable agricultural communities.

6. List of NICRA implementing KVKs under Zone-VII, Umiam

The TDC-NICRA project is being implemented in designated high-risk districts, engaging 15 Krishi Vigyan Kendras (KVKs) under the Agricultural Technology Application Research Institute (ATARI) at Umiam. These KVKs are strategically positioned to encompass various agro-climatic zones across five northeastern states: Manipur, Meghalaya, Mizoram, Nagaland, and Tripura. A variety of interventions and adaptive strategies have been developed to address the challenges presented by climate change, focusing on its effects on agriculture, food security, and the livelihoods of farming communities

Below are a list of the KVK districts' various vulnerabilities:

Table 1.1: Details on active NICRA KVKs by state, including their climate vulnerability.

State	District	Vulnerability
Manipur	Chandel	Drought/ Water stress
	Senapati	
	Ukhrul	Frost/ Soil Erosion
Meghalaya	Jaintia Hills	Drought/ Cold wave
	Ri Bhoi	Drought/ Water stress Frost/ Hailstorm
	South Garo Hills	Drought/ Water stress/ Cold wave
	West Garo Hills	Drought/ Water stress
Mizoram	Lawngtlai	Drought/ Water stress/ Cold wave
	Lunglei	Water stress
	Siaha	Drought/ Water stress/ Cold wave
	Serchhip	Drought
Tripura	Phek	Drought/ Water stress
	Mon	Drought/ Soil erosion
	Tuensang	Drought/ Cold wave/ Frost
	Sepahijala	Flood/ Soil erosion

Chapter 2

Success Stories

2.1 Horti-based Integrated Farming System: A Gateway to Doubling the Farmer's Income

Profile of the farmer:		
Name of the grower	:	Shri. Hamjen Thaosen
Village	:	Dovapur
Block	:	Dhansiripar
District	:	Chumukedima
Enterprise	:	Horti-based Integrated Farming System
Name of the Centre	:	KVK Dimapur, Nagaland

Background information of the grower: Mr. Hamjen Thaosen is a young, successful entrepreneur from Doyapur village under the Dhansiripar block of Chumukidema District, Nagaland. He graduated with a BCA from Punjab Technical University in 2015. After working in a call centre in Delhi for 2 years, he realised he could earn the same amount in less time by farming on his 7.5 ha of land. Seeking guidance, he approached KVK Dimapur, ICAR Research Complex for NEH Region, Nagaland Centre in 2018.

Technology/process intervened: The awareness campaign by KVK Dimapur and ICAR Nagaland Centre helped him learn about the potential of integrated farming systems. He applied this knowledge to convert 3.3 hectares of his 7.5-hectare land into a Horti-based Integrated Farming System. His farm includes four fishing ponds (1.24 hectares), a duckery unit with 500 ducklings per year, a poultry unit with 2,000 birds annually, a piggery with 25 adult pigs, a vermicompost unit, and a horticulture plot.

Effect of the technology /process:

Poultry-cum-Fish Culture: A farmer constructed a low-cost poultry unit for rearing 500 broiler chicks on the dykes of a 1-hectare fishpond. He rears 500 birds in four batches per year, selling each bird at 155/kg after 45 days when they weigh 2 kg. This

results in 3,880 kg of meat annually, earning Rs. 6,01,400 as gross income, with a net profit of Rs. 2,77,400 and a benefit-cost ratio of 1.86:1. Additionally, the fishpond was stocked with 10,000 fingerlings of Indian and Exotic Carp, yielding 1,260 kg of fish. Selling the fish at Rs. 190/kg, he earned a net profit of Rs. 1,35,000/year, with a benefit-cost ratio of 2.29:1.

Duckery: A duckery unit was introduced as part of the Integrated Farming System (IFS) to boost income. A low-cost duck shed was built using locally available materials. He rears 250 White Pekin ducks in two batches per year, allowing them to swim in the farm pond, where they act as bio-aerators. After 2-3 months, each duck reaches an average weight of 2.5 kg. The farmer sells 1,250 kg of duck meat annually, earning a net profit of Rs. 1,85,000 annually with a benefit-cost ratio of 1.97:1.

Piggery: KVK Dimapur assisted the farmer in establishing a piggery unit with scientifically designed pig sheds. He has 25 large White Yorkshire and Rani pigs, including 5 sows for breeding and 20 pigs for fattening. Annually, he produces around 70 piglets, selling them at Rs. 5,000 each, earning a gross income of Rs. 350,000 and a net profit of Rs. 2,06,000 from breeding. From fattening, he earns Rs. 5,40,000 in gross income and Rs. 3,70,000 in net profit. Overall, the piggery unit provides a yearly net profit of Rs. 5,76,000 with a benefit-cost ratio of 2.83:1.

Fishery: After attending a training program on "Fish Breeding and Fish Seed Rearing," the farmer developed three additional fishponds of various sizes (0.04 ha, 0.07 ha, and 0.13 ha). In the first two ponds (0.1 ha total), he raised Indian Major Carps (Catla, Rohu, and Mrigal) and Exotic Carps (Silver Carp, Grass Carp, and Common Carp) in specific ratios. After one year, he harvested 1,540 kg of fish, earning Rs. 1,30,000 by selling them at Rs. 190/kg. In the third pond (0.13 ha), he raised Pangasius/Chanda fish, harvesting 1,050 kg and earning a net profit of Rs. 95,000 annually, with a benefit-cost ratio of 1.84:1.

Horticulture component: The borders of the fishery bonds were used for planting horticultural crops such as banana, mango, arecanut, and assam lemon to get maximum income from his farm.

Banana: He planted 150 Grand Naine banana plants in 2018, harvesting 1,050 banana hands over two years and earning Rs. 52,500 annually, with a benefit-cost ratio of 2.50:1.

Mango: 120 Dasheri and Alphonso mango varieties were planted during the year 2018. Harvesting started in the year 2022. He could harvest around 540 kg of mangoes and earn around Rs. 48,600 during the last two years by selling Rs. 90/kg with a B:C ratio of 2.04:1.

Arecanut: He planted 500 Assam Tall arecanut trees in 2018, but they have yet to reach the bearing stage.

Assam Lemon: He planted 30 Assam lemon and acid lime trees, earning Rs. 6,750 per year with a benefit-cost ratio of 2.27:1.

Vermicomposting: One vermicompost tank was introduced on the farm to recycle the farm waste. Around 900 kg of compost are harvested in a year. Half of the harvest is used to meet the nutrient requirement of horticultural crops in the farm itself, and the other half is sold for Rs. 30/kg, earning approximately Rs. 13,500/ year.

Acceptance of technology/process in terms of views of the farmers: This technology is well accepted by the farmer, as he is getting income throughout the year. It has also created employment opportunities for the family as well as neighbouring farmers. The IFS model developed by KVK Dimapur has become a learning centre for many young entrepreneurs like him. Before the IFS, his annual income was around Rs. 50,000/annum, but now he is earning around Rs. 20 lakh/ annum.

Out scaling of technology: He has been the source of information and knowledge sharing in and around his village. Mobilised youths for various training programs under KVK, ATMA, and YouthNet, as well as ICAR. As a successful entrepreneur, he was able to contribute his ideas to the youths of his locality about scientific farming systems. He has also provided piglets to eight youths from his farm free of charge as a start-up.

Under him, fourteen youths are taking up piggery, poultry, fishery, and horticulture crops as an enterprise in different villages under Dhansiripar block.

Substitution or replacement of commodities: Before the intervention, he raised local chickens and pigs for household consumption and practiced monoculture in fish farming, resulting in poor outcomes and low income. After KVK Dimapur's intervention, improved poultry and pig breeds were introduced, along with composite fish farming using six species (Catla, Rohu, Mrigal, Grass Carp, Silver Carp, and Common Carp). These changes significantly improved his results and increased his income.

Aerial view after IFS

Socio-economic impact: Shri. Hamjen Thaosen is a renowned farmer in the Dhansiripar area, inspiring and empowering local farmers while generating employment opportunities. His work has gained recognition from various agricultural and allied departments. His farm serves as a learning centre for training programs conducted by different departments. KVKs, ATMA, and schools frequently organise exposure visits to his farm, and he is also invited by Nagaland State Rural Livelihood Mission (NSRLM) to train village-level officers (VLO) on fishery farming.

Aerial view after IFS

Marketing network established: Initially**,** the farm produce was sold in and around the local market within the village. Slowly his produce started to capture bigger markets in the commercial hub of the district (Dimapur). KVK Dimapur has also formed a WhatsApp group, especially for the piglets and chicks, where he sells his chicks and piglets and does the purchasing.

Establishment of process/ units: With continuous support from KVK Dimapur, Shri. Hamjen Thaosen established a poultry unit, leading to significant growth in his farming system. Initially, managing the unit was easy, but as demand increased, sourcing chicks from outside became challenging. To address this, he acquired an 800-capacity hatchery unit, which he now uses to hatch his chicks and ducklings, ensuring a steady supply for his poultry unit.

Linkage with technology/ development organizations: Shri. Hamjen Thaosen has strong linkage with research organisations like Krishi Vigyan Kendra Dimapur, Indian

Council of Agriculture Research, Nagaland Centre, ATMA Dimapur, YouthNet Nagaland, District Agriculture Office, Dimapur, and NSRLM, through which the problems encountered, constraints, and needs are identified and addressed periodically. Through this linkage, he can avail all kinds of information relating to the availability of quality seeds and germplasm, farm tools, and machinery and also get information on the various schemes.

2.2 Japanese fruit Persimmon thriving in Phek district of Nagaland

Profile of the farmer:		
Name of the grower	:	Mrs. Vezokholu Chuzho
Village	:	Thipuzu (Rihuba)
Block	:	Chetheba
District	:	Phek
Enterprise	:	Persimmon fruit
Name of the Centre	:	KVK Phek, Nagaland

Background information of the grower: Mrs. Vezokholu Chuzho, a 48-year-old mother of six from Thipuzu village in Phek district, Nagaland, began growing persimmons in 2005 with three Fuyu saplings from the State Horticulture Farm at Pfutsero. After realising the crop's potential, she and her horticulture-trained son expanded their farm by grafting saplings and establishing a small nursery at home. Today, they continue grafting for commercial purposes while maintaining their backyard orchard.

Technology/process intervened: As Thipuzu village is a NICRA-adopted village, KVK Phek officials provided capacity-building programs on improved persimmon cultivation and post-harvest technologies. They also conducted hands-on grafting demonstrations to expand the nursery for commercial purposes. These training opportunities significantly enhanced local

entrepreneurial skills, helping Mrs. Vezokholu Chuzho support her family's persimmon farming business.

Effect of the technology /process:

Production: The first persimmon harvest came after 3 years, yielding 4 kg from each of her 3 plants. The following year, the yield increased to 7 kg, and by 2012, it reached 30 kg per plant. That same year, she planted 30 more saplings, expanding her farm. Now, with 33 plants, she harvests 2 tonnes of persimmon annually, with each tree producing 60-65 kg of fruit after 7 years.

Productivity: She harvested 2 tonnes of fruit from 33 plants that occupied an area of 1190 m^2. As a result, 16.80 tonnes/ha of productivity were achieved.

Economic gains: Cost of cultivation of persimmon/ha

Particulars	Cost (Rs)	Quantity	Total (Rs)
Sapling cost	200.00	277 nos	55,400.00
Field preparation/clearing of jungle	600.00	20 man-days	12,000.00
Pit digging and filling of pits	600.00	60 man-days	36,000.00
Manure for pit filling (277pits)	10.00	600 kgs	6,000.00
Planting	600.00	5 man-days	3,000.00
Intercultural operations (3 times weeding in a year for 5 years)	600.00	180 man-days	1,08,000.00
Manuring for 5 years for pit filling (277 pits)	10.00	1500 kg	15,000.00
Intercultural operations (3 times earthing up in a year for 5 years)	600.00	75 man-days	45,000.00
Stacking (Bamboo pole)	30,000.00	-	30,000.00
Labour charges to fixing of bamboo poles during fruiting	600.00	30 man-days	18,000.00
Harvesting	600.00	15 man-days	9,000.00
Total			**3,37,400.00**

From per hectare orchard, 16000 kgs (16 tonnes/ha) yield can be obtained, which in turn will earn a gross income of Rs. 16,00,000 when sold at Rs. 100/kg. Thus, per hectare, a net income of Rs. 12,62,600 will be obtained with a benefit-cost ratio of 4.74.

Suitability and adaptability in the existing farming systems: The high organic matter in the soil and favourable climate have supported persimmon farming in Thipuzu. Despite the farm's uneven terrain, Mrs. Vezokholu Chuzho maintains a plant spacing of 15 by 12 feet. The saplings were planted during the dormant season in January and February, as the farming system is rainfed. The climate has proven ideal for persimmon growth, and the crop has adapted well to the region.

Acceptance of technology/process in terms of view of the farmers: She perceives that the adoption of improved production technology on persimmon and her booming nursery has benefitted in terms of higher yield and income.

Out scaling of technology: This year, she planted 200 new persimmon saplings on her farm. Influenced by her, more than 240 farmers in her village and neighbouring villages have taken up persimmon plantations on their farms, covering an approximate area of 17 ha.

Substitution or replacement of commodities: She had previously grown passion fruit, plums, and peaches; however, she stopped cultivating them because of their short shelf lives. However, her production of passion fruit was profitable since she could sell it to the processing units in the neighbouring state of Manipur. But after a few years, the processing units were shut down, so she opted to start persimmon farming instead.

Socio-economic impact: The investment made in persimmon orchards is a profitable endeavour that is financially viable and a socially acceptable trade in Nagaland. Persimmon being an exotic fruit, there is good demand in the local market. It will be essential to meet the demand for fresh and processed persimmon goods in the state and local markets, as well as to boost the on-farm primary processing-based agro sector and create job opportunities through entrepreneurship development.

Marketing network established: There is now a vacuum in the market network because neither the village nor the nearby towns have a regulated market.

Establishment of process/ units: In the year 2023, under the Scheme of Fund for Regeneration of Traditional Industries (SFURTI) program, an initiative of the Ministry of Micro, Small, and Medium Enterprises (MSME), Government of India, Thipuzumi Persimmon, Kiwi, and allied food processing clusters through the Common Facility Centre (CFC) was set up in the village with a processing line capacity of 500 kg/per hour and 3,000 cft of cold storage.

Linkage with technology/ development organizations: Mrs. Vezokholu Chuzho has strong linkage with research organisations like Krishi Vigyan Kendra, Phek, Nagaland, and agencies like The Northeast Initiative Development Agency (NEIDA), Pfutsero, Nagaland, Entrepreneur Associates (EA), Nagaland, and Chakesang Women Welfare Society (CWWS), Pfutsero, Nagaland.

2.3 Conservation Agriculture: Embracing Zero Tillage for Thriving Field Peas

Profile of the farmer:		
Name of the grower	:	Mrs. Nepolu Yhobu
Village	:	Kikruma village
Block	:	Kikruma
District	:	Phek
Enterprise	:	Field pea
Name of the Centre	:	KVK Phek, Nagaland

Background information of the grower: Mrs. Nepolu Yhobu, a forward-thinking farmer from Kikruma village, received an intervention from KVK Phek under the NICRA project. Over two consecutive years, demonstrations were conducted in her field, spanning 0.5 ha. Traditionally focusing on maize cultivation during the Kharif season, Mrs. Yhobu had previously left her Jhum land fallow due to inadequate rainfall in the Rabi season. The introduction of zero-tillage technology during Rabi season in her paddy field enabled her to pursue double cropping. This adoption not only resulted in a significant increase in income but also enhanced soil fertility. The utilisation of zero-tillage technology improved soil moisture retention capacity, leading to improved crop performance.

Technology/process intervened: The Technology Demonstration Component (TDC) was conducted under crop production during the years 2020-21 and 2021-22. The demonstration focused on cultivating the field pea variety Aman in a 0.5-hectare area of the terrace rice field, following the harvest of paddy. Seeds were sown in rows without tilling the soil, aiming to conserve soil moisture, with a spacing of 60 x 20 cm and a seed rate of 80 kg/ha. Before implementing the technology, capacity-building programs and hands-on demonstrations were conducted in farm fields to disseminate knowledge about the approach

Demonstration on zero tillage in field pea

Flowering stage in field pea under zero tillage

Effect of the technology /process:

Year	Yield (q/ha)		Cost of cultivation (Rs.)		Gross income (Rs.)		Net Income (Rs)		BC	
	Demo	Check	Demo	Check	Demo	Check	Demo	Check	Demo	Check
2020-21	14.75	10.92	42400	42000	125375	92820	82975	50820	2.95	2.21
2021-22	12.60	9.08	32100	27600	75600	54480	43500	26880	2.35	1.97

Suitability and adaptability in the existing farming systems: The adoption of zero-tillage cultivation for field pea has significantly contributed to the conservation of soil and water resources while enhancing water use efficiency for the crop. This approach has also improved soil aggregate stability and increased soil organic matter, thereby reducing soil erosion. Furthermore, adopting this technology has enabled the farmer to reduce the overall cost of cultivation.

Acceptance of technology/process in terms of views of the farmers: Due to this technology, the farmer noted a delayed emergence of weeds, attributed to minimal soil disturbance in the uncropped area. Additionally, adopting zero-tillage technology resulted in improved crop performance due to greater water retention in the soil compared to traditional cultivation methods. Consequently, it has garnered widespread acceptance among the farming community due to its ease of implementation and its contribution to sustainable agriculture.

Out scaling of technology: The technology has spread to an area of 5 ha as compared to the area when it was only 0.5 ha. Farmers from neighbouring villages, after observing crop growth and yield, are motivated to adopt this technology in their fields too.

Substitution or replacement of commodities: Following the paddy harvest, the soil compacts, necessitating increased tilling for crop cultivation. This reliance on mechanical tillers proved costly and, more significantly, disrupted soil structure, resulting in diminishing water retention capacity. Therefore, the implementation of zero tillage emerged as a favourable alternative.

Socio-economic impact: Due to its low labour intensity, the technology enabled her to generate a higher income with minimal expenditure. Consequently, she could elevate her family's economic status.

Marketing network established: The produce is sold only in the local market and at the village marketing shed.

2.4 Enhancing Garden Pea Growth: Harnessing Straw Mulching for On-Site Moisture Preservation

Profile of the farmer:		
Name of the grower	:	Mrs. Ruchuhulu Rose
Village	:	Thipuzu village, Phek, Nagaland
Block	:	Kikruma
District	:	Phek
Enterprise	:	Garden pea
Name of the Centre	:	KVK Phek

Background information of the grower: Mrs. Ruchuhulu Rose, a diligent farmer from Thipuzu village, cultivates a variety of vegetables and fruits. Besides, she also has a dozen poultry birds and four pigs. She efficiently juggles her responsibilities, ensuring her children's education and daily expenses are covered through her agricultural pursuits. Her commitment to farming not only sustains her family but also radiates a positive image within her circle of friends and the wider community.

Technology/process intervened: In 2020-21, Phek district's garden pea cultivation yielded 756 metric tonnes from 122 hectares. To address drought challenges in Thipuzu village, part of the NICRA Project, a straw mulching demonstration was held. This method increased yields to 78.57 quintals per hectare compared to 44.8 quintals in control plots, using paddy straw to protect crops and reduce costs.

Effect of the technology /process:

Particulars	Straw Mulching in Garden Pea	Without straw mulching
Average yield /ha (q/ha)	78.57	44.28
Gross Cost (Rs/ha)	139200	136000
Gross income	382850	221185
Net income	253650	85185
Benefit Cost Ratio	2.82	1.63

Suitability and adaptability in the existing farming systems: Farmers in the Phek district traditionally practice monocropping, mainly cultivating local variety paddy. However, after the paddy harvest, the land remains fallow for the rest of the year due to water scarcity. Recognising this challenge, KVK Phek has intervened by providing training and demonstrations on straw mulching for winter crops, particularly in fallow paddy fields. This initiative aims to conserve soil moisture, suppress weeds, and enhance overall land productivity.

Acceptance of technology/process in terms of views of the farmers: Examining the advantages of utilising paddy straw, farmers from neighbouring villages have embraced the technique, extending its application beyond garden pea to include other winter vegetables such as cabbage and potato. This technology has been readily accepted by farmers, particularly considering soil moisture stress caused by dry spells during the winter seasons.

Out scaling of technology (Horizontal spread): Prior to KVK intervention in the village, garden pea cultivation covered 1.4 hectares. Following the adoption of technology, there has been a significant expansion in the cultivation area, with farmers now practicing across 5.5 hectares. Previously fallow after paddy harvest, these lands are now productive due to the adoption of technology.

Substitution or replacement of commodities: Previously, after the paddy harvest, the fields remained fallow due to drought-like conditions. However, with the introduction of straw mulching, garden peas can now be cultivated, contributing to the maintenance of soil fertility levels besides conserving soil moisture.

Socio-economic impact: Rather than leaving the land fallow after the paddy harvest, farmers have opted to cultivate garden pea, thereby generating additional income.

Marketing network established: The farmers have begun selling their produce both in the local market and at the village marketing shed located near the highway.

2.5 Boxing Clever: Transforming Chick Care with Scientific Nesting Boxes

Profile of the farmer:		
Name of the grower	:	Vevozho SHG
Village	:	Thipuzu Village, Phek, Nagaland
Block	:	Kikruma
District	:	Phek
Enterprise	:	Poultry
Name of the Centre	:	KVK Phek

Background information of the grower: The Vevozho Self-Help Group (SHG) was established in 2014, and since its inception, it has been actively engaged in cultivating seasonal vegetables and undertaking poultry rearing. Comprising 10 like-minded women members with a keen interest in farming, the group pooled their resources in the form of membership fees during the initial year. With these funds, they purchased vegetable seeds to kickstart cultivation efforts aimed at generating income.

Technology/process intervened: In 2015, a simple technology was introduced in the village, providing ten female beneficiaries with nesting boxes for their hens. Each box, measuring 12 x 14 x 18 inches, accommodates 3-4 hens and includes pine wood shavings or straw as nesting material. A roost bar was added for easy access, along with a lip to prevent bedding and eggs from falling out. The sloped top discourages roosting on the boxes, and farm women were advised to elevate the boxes to protect against cats and other predators. Simple technology was initiated in the village. Ten (10) boxes with 3 cubicles were given to 10 female beneficiaries following training in the year 2015.

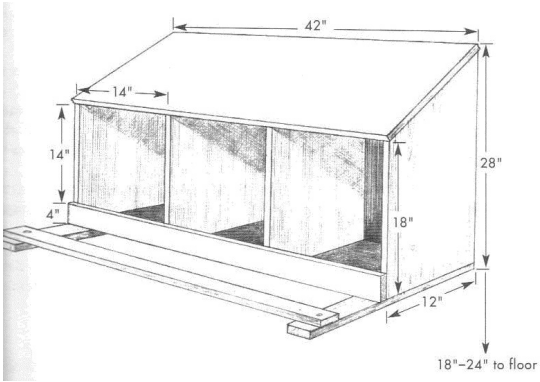


Fig: Nesting box

Effect of the technology /process: The innovative nesting boxes improved hygiene and bedding, significantly reducing egg hiding and scattered laying, which increased hatchability. Beneficiaries reported a net return of Rs. 912 per box with a benefit-cost ratio of 1.14, compared to the traditional method, which had a net return of Rs. 716 per box and a ratio of 0.75. The Self-Help Group (SHG) is now encouraged to produce these boxes for profit and to support fellow farmers in the village.

Suitability and adaptability in the existing farming systems: Since the raw materials required for constructing these nesting boxes are readily available locally, farmers can easily access them at a low cost, providing them with an added advantage in constructing the boxes.

Acceptance of technology/process in terms of views of the farmers: Farm women appreciated the simple and convenient technology of the scientific nesting boxes, which can be made from locally available materials. Previously, traditional nesting boxes placed in verandahs or on coop walls led to mite and flea infestations, posing health risks. The new boxes, using clean bedding materials, effectively addressed this issue, resulting in less egg hiding and scattered laying and consequently increased hatchability, as reported by beneficiaries.

Out scaling of technology: The SHG is presently being encouraged to produce similar boxes upon request, aiming to generate profit and help fellow farmers in the village.

Substitution or replacement of commodities: Traditional nesting boxes have been replaced with this effortless technology.

Socio-economic impact: With the reduction in scattered egg laying, hatchability rates have increased, resulting in improved profitability for farmers.

Marketing network established: The adult poultry birds are locally sold in the village on demand.

2.6 Beating Drought: Maximizing Soybean Yield with Early Sowing

Profile of the farmer:		
Name of the grower	:	Mrs. Vezokholu
Village	:	Thipuzu village, Phek, Nagaland
Block	:	Kikruma
District	:	Phek
Enterprise	:	Soybean
Name of the Centre	:	KVK Phek

Background information of the grower: Mrs. Vezokholu, a dedicated farmer from Thipuzu village, is known for growing crops like potatoes, maize, cabbage, and chilies. Her commitment to farming attracted the attention of KVK officials, resulting in her involvement in the NICRA project. Between 2015 and 2016, a demonstration program was conducted on her 0.8-hectare land, emphasizing early soybean sowing to alleviate moisture stress during critical flowering and pod-filling stages.

Technology/process intervened: The TDC was conducted in the year 2015-16 and 2016-2017, under crop production. The demonstration was taken on soybean var. JS 335 in an area of 0.5 ha in Jhum field during 1st fortnight and 2nd fortnight of May earlier than the conventional time of sowing which is at 1st fortnight of June. The seeds were sown in line at a spacing of 30x10 cm and the seed rate was 80 kg/ha. Before the intervention of the technology, a capacity building programme and hands-on demonstration in the farmer's field was conducted for dissemination of the technology.

Effect of the technology /process (with facts and figures) (max. 200 words):

Year	Yield (q/ha)		Cost of cultivation (Rs.)		Gross income (Rs.)		Net Income (Rs)		BC	
	Demo	Check	Demo	Check	Demo	Check	Demo	Check	Demo	Check
2015-16	22.15	13.08	28000	32000	88600	52320	60600	20320	3.16	1.63
2016-17	23.25	14.26	28000	32000	93000	57040	65000	25040	3.32	1.78

Suitability and adaptability in the existing farming systems: As previously noted, the region grapples with moisture stress, due to aberrant rainfall resulting in significant losses for farmers. However, the implementation of this technology has yielded positive results, mitigating such losses effectively. Consequently, it proves not only suitable for the area but also finds wide acceptance within the local community.

Acceptance of technology/process in terms of the views of the farmers: Initially, farmers were hesitant to adopt the practice, as it deviated from traditional methods. However, the success of early sowing for soybeans, a short-day crop with specific temperature needs, proved remarkable. It yielded satisfactorily in comparison to the conventional sowing period. Witnessing these positive results, the farming community has now embraced this approach wholeheartedly.

Out scaling of technology: The technology has expanded horizontally from 1 ha to 4.5 ha area, covering a larger area compared to its initial implementation. Furthermore, it has also extended to neighboring villages, contributing to its widespread adoption and impact in the region.

Substitution or replacement of commodities: Earlier, she had grown groundnut but due to less market demand she opted for Soybean as it has more demand in the district for its value-added products like Axone (fermented soybean) which is an important ingredient used in traditional food.

Socio-economic impact: This technique not only facilitated higher yields but also resulted in increased economic returns compared to traditional sowing practices. The adoption of the technology helped her to generate more income due to the advancement of sowing time which resulted in better yield.

Marketing network established: She initiated her business right from her own home, initially selling soybean grains to her neighbors. As she expanded her cultivation area, her yield increased, prompting her to market her produce in Pfutsero town, located in the Phek district.

2.7 Cultivation of Rapeseed crops under Zero tillage practices in rice fallow

Profile of the farmer:		
Name of the grower	:	Mr. Angpa Konyak
Village	:	Ngangching
Block	:	Aboi
District	:	Mon
Enterprise	:	Rapeseed cultivation under zero tillage
Name of the Centre	:	KVK Mon

Background information of the grower: Mr. Angpa Konyak is a marginal farmer from Ngangching under Aboi Block in Mon District of Nagaland. His income was fully dependent on agriculture and the most important crop grown by him is rice. He did not pay much attention to any crops during the rabi season, and the field was kept barren. But after attending, the training program on the production technology of toria he started to grow toria on his small (1.0 ha) land. The KVK gives him seeds and helps him in implementing zero tillage in Toria.

Technology/process intervened: Mr. Angpa Konyak previously cultivated local paddy (150 days) before KVK Mon assessed his field. The soil analysis revealed it was acidic (pH 5.0-5.4) and had medium levels of nitrogen (268-278 kg/ha), phosphorus (20.10-27.20 kg/ha), and potassium (132.8-146.50 kg/ha). The average moisture content was 18.11% up to 15 cm and 20.33% at 15-30 cm before planting. No farmyard manure or chemical fertilizers were used. The Toria (TS-67) crop was sown using the broadcast method in the last week of October, with thinning done one week after germination to maintain 15 cm spacing. Frontline demonstrations in Toria were conducted at 1 ha in 2019, increasing to 5 ha in 2021 and 10 ha in 2022.

Effect of the technology /process: The yield data showed that the average toria yield under the demonstration package was 6.75 q/ha, compared to 5.50 q/ha for farmers' practice, marking an 18.5% increase. The net return was ₹17,000/ha for the demonstration package versus ₹7,000/ha for the farmers' practice, with a cost-benefit ratio of 2.70 for the demonstration and 1.47 for the farmers' practice.

Yield and Economics:	Crop productivity and economics of rapeseed crop in rice fallow				
	Seed Yield (q/ ha) ± SD	Gross cost	Gross return	Net return	B: C ratio
	6.75	10,000	27,000	17,000	2.70
	5.50	15,000	22,000	7000	1.47

Suitability and adaptability in the existing farming systems: Farmers in these villages often leave fields fallow during the rabi season due to dry spells and lack of irrigation. By adopting zero tillage, they increased productivity and reduced cultivation costs, leading to higher cropping intensity and additional income with less effort. This method allows for timely sowing in October, conserves soil moisture, requires less water, saves tillage costs, and protects soil from erosion by retaining surface residues. Additionally, zero tillage proves effective under climatic stress and is suitable for the paddy-toria cropping sequence.

Acceptance of technology/process in terms of views of the farmers: The farmers of the village were highly impressed and motivated by the zero tillage cultivation practices due to its cost-effectiveness, less labour consuming, high energy saving increasing cropping intensity (%) and higher net income with efficient utilization of available resources in the village. The success of zero tillage technology empowered the farmers to put their demand before the state line department for the cultivation of toria in addition to off-season vegetables in the rice fallow as second crops.

Out scaling of technology: The impressive performance of Zero tillage in toria awakened the farmers, farm women, and rural youths of the same village as well as neighbouring villages namely Totokchingha, Langmeing, and Sowachangle to adopt this resilient technology as it helps to increase the cropping intensity and elevate net income.

Substitution or replacement of commodities: Generally, most of the farmers in the village follow a mono-cropping system of rice cultivation. After the intervention, rice-toria cropping sequence the villagers became aware of the benefits of toria. The seed and oil are used as condiments in the preparation of pickles and curries. Besides, the utilities of oil obtained from the seeds, the sprouts, leaves, and tender plants are also consumed as spices and vegetables. The oil cake used as feed and manure led to higher production, especially in piggery, cattle rearing, and farms.

Socio-economic impact: Rapeseed-mustard is a key source of income for small farmers in rain-fed areas. A skill-based training program provided villagers with scientific knowledge for better management. Mr. Angpa Konyak from Ngangching Village increased his income, achieving an average net profit of ₹17,000 per hectare

with a low investment of ₹10,000. This encouraged 10 farmers in the Aboi area of Mon district to adopt zero tillage cultivation, increasing the area to 10 hectares.

Marketing network established: The farmers of the village sell their produce in a local bazaar that fetches a good market price for their produce. They also display their products during Technology Week, fairs, and exhibitions under the guidance of KVK Mon.

Linkage with technology/ development organization: Realising the potential of zero tillage toria cultivation in rice fallow, most of the Krishi Vigyan Kendras in the state have started demonstrating the technology in the farmers' field. Popularizing of the technology is being undertaken under the Cluster Front Line Demonstration programme by KVK Mon, ATMA, and State departments.

2.8 Mulching Magic: Boosting Garlic Yields with Paddy Straw

Profile of the farmer:		
Name of the grower	:	Ashoi Konyak
Village	:	Sowa Changle
Block	:	Aboi
District	:	Mon
Enterprise	:	Crops
Name of the Centre	:	KVK Mon

Background information of the grower: Ashoi, a 38-year-old, mother of two from Sowa Changle village in Mon District, is a small-scale farmer with 0.7 hectares of land. Despite limited resources, she works hard to support her family. Ashoi's dedication to farming reflects her resilience and determination, providing for her household while contributing to the local economy. Her efforts symbolize the spirit of rural life, embodying the strength and perseverance of marginalized farmers in her community.

Technology/process intervened: The innovation involved using paddy straw mulch for moisture conservation in rabi crops, particularly garlic. After harvesting the paddy, the field was left fallow, and paddy straw was spread as mulch This method conserves moisture, reduces weed growth, and minimizes labor for weeding and irrigation.

Effect of the technology /process: Paddy straw mulching provides significant cost savings and reduces weed growth by 50-70%, decreasing reliance on herbicides and manual weeding, leading to savings of 30-50% compared to traditional methods. It also improves soil health, reduces irrigation needs, and enhances crop yields.

- Production: 684 kg
- Productivity: Yield before intervention- 18.4 q/ha

  Yield after intervention- 22.8 q/ha
- Economic gains: Benefit: Cost (B: C): 2.35

Suitability and adaptability in the existing farming systems: Paddy straw mulching is ideal for pea and garlic cultivation in remote rainfed areas, where water scarcity and erratic weather pose challenges. It retains soil moisture, regulates temperature, and enriches soil nutrients, helping farmers cope with these issues. Its low-cost and locally available nature makes it accessible, reducing the need for irrigation and chemical inputs. This practice promotes sustainable agriculture, ensuring long-term resilience and prosperity for farmers in rainfed regions.

Acceptance of technology/process in terms of views of the farmers: Paddy straw mulching is embraced by farmers for its economic viability, ease of implementation, and favorable effects on crop productivity. Its utility in moisture retention, weed suppression, and soil fertility enhancement garners growing favor among agricultural practitioners as a sustainable cultivation technique.

Out scaling of technology (Horizontal spread): In rainfed areas and among small and marginal farmers, the horizontal spread of paddy straw mulching is growing. Its cost-effectiveness and effectiveness in conserving soil moisture make it popular. Farmers share knowledge, leading to widespread adoption and improved agricultural resilience in villages.

Substitution or replacement of commodities: Paddy straw mulch serves as a sustainable substitute for conventional agricultural inputs like plastic mulch or chemical fertilizers. Its use reduces reliance on synthetic materials, promotes soil health, and conserves resources. This substitution enhances sustainability and resilience in agricultural practices while minimizing environmental impact.

Socio-economic impact: Paddy straw mulch has a significant socio-economic impact on marginal farmers in villages. By reducing input costs and enhancing soil fertility, it improves crop yields and household incomes. Additionally, it minimizes labor requirements for weeding and irrigation, allowing farmers to allocate time and resources to other activities. This leads to improved livelihoods, food security, and resilience to climate variability. Furthermore, as farmers share knowledge and adopt

sustainable practices, there is a ripple effect, fostering community development and enhancing the overall socio-economic fabric of rural areas.

Marketing network established: Currently, Ashoi engages in direct sales to consumers while also distributing its produce to local markets and intermediaries. Due to its superior quality, her harvest is quickly depleted and commands a favorable price in the local market.

Establishment of process/ units: The NICRA initiative promoted the use of paddy straw mulch in garlic and pea cultivation to help marginal farmers adapt to climate change. By facilitating access to knowledge, resources, and support, NICRA encouraged sustainable farming practices that mitigate climate impacts. This technology enhances farmers' resilience to climate variability, ensuring the long-term sustainability of their livelihoods.

2.9 Rearing of Improved climate resilient Dual-purpose poultry (Kuroiler) for egg and meat purpose

Profile of the farmer:		
Name of the grower	:	Smt. Ephong Konyak
Village	:	Langmeing
Block	:	Aboi
District	:	Mon
Enterprise	:	Poultry
Name of the Centre	:	KVK Mon

Background information of the grower: Smti. Ephong Konyak is a farmer in District Mon. She holds 2.0 ha of land for maintaining a family of 8 members. Before the intervention, in backyard poultry, she was rearing only the local breed. After the start of the NICRA project in her village, she came in contact with Krishi Vigyan Kendra (KVK) Mon in the year 2021-22. Principal Investigator, NICRA Project, along with KVK scientists and YP provided technical knowledge about crop production, livestock management, and the strategies to cope with the prevailing climate. She decided to adopt improved rearing of climate-resilient dual-purpose poultry (Kuroiler) for egg and meat purposes.

Technology/process intervened: Smt. Ephong Konyak was rearing local chickens feeding locally available grains like maize and rice besides the feed material available from free-ranging. After the intervention, she was provided with 80 poultry birds. She started feeding a starter ration up to 2nd week followed by a grower ration replaced with locally available feeds (maize, dried Colocasia, and broken rice) up to 40 % ad libitum feeding. Mineral mixture added to feeds 1% in 2nd week onwards free-ranging and feeding twice a day (morning and evening). She also made available fresh and clean water in bamboo-made watering and feeding troughs.

Effect of the technology /process (with facts and figures): With a stock of 73 birds (mortality 7 Birds), earned an average net profit of Rs. 38,340/- with a benefit-cost ratio of 2.6. At 16th weeks, the chicken had reached an average body weight of around 2.4 kg. She sold live birds at a price range of **₹300/ Kg live weight**, while eggs were occasionally sold for Rs. 10/kg . The economics of production are presented in the table below

Items	Nos.	Rate(₹)	Amount (₹)
Chicks	80	60	4800
Feeds kg upto 4 weeks/bird	1 kg/ month	60	7200
Survival upto 16th week	73	60	2220
		Gross cost	14220
Average bogy weight (kg) at 16th week	2.4	300	52560
Gross income			52560
Net income			38340
BC ratio			2.69

Suitability and adaptability in the existing farming systems: Kuroiler birds are dual-purpose breeds producing more eggs and meat than desi birds. They are relatively resistant to various poultry diseases; thrive well on locally available feed resources and are good scavengers. They perform well in mid-altitude areas of 1000 masl and are suitable for the geo-climatic condition of Mon district Nagaland. Farmers in this region mostly practice Jhum in upland hilly terrain thereby increasing the chances of

crop failure due to changing climate scenarios. Hence, backyard Kuroiler farming has the potential to stabilize farm income and bridge the protein supply gap by improving the livelihood of the tribal farmers.

Acceptance of technology/process in terms of views of the farmers: Maximizing output is crucial in the poultry industry, focusing on achieving high bird weights to meet the increasing meat demand. Observing increased income from selling meat, eggs, and manure, farmers in the community were encouraged to adopt this technology. They approached KVK Mon for vaccinated Kuroiler chicks, while some sourced them independently for backyard rearing. KVK Mon's initiative attracted farmers from nearby villages, offering a low-capital, sustainable economic return and serving as a livelihood-oriented enterprise for small and marginal farmers in the district.

Out scaling of technology (Horizontal spread): Smt. Ephong Konyak has become a role model for rural youth and farm women, promoting improved backyard poultry as a viable agro-preneurship practice for sustainable livelihoods. Inspired by her success, farmers formed three new Self-Help Groups of ten women each to pursue backyard poultry for additional income. They received guidance on preparing affordable poultry feed with local materials, maintaining hygiene and sanitation to prevent diseases, and identifying common health issues to administer treatments themselves, reducing dependence on external veterinary services.

Substitution or replacement of commodities: The farmers sell chicken and eggs to purchase food items, support school fees, get cash for grain milling services, purchase improved seeds, and increase flock size. The market for poultry meat is growing faster than that for any other meat product and to cope with the high demand the farmers have an advantage by adopting this dual-purpose bird which has a short generation interval and a high rate of productivity. They can also be transported with ease to different areas and are relatively affordable.

Socio-economic impact: The community is satisfied with their poultry's performance, noting low mortality rates, rapid growth, and high egg production. Poultry farming is viewed as a viable solution to poverty, offering protein, increased income, and job opportunities in rural areas. The KVK Mon's skill-based training program provided villagers with essential knowledge and skills for managing improved climate-resilient Kuroiler poultry, benefiting local farmers.

Marketing network established: The main market for chicken products and by-products is within their premises. Chicken products were sold in nearby shops, restaurants/hotels. The demand increases during socio-cultural and religious events and occasions such as weddings and birthdays etc. They also display their products during Technology Week, fairs, and exhibitions under the guidance of KVK Mon.

Linkage with technology/ development organization: Popularization of the technology is being undertaken under the "**KSHAMTA" (**Knowledge Systems and Homestead Agriculture Management in Tribal Areas) Demonstration programme by KVK Mon and the state department.

2.10 Tomato Tales- Maximising Yield under Protected Cultivation

Profile of the farmer:		
Name of the grower	:	S Yanchuba
Village	:	K. Wongthu
Block	:	Chessore
District	:	Tuensang
Enterprise	:	Cultivation of Tomato var. Arka Abhed under protected cultivation.
Name of the Centre	:	KVK Tuensang

Background information of the grower: Mr. S. Yanchuba worked as a Physical Education Teacher at Government High School Kuthur, Tuensang. After a rewarding thirty-five years of service, he seamlessly transitioned into community leadership as the village chairman. Retirement didn't slow him down; instead, it ignited his passion for agriculture, and it has been three years since he has been actively involved in agriculture. At 63 years of age now, Mr. Yanchuba embraces technology, incorporating it into his farming practices and working with the KVK to modernize agricultural methods in his village. His tireless dedication to both education and agriculture exemplifies his commitment to the betterment of his community.

Technology/process intervened: The Tomato var. Arka Abhed with triple disease resistance is developed by the Indian Institute of Horticultural Research and is characterized by its firm texture, oblate round, and medium-large fruit, and deliciously sweet flavor, well suited for open field and protected cultivation. Low-cost poly houses are invaluable assets for farmers seeking to optimize crop production in challenging environments. It creates a microclimate by regulating the temperature, humidity, ventilation etc conducive to plant growth and shielding the crops from extreme weather and pests. Constructed from readily available and affordable materials like bamboo and polyethylene sheets, their cost-effectiveness and versatility are indispensable for sustainable agriculture.

Effect of the technology /process (with facts and figures): The introduction of the hybrid tomato cultivar Arka Abhed under protected cultivation has transformed tomato farming in the village, offering a sustainable solution to increase production and adapt to climate change. The protective structure creates a microclimate, shielding crops from adverse weather like heavy rain and temperature extremes. This method reduces plant disease and pest infestations, minimizing the need for chemical treatments, with neem oil used to manage any remaining issues. Additionally, the controlled environment conserves water by reducing evaporation. Mr. S. Yanchuba harvested 200 kg of tomatoes from 29 m^2 of protected cultivation, earning a profit of ₹12,000 from market sales.

Suitability and adaptability in the existing farming systems: The cultivation of tomato var. Arka Abhed under protection is suitable and adaptable to existing farming systems, especially in the village settings. The crop performed exceedingly well resulting in higher yield, minimal disease, and pests' incidences generating revenue for the farmer. The easy construction and operation of protected cultivation, their affordability, and simplicity make them accessible to small-scale farmers with limited resources, empowering the farmers to optimize their production and adapt to changing climatic conditions. Its versatility allows the farmers to grow a diverse range of crops

even during off seasons providing food all year round, enhancing food security and income stability.

Acceptance of technology/process in terms of views of the farmers : The acceptance of the technology has been very positive and encouraging. Initially, the farmer was not aware of the variety and the benefits of protected technology. The whole village had only sparse tomato cultivation with a lower yield. The success of the tomato cultivation venture under protected cultivation has encouraged the farmers to go for a larger scale of cultivation.

Out scaling of technology (Horizontal spread): Initially the demonstration trials for the technology were given to two farmers of the village, however seeing the success of the crop grown in the protected cultivation, another farmer also started in its adoption. Their successful ventures, farmer-to-farmer exchange, have also attracted other villagers to adopt the technology and school students from neighboring villages for field visits for their agricultural vocational studies.

Substitution or replacement of commodities: Farmers can substitute the traditional low-cost polyhouses with more advanced polyhouse technologies, traditional polyhouses materials could be replaced with more durable alternatives and the cultivation of traditional open field crops can be replaced with high-value vegetable crops that fetch higher prices in the market.

Socio-economic impact: The protected cultivation of tomatoes had a profound socioeconomic impact on the farmer by increasing his income through all-year-round crop cultivation helping him improve his livelihood. Disease and pest infestation were negligible and so the use of chemical inputs was nil, reducing his spending on fungicides and pesticides. The construction of the poly house also created employment opportunities for the villagers encouraging community collaboration and development, fostering inclusive growth and empowerment in the rural communities.

Marketing network established : The village does not have marketing sheds so whatever produce is harvested from the field is either sold in the markets of the neighboring villages or sold in the main market at Tuensang town. With increasing demands for tomatoes in the local markets, the tomatoes were sold off quickly generating higher revenue for the farmer.

Establishment of process/ units : The low-cost polyhouse unit was established under the NICRA Project by KVK Tuensang, Nagaland. Site selection with good sunlight exposure was chosen for its establishment. The necessary materials required for its construction such as polyethelene sheets, bamboo etc were procured and the frame was constructed carefully and the polyethylene sheets well secured. A shade net was installed to provide shade and control the amount of sunlight entering the polyhouse,

especially during the hot summer months. Regular monitoring and maintenance were done to ensure its proper functionality. The seeds of the Tomato var. Arka Abhed was procured from the Indian Institute of Horticultural Research, Bangalore, Karnataka.

Linkage with technology/ development organizations: Linkage with Research Institutions in the availability of such higher-yielding seed varieties and their availability to the farmers will help in improving the livelihood of the farmers cultivating the crops. Linkage with financial institutions will also help in accessing funds for polyhouse construction. Linking with other line departments in agriculture and the allied fields will also facilitate technology transfer, market connectivity, etc which will uplift the livelihood of the small-scale farmers in the long run.

2.11 Mushroom Magic- Chendang Village Women's Cultivation Success Tale

Profile of the farmer:		
Name of the grower	:	Chendang Village Women's Mushroom Growers
Village	:	Chendang
Block	:	Sangsangyu
District	:	Tuensang
Enterprise	:	Cultivation of Oyster Mushroom sp. Pleurotus ostreatus
Name of the Centre	:	KVK Tuensang

Background information of the grower: Ten women (Tosangla, Sungmomung, Naong, Noksen, Kumluchu, Shemjila, Mongshai, Among, Nasen Kuntang and Nyemang) from Chendang village were selected to undergo training on mushroom cultivation. These women come from diverse backgrounds, all interested in the cultivation of mushroom. To supplement their income and promote sustainable agriculture, they started on the journey of mushroom cultivation under the guidance of NICRA, KVK Tuensang. The project helped not only by providing economic opportunities but also by fostering women's empowerment through mushroom cultivation.

Technology/process intervened: The technology process evolved with the procurement of high-quality mycelium-infused spawn which was inoculated into a growing medium of well sterilized paddy straw. After inoculation, the substrate bags were kept in an ideal environment for their growth, monitoring, harvesting, etc. Upon full colonization of the substrate bags and subsequent growth of the mushroom, it

was harvested by carefully twisting and removing it from the substrate. Hygiene was maintained to prevent contamination.



Effect of the technology /process (with facts and figures): Initiatives like mushroom cultivation training and spawn provision have empowered the women of the village, providing them with valuable skills and economic independence that contribute to household livelihoods. This venture has diversified agricultural practices and offered a sustainable alternative to traditional crops while enhancing nutrition. Collective mushroom cultivation has fostered a strong sense of community and shared responsibility. With support from the NICRA Project, the group established a mushroom unit with a capacity of 150 bags, harvesting approximately 180 kg over three pickings and earning ₹18,000 by selling at ₹100/kg.

Suitability and adaptability in the existing farming systems: Cultivation of mushroom requires low resources and is quite suitable and adaptable within the existing farming systems. It complements crop cultivation by utilizing agricultural products such as straw and other plant materials, minimizing waste and maximizing resource efficiency. Besides, after the cultivation of mushroom, the substrate left is further used for composting purposes to add nutrients to the soil. Along with agricultural practice, its cultivation can provide an additional source of income for the farmers.

Acceptance of technology/process in terms of views of the farmers: The acceptance of the technology has been very positive and encouraging especially because of its low investments and higher returns benefits. After seeing the success of oyster mushroom cultivation, growers have shared their interests in further expansion and cultivation of the mushroom and have also requested more procurement of the mushroom spawn.

Out scaling of technology (Horizontal spread): The demonstration trials for the technology were given to ten women of the village to cultivate the mushroom

individually as well as in groups. Their successful ventures have attracted other villagers to adopt technology. The mushroom growers have also expressed the need for its cultivation on a larger scale.

Substitution or replacement of commodities: The growers can also go for cultivation of other mushroom species that are found suitable to grow in the region and the demand in the market.

Socio-economic impact : The cultivation of mushroom had a profound socio-economic impact on the growers by increasing their income and improving their livelihood. It has also encouraged community development fostering inclusive growth and women empowerment through collaborative participation in its cultivation.

Marketing network established: The harvested mushrooms are sold in the marketing shed of the village located on the side of the road. Some of the produce is also sold in the markets of the neighboring villages or in the main market at Tuensang town. With increasing demands for mushroom in the local markets, the mushrooms were sold off quickly generating higher revenue for the farmer.

Establishment of process/ units: The NICRA Project established a mushroom unit with a capacity of 150 bags, providing the necessary materials like mushroom spawns, growing bags, and equipment for cultivation. Women in the village received training in oyster mushroom cultivation. With support from the project and their dedication, they successfully maximized their income, achieving economic independence.

Linkage with technology/ development organizations: Linkage with Research Institutions in the availability of good quality spawn and its availability to the farmers will help in improving the livelihood of the farmers cultivating the mushroom. Linking with other line departments in the Agriculture and the allied fields will also facilitate technology transfer, market connectivity etc which will uplift the livelihood of small-scale farmers in the long run.

2.12 Polymulching in cole crops

Profile of the farmer:		
Name of the grower	:	Yongkhong Chingmak
Village	:	Chendang
Block	:	Sangsangyu
District	:	Tuensang
Enterprise	:	Polymulching in cole crops.
Name of the Centre	:	KVK Tuensang

Background information of the grower: Mr. Yongkhong Chingmak, a 37-year-old farmer, is transforming agriculture in his village with innovative practices despite being illiterate. He utilizes contour bunds, improved crop varieties, drip irrigation, and water harvesting to ensure sustainable production. A low-cost polyhouse, constructed with support from KVK Tuensang, allows for off-season cultivation. His dedication to modern techniques exemplifies the adoption of sustainable farming practices, leading to improved livelihoods.

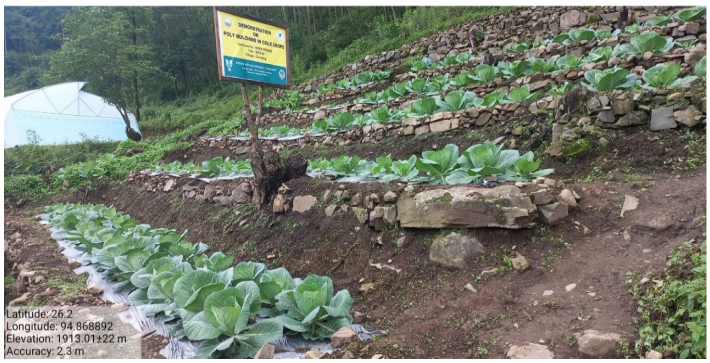
Technology/process intervened: Polymulching is an innovative climate-resilient practice that involves the application of layer of organic or inorganic materials to cover the soil surface around the crops. The process of innovation/adoption was carried out after testing the practicality and utility of climate resilient polymulching. Black polythene mulch film was laid carefully after the land preparation ensuring uniform placement and coverage while the outer edges of the film were covered with soil to keep it tightly bind. Based on the spacing of the crop, holes were then made for transplanting the seedlings.

Effect of the technology /process (with facts and figures): Polymulching helps in reducing evaporation preventing the soil from drying out quickly and conserving soil moisture, critical for adapting to changing rainfall patterns. It acts as a buffer against extreme temperatures by regulating soil temperature providing a more stable microclimate for the crop. It is cost effective; suppresses weed competition with the main crop reducing the need for herbicides. Technology has helped the farmer to achieve a yield improvement of the vegetable crops comparatively over the local practice.

Impact of polymulching of cole crops at Chendang village, Tuensang district.

Intervention	Year	Yield (q/ha)	Cost of cultivation (Rs/ha)	Gross return (Rs/ha)	B:C Ratio
Polymulching	2022-23	229.50	1,83,950	2,30,250	1.25
Control	2022-23	175.80	94,550	98,200	1.03

Suitability and adaptability in the existing farming systems : Poly mulching in cole crops have been observed to be quite suitable and adaptable to existing farming systems. The practical utility and the successful adoption of the poly mulch have encouraged the farmer to continue with its adoption and further increase its coverage in the field. Its proven benefits such as moisture retention, weed suppression, cost effectiveness etc has led to it larger adoption for sustainable cultivation.



Acceptance of technology/process in terms of views of the farmers: He had heard about the technology but didn't have the material to apply in his field. With the help of NICRA project, he was able to practically demonstrate and assess it in his field. Based on farming experiences, the farmer has expressed satisfaction over the use of the technology and has expressed to expand its use further.

Out scaling of technology (Horizontal spread) : The adoption of polymulching innovation by the farmers through their experiences, and techniques has increased awareness and adoption facilitating the spread of knowledge and further adoption of polymulching among the villagers and neighboring villages. Three farmers in the village have already adopted polymulching and furthermore two from the neighboring village have also adopted the technology.

Substitution or replacement of commodities: Farmer can opt for a more durable and greater technology of polymulches to ensure their longevity in the field layout. This will help the farmers to invest one time instead of spending more money purchasing lower quality polymulches repeatedly.

Socio-economic impact: The polymulching in cole crops had a profound socioeconomic impact on the farmer by increasing his income and improving his livelihood. There was reduced spending on weed control as weeds were suppressed under the polymulches. Polymulches helped in mitigating soil erosion and improving soil health resulting in higher quality produce.

Marketing network established: The crop produce is sold in the farmer's marketing shed located near his field on the side of the road. Whatever crop is harvested, he sells it off from his shed. Travelers usually stop on the way to buy the produce from his marketing shed. In case of heavier demands, he sends his produce in bulk to the main market of the Tuensang town or neighboring villages. He supplies his produce even to the neighboring district of Shamator.

Establishment of process/ units: The innovation of climate-resilient poly mulching began with testing its practicality and utility. Training programs and field demonstrations prompted their adoption among farmers. After land preparation, black polythene mulch film was laid uniformly, with soil covering the edges for stability. Holes were made for transplanting seedlings based on crop spacing. Continuous monitoring and field visits ensured the technology's effectiveness, resulting in higher crop yields through the farmer's persistent efforts.

Linkage with technology/ development organizations : The availability of higher and good quality polymulching material in connection with the research institution will help in improving the applicability in the field. Linkage with financial institutions will also help in accessing funds for the procurement of poly mulches. Linking with other line departments in agriculture and the allied fields it will also facilitate technology transfer, market connectivity, etc which will uplift the livelihood of small-scale farmers in the long run.

2.13 From Seed to Harvest- K. Wongthu Farmer's Tomato Cultivation Journey under Protected Cultivation

Profile of the farmer:		
Name of the grower	:	S. Kumkiuba
Village	:	K. Wongthu
Block	:	Chessore
District	:	Tuensang
Enterprise	:	Cultivation of Tomato var. Arka Abhed under protected cultivation
Name of the Centre	:	KVK Tuensang

Background information of the grower: Mr. S. Kumkiuba, a 64-year-old seasoned agriculturist, exemplifies dedication and passion in farming. He cultivates a diverse range of crops, including maize, kidney beans, millets, cabbage, potatoes, and garden peas. Actively participating in departmental activities and diligently following provided training, he embodies a willingness to learn. With a perpetual smile, S. Kumkiuba inspires his agricultural community as a pillar of sincerity and a strong work ethic.

Technology/process intervened : The Tomato var. Arka Abhed, developed by the Indian Institute of Horticultural Research, features triple disease resistance, firm texture, oblate round shape, and sweet flavor, making it ideal for open fields and protected cultivation. Low-cost poly houses are invaluable for farmers, creating a

microclimate that regulates temperature, humidity, and ventilation, shielding crops from extreme weather and pests. Constructed from affordable materials like bamboo and polyethylene sheets, these structures are cost-effective and versatile, essential for sustainable agriculture.

Polyhouse Prepared for Cultivation

Effect of the technology /process (with facts and figures): The introduction of the hybrid tomato cultivar, Arka Abhed, under protected cultivation, has transformed tomato farming in the village, providing a sustainable solution for increased production and climate adaptation. The protective structure creates a microclimate that shields crops from harsh weather, extending the growing season. This method enhances disease resistance, reducing pest infestations and the need for chemical treatments, with neem oil used for any remaining issues. The controlled environment also conserves water by minimizing evaporation. As a result, Mr. Kumkiuba harvested 180 kg of tomatoes from 45 m^2 of protected cultivation, earning ₹10,800 from market sales.

Suitability and adaptability in the existing farming systems: Cultivating the tomato variety Arka Abhed under protected conditions is highly suitable for existing

farming systems in village settings. The crop has shown exceptional performance, yielding higher outputs with minimal disease and pest issues, thus generating revenue for farmers. The simple construction and operation of protected cultivation make it affordable and accessible for small-scale farmers with limited resources, empowering them to optimize production and adapt to changing climatic conditions. This versatility allows for the cultivation of diverse crops year-round, enhancing food security and income stability for the community.

Acceptance of technology/process in terms of the views of the farmers: The acceptance of the technology has been very positive and encouraging. Initially, the farmer was not aware of the variety and the benefits of protected technology. The whole village had only sparse tomato cultivation with lower yields. The success of the tomato cultivation venture under protected cultivation has encouraged the farmers to go for a larger scale of cultivation.

Out scaling of technology (Horizontal spread) : Initially the demonstration trials for the technology were given to two farmers of the village, however seeing the success of the crop grown in the protected cultivation, another farmer also started in its adoption. Their successful ventures, farmer-farmer exchange have also attracted other villagers to adopt the technology and school students from neighboring villages for field visits for their agricultural vocational studies.

Substitution or replacement of commodities : Farmers can substitute the traditional low-cost poly houses with more advanced polyhouse technologies, traditional polyhouses materials could be replaced with more durable alternatives and the cultivation of traditional open field crops can be replaced with high-value vegetable crops that fetch higher prices in the market

Socio-economic impact: The protected cultivation of tomatoes had a profound socioeconomic impact on the farmer by increasing his income through all-year-round crop cultivation helping him in improving his livelihood. Disease and pest infestation were negligible and so the use of chemical inputs was nil, reducing his spending on fungicides and pesticides. The construction of the poly house also created employment opportunities for the villagers encouraging community collaboration and development, fostering inclusive growth and empowerment in the rural communities.

Marketing network established : The village does not have marketing sheds so whatever produce is harvested from the field is either sold in the markets of the neighboring villages or sold in the main market at Tuensang town. With increasing demands for tomatoes in the local markets, the tomatoes were sold off quickly generating higher revenue for the farmer.

Establishment of process/ units : The low-cost polyhouse unit was established under the NICRA Project by KVK Tuensang, Nagaland. A site with good sunlight exposure was selected for construction. Necessary materials, including polyethylene sheets and bamboo, were procured, and the frame was carefully built and secured. A shade net was installed to control sunlight entering the polyhouse, especially during the hot summer months. Regular monitoring and maintenance ensured proper functionality. Seeds of the tomato variety Arka Abhed were sourced from the Indian Institute of Horticultural Research in Bangalore, Karnataka.

Linkage with technology/ development organizations : Linkage with Research Institutions in the availability of such higher-yielding seed varieties and their availability to the farmers will help in improving the livelihood of the farmers cultivating the crops. Linkage with financial institutions will also help in accessing funds for polyhouse construction. By linking with other line departments in agriculture and the allied fields it will also facilitate technology transfer, market connectivity, etc which will uplift the livelihood of small-scale farmers in the long run.

2.14 Transforming livelihoods: low-cost climate resilient affinitive pig pen model's journey towards climate resilience and economic improvement

Profile of the farmer:		
Name of the grower	:	Janario Phawa
Village	:	Wahiajer
Block	:	Thadlaskein block.
District	:	West Jaintia Hills
Enterprise	:	Livestock production
Name of the Centre	:	KVK Jaintia hills

Background information of the grower: Janario, aged 24, is a young and ambitious individual who has completed a degree in Biotechnology with high hopes of securing a job in his field. However, he soon realized that the job market was highly competitive and faced a shortage of suitable activities, determined not to be discouraged he decided to explore alternative avenues to make a living. Being from a rural background and having witnessed the potential in agriculture, Mr. Janario saw an opportunity in piggery farming and took the initiative for a piggery unit. But before NICRA intervention, he was faced with problems of frequent incidence of diseases in pigs and an increased

mortality rate, especially during cold stress season. But with KVK Jaintia intervention under NICRA project, he was introduced to the pig pen model, which enhanced the resilience of his piggery by raising them using locally available resources. Through training, he gained more knowledge about the care and management of piggery which helped him to address the problems faced. The pig manure was utilized in the field as organic fertilizer for the crops thus reducing his dependence on chemical fertilizers, and in turn promoting nutrient cycling.

Technology/process intervened: Piggery farming is expanding in Meghalaya, where pork is the preferred meat and a vital livelihood for many rural residents. However, challenges like improper housing and health management hinder growth. To address these issues, KVK Jaintia Hills has implemented a technology for constructing deep litter pig sheds to alleviate winter stress and maintain a comfortable environment for pigs during extreme weather.

The low-cost, eco-friendly pens use locally sourced materials, featuring sawdust flooring. Each shed measures 12 feet long and 7 feet wide, with a 5-foot bedding area and a 7-foot outdoor space for feeding and defecation. The pigs achieve a marketable body weight of 80-90 kg, with reductions in lameness (6.6%), skin diseases (25.5%), diarrhea (15.2%), and respiratory issues (7.2%). The average temperature in the shed during peak winter months remains within 20-23 °C.

Effect of the technology /process: -

- Piglet Production: The farmer experienced a significant increase in piglet production, with 16 piglets compared to 12 piglets before technology intervention. This indicates improved breeding and management practices.
- Gross Return: The gross return saw a substantial rise of ₹72050, as compared to earlier ₹ 54000 before technology intervention.
- Gross Cost: Despite a slight increase in gross costs from Rs. 21500 before intervention to Rs. 22080, the revenue earned was more hence, compensating the additional expenses incurred and in turn reflecting efficient cost management.
- Net Return: The net return surged from Rs.32500 before intervention to Rs. 49970 after intervention, indicating a significant improvement in profitability. This could be attributed to higher production efficiency and better pricing strategies.
- Benefit-Cost Ratio (BCR): The BCR increased from 1.5 to 2.26 after technology intervention. This suggests a more favorable condition for the piggery unit as compared to the previous year.

Components	Number of pigs	Production/ year	Gross Returns	Gross Cost	Net returns	B:C ratio
Piggery (after NICRA intervention)	2	16 piglets per year	72,050	22,080	49970	2.26
Piggery (before NICRA intervention)	2	12 piglets per year	54, 000	21,500	32500	1.5

Suitability and adaptability in the existing farming systems: The pig pen model was suitable in villages due to its simplicity, cost-effectiveness, and adaptability to small-scale farming. It provides a controlled environment for pigs, minimizing disease risks and maximizing productivity. Additionally, it allows for easy waste management and integration with other agricultural activities in the village.

Acceptance of technology/process in terms of views of the farmers: The farmers accepted the pig pen model technology due to its practicality, low cost, and potential for increased income. Its simplicity makes it accessible to farmers with limited resources. Moreover, the model's ability to improve pig health and productivity while requiring minimal space and investment makes the farmers adopt it as a sustainable livelihood option.

Out scaling of technology : So far 8 farmers have adopted the pig pen model in nearby villages namely Larnai, Mobakhon, Wahiajer, Thangbuli and Thad Muthlong.

Socio-economic impact: After successfully selling his pig and piglets, he earned Rs. 49970. This income has a significant socioeconomic impact on his life and the community around him. Economically, his earnings allow him to invest in modern farming equipment and tools. With higher income, he will be expanding his farm and hiring more workers, providing employment opportunities in the village. Socially, his increased income enables him to support his family better. He can afford his children's education. Additionally, he contributes to local businesses by purchasing goods and services, increasing the village economy. Thus, his earnings from the piggery unit not only improve his livelihood but also help to improve his society.

2.15 Unveiling the transformative power of walk-in tunnels in NICRA villages

Profile of the farmer:		
Name of the grower	:	Amrita Phawa
Village	:	Wahiajer
Block	:	Thadlaskein block.
District	:	West Jaintia Hills
Enterprise	:	Walk-in tunnel
Name of the Centre	:	KVK Jaintia hills

Background information of the grower: Smt Amrita Phawa, hailing from Wahiajer village is a dedicated farmer ready to adopt new technologies. When she attended one of the training courses on Climate resilient technologies under the NICRA project in the year 2021, she expressed her interest in the protected cultivation of vegetables. She was selected as one of the beneficiaries of Walk in the Tunnel- Off season vegetable cultivation

Technology/process intervened: The Jaintia Hills district faces low cropping intensity, typically growing only one vegetable crop per year. To boost production, multiple cropping systems are needed, but cold winters hinder growth. Polyhouses offer year-round cultivation but are costly. Instead, walk-in tunnels made of iron pipes and bamboo provide a cheaper, movable alternative, protecting crops from harsh weather. Measuring 6 feet high, 2 meters wide, and 15 meters long, these tunnels use a non-UV stabilized plastic sheet (120 GSM) to trap heat and shield against frost and hailstorms. Farmers can grow high-value vegetables like cabbage and tomatoes, achieving three crops annually: tomato (January-April), cabbage (May-August), and tomato (September-December), with spacings of 45x45 cm for tomatoes and 30x30 cm for cabbage.

Effect of the technology /process (with facts and figures) : The economic impact of the walk-in tunnel is very high and it proved to be a very successful intervention

because, with tomato as a sole crop in open conditions, the yield recorded was 2.9q in the 120sqm (size of the unit), with a net income of Rs. 3600 whereas with tomato, cabbage, and tomato in the walk-in tunnel (size of each walk in tunnel is 30sqm and for each unit there are 4 tunnels) yield recorded of tomato was 7.2q, cabbage was 5.25q and tomato was 7.1 q and with a high net income of Rs. 44500. The net return was high due to the off-season production of the vegetables which could reach a higher price per kg. This intervention has proved to be a livelihood improvement for the farmers with an increase of the B:C ratio from 2.64 to 7.4:1.

Technology	Production (Q.)	Gross cost	Gross Income (Rs.)	Net Income (Rs.)	B:C ratio
Tomato in open conditions	2.9	2200	5800	3600	2.64:1
Protected cultivation of tomato followed by cabbage followed by tomato	Tomato= 7.2q, cabbage = 5.25q and tomato= 7.1q	6940	51450	44500	7.4:1

Acceptance of technology/process in terms of views of the farmers: By setting up walk-in tunnel, crops can be cultivated year-round irrespective of seasons and well protected from extreme weather conditions. The higher production obtained has also encouraged other farmers in the village with the technology.

Out scaling of technology: At present the number of farmers benefitted is 6. This technology benefits the youth and farmers with less land holding since the outcome is more from a small unit area. It has more scope for upscale in urban areas.

Socio-economic impact: Smti Amrita Phawa has become one of the role models for other farm women. She has also started a woman SHG Saindurlang for proper functioning and benefitting the marginal farm women in her village.

Marketing network established: She markets the produce herself in the nearby local market on a particular market day and the rest is sold to a middleman, transporting her produce to different parts of the state**.**

Linkage with technology/ development organizations: She has received assistance from other agencies such as a house for rearing silkworms from the Sericulture Department, and seeds and biopesticides from the State Agriculture Department. She also attends training and exposure visits to the ICAR-RC for NEH region, the Sericulture department, State Agriculture and Horticulture Department.

2.16 Crop rotation: from fallow to flourishing production

Profile of the farmer:		
Name of the grower	:	Smti Hilda Lamare
Village	:	Wahiajer
Block	:	Thadlaskein block.
District	:	West Jaintia Hills
Enterprise	:	Crop Rotation
Name of the Centre	:	KVK Jaintia hills

Background information of the grower: Paddy is one of the major crops grown in the region followed by maize. The farmers in this region mostly leave their land fallow after the cultivation of paddy. This leads to low crop intensity, poor land utilization and resources. As so, is the case of Smti. Hilda Lamare, hailing from Wahiajer village, has been practicing monocropping for ages. It was on one of the field visits that the SMS noticed the potential of the fallow paddy lands to be converted into fertile and productive land by the cultivation of potatoes and winter vegetables. With the intervention of KVK Jaintia Hills, the farmer was advised to take up crop rotation by cultivating potato crops after paddy and other winter vegetables such as cabbage and pea which are high-remunerative crops.

Technology/process intervened: To address monocropping and low crop intensity, a paddy-based crop rotation was adopted under the Natural Resource Management module. This method utilizes water retention in paddy fields to create raised beds for growing potatoes and cabbages.

Unlike traditional monocropping (June-November), this technology allows for two crops on the same land. The cabbage variety Wonderball is nursery-raised in low-cost protected structures in October and planted (November-February) after harvesting paddy in November, with a spacing of 45x45 cm. Potatoes, specifically Kufri Megha, are planted in the raised beds (February-May) after paddy harvest, spaced at 30x30 cm.

Organic fertilizers, including a basal dose of FYM treated with Metarhizium

(250 g/50 kg FYM) to control white grub, were applied along with 120 kg/acre of rock phosphate to enhance soil fertility. Cabbage seedlings were treated with biofertilizers (Azotobacter + PSB at 2 kg each in 10 liters of water) to improve soil microbial activity. For potatoes, the soil was inoculated with biofertilizers (Azotobacter + PSB at 250 g each in 100 kg compost) and Trichoderma (250 g/50 kg compost). Copper oxychloride (0.25%) was sprayed to control late blight, and the farmer created her biopesticide using locally available materials like chili, garlic, and pepper for other pests.

Effect of the technology /process : Intending to increase the cropping intensity in the district, KVK Jaintia Hills conducted a Front Line Demonstration on paddy-based crop rotation, namely, paddy followed by cabbage and paddy followed by potato in the lowland areas where there is water retention. This is beneficial since additional irrigation during the dry season is not required. Increased production from 19.1q to 350.25q was observed in the farmer's field. Initially, her net income was a mere Rs. 33900 from monocropping of paddy, which has increased manifolds to Rs. 297460 after adopting crop rotation. The B: C ratio increased from 1.8:1 to 2.46:1. The higher returns obtained have improved her socio-economic conditions and have enabled her even to increase her area under cultivation.

Technology	Area (ha)	Production (Q.)	Gross cost	Gross Income (Rs.)	Net Income (Rs.)	B:C ratio
Before intervention: Monocropping of paddy	1	Paddy=19.1	42500	76400	33900	1.80:1
After intervention: Paddy followed by cabbage (A)	1	Paddy=22.8 Cabbage=256	138865	347200	208335	2.50:1
After intervention: Paddy followed by Potato (B)	0.5	Paddy=11.4 Potato=60.2	129865	308100	178235	2.37:1
Total after intervention (A+B)	1.5	350.25	203790	501250	297460	2.46:1

Acceptance of technology/process in terms of views of the farmers: Before NICRA intervention, only monocropping was followed and the field was left fallow after harvest of paddy. The introduction of crop rotation under NICRA intervention helped her to cultivate more than one crop in one year. In addition, improvements in soil quality and crop health were observed ultimately resulting in much higher yield.

Out scaling of technology : The Potato and vegetable field of the farmer has become a model plot for exposure visits of other farmers from other villages which has helped in dissemination of the technology to other villages. Through her success, the technology

has spread to other farmers and about 12 farmers in her village have started practicing crop rotation in their fields. Additionally, the technology so far has spread to 2 neighbouring villages.

Socio-economic impact: Smti. Hilda Lamare has become a role model for other farmwomen. She has also started a women's SHG to assist the marginal farm women in her village.

Marketing network established: Her produce is sold in a nearby market on traditional market day.

Linkage with technology/ development organizations: The farm woman has received assistance from other agencies such as a house for rearing silkworms from the Sericulture Department, and seeds and biopesticides from the State Agriculture Department. Training and exposure visits to ICAR-RC for NEH Region, Sericulture department, State Agriculture and Horticulture department.

2.17 From fields to fisheries: success story of paddy-cum fish

Profile of the farmer:		
Name of the grower	:	Manbha Mukhim
Village	:	Mukhnang
Block	:	Thadlaskein block
District	:	West Jaintia Hills
Enterprise	:	Paddy-cum Fish
Name of the Centre	:	KVK Jaintia hills

Background information of the grower : Mr. Manbha Mukhim (42 years) from Muknang village of West Jaintia Hills district is a dedicated and hard-working farmer who is always willing to take up new technologies. His primary source of income is agriculture, and he mostly cultivates paddy as it is the staple food of the region. However, due to the high labour cost involved in paddy cultivation, he could profit from it. With the intervention of the NICRA project under KVK Jaintia Hills, he was chosen as the beneficiary from the village and improved technology on rice-fish integration developed by ICAR, Umiam (2013) was demonstrated in his paddy field in an area of 0.1ha.

Technology/process intervened: A low-lying area that retains water for 4-6 months has opted for rice-fish farming under mid-hill conditions. The rice-fish plot (500sq. mt) was designed with a perimeter canal (size 1mt width & 0.5m depth) for rearing an improved variety of common carp i.e., amur carp and also local common carp at a stocking density of 4000 nos. per ha. A Paddy (local variety) was transplanted in the 2nd week of July and after 21 days of transplantation an amur carp and local common carp of size 10-15 cm length were released in the ratio of 1:1. The total nos. of fingerlings released was 400 Nos.

Effect of the technology /process (with facts and figures): The fish were harvested in November at the time of harvesting of paddy. Amur carp obtained an average growth of 250 gm and the average growth of local common carp was recorded to be 190 gm after 120 days of culture duration. The survival percentage of fish was 90-95%. The total yield of paddy and fish was 2.3q & 0.55q respectively from an area of 0.1 ha.

Parameters	Technology(ha)	Farmers Practice
Yield	Paddy yield:2.3 quintal Fish yield:0.55q	Paddy yield:2.5q
Gross return	19050	8750
Net return	11250	4500
BC ratio	2.44:1	1.94:1

Suitability and adaptability in the existing farming systems: During periods of drought, the fish provide an additional source of income when rice yields are lower. The farmer also benefits from his paddy-cum-fish system during periods of market fluctuations. While rice prices may fluctuate throughout the year, the income obtained from selling fish provides a steady stream of revenue, helping to stabilize his overall income and livelihood

Acceptance of technology/process in terms of views of the farmers: The additional income obtained from marketing fish provides the farmer with much-needed financial stability, allowing him to invest in better farming equipment and education for his children. He shares his success story with other farmers in the village, encouraging them to adopt paddy-cum-fish farming as well

Out scaling of technology: The intervention of rice-cum-fish culture has significantly improved farmers' income, increased paddy yields, and enhanced nutrient intake, contributing to food security. The presence of fish in rice fields creates a more balanced ecosystem, helping control insect pests and reducing pesticide contamination in water and soil. This sustainable farming practice has gained acceptance among farmers, with expansion plans. Currently, four additional farmers have adopted this technology.

Socio-economic impact: In addition to rice cultivation, he now generates revenue from selling fish. This diversification helps against market fluctuations and provides a more stable income for his family. Also, by hiring labor from the community, he contributes to rural livelihoods and economic development. He becomes a source of knowledge and inspiration for other farmers in his community. He shares his experiences and best practices in paddy-cum-fish farming, encouraging others to adopt this innovative approach. Through collaboration and knowledge-sharing, the entire village benefits.

Marketing network established: The farmer usually sells his produce in his village and the nearby villages as well.

Linkage with technology/ development organizations: He received training from the agriculture department and received help from the Agriculture Technology Management Agency.

2.18 Zero tillage on Mustard

Profile of the farmer:		
Name of the grower	:	Enin M. Sangma
Village	:	Asugre
Block	:	Chokpot
District	:	South Garo Hills
Enterprise	:	Zero tillage on Mustard
Name of the Centre	:	KVK South Garo Hills

Background information of the grower: Smt. Enin M. Sangma, a marginal farmer from Asugre village located in Chokpot block under the South Garo hills district of Meghalaya, was selected under the NICRA Project. Her family comprising 5 members obtained their livelihood from 1.8 ha of land, where crops like paddy, mustard, and other crops are grown following traditional practices. Generally, a monocropping system of paddy cultivation was practiced, whereby, the paddy field was left fallow after the harvest. Cultivation of paddy becomes impossible due to the onset of winter resulting in spikelet sterility thus putting the socio-economic status of the farmer at a dismal state.

Technology/process intervened: To address severe water scarcity and moisture stress from November to February, KVK South Garo Hills introduced Zero Tillage technology using mustard variety DRMR-150 in farmers' fields under NICRA-TDC. Initial capacity-building programs provided farmers with skill-based knowledge and essential inputs like seeds, biofertilizers, and biopesticides. This resource-conserving technology improved cropping intensity, farm income, and livelihoods. Utilizing residual soil moisture and existing kharif paddy crop residues also enhanced soil health and microbial activity.

Effect of the technology /process: The adoption of zero tillage in mustard in rice-fallow, not only helped in conservation of resources but also gave increased yield, thus providing better income to the farmer. An average productivity of 12 q/ha was observed in adopters' field as compared to 9 q/ha in traditional practices. During the year 2023-24, the Zero tillage in mustard technology was found to earn more net income with B:C ratio of 2.83 as compared to non-NICRA farmers whereby, B:C ratio was 2.49

Suitability and adaptability in the existing farming systems: The successful demonstration of this climate-resilient zero tillage cultivation of mustard in rice fallow by KVK, South Garo Hills under NICRA-TDC, created an impact among the farmers of the Asugre village to go for extensive adoption of this technology for better income generation.

Acceptance of technology/process in terms of views of the farmers : The Farmers of Asugre village were highly impressed and motivated by the Zero tillage cultivation

practices due to cost-effectiveness, less labour consuming, high energy saving increasing cropping intensity (%), and higher net income with efficient utilization of available resources in the village. The success of Zero tillage in mustard empowered the farmers of the Asugre village to put their demand before the State Line Department for cultivation of oilseed like mustard, rapeseed, and rabi Pulses like pea, in addition to off-season vegetables in the paddy fallow as second crops.

Out scaling of technology: The impressive performance of the Zero tillage demonstration of mustard conducted in Asugre village encouraged the farmers, farm women, and rural youth of the village as well as neighbouring villages namely Anigre, Bolchimdagre, and Allagre to adopt this resilient technology.

Substitution or replacement of commodities: Before the intervention of this technology, the Paddy field in Asugre village usually remained fallow without growing any second crop after Paddy. But with successful intervention of this technology, farmers of the village could think of growing oilseed crops like mustard after kharif Paddy instead of keeping the Paddy field fallow during rabi season.

Socio-economic impact : The Paddy- Rapeseed Cropping sequence under the Zero tillage system enhanced the cropping intensity of the area with substantial income enhancement of Rs. 50,400/- over the paddy fallow (monocropping) system. To adopt this resilient technology under climate change adaptation and mitigation go for the second crop after paddy as it helps to increase the cropping intensity and elevate net income. Moreover, this technology was also found to be better reconciliation under the climatic stress condition.

Marketing network established : The produce is usually sold in local Bazar and Chokpot bazaar where a good market price is fetched.

2.19 Cabbage cultivation using polymulch

Profile of the farmer:		
Name of the grower	:	Kennedy D. Momin
Village	:	Asugre
Block	:	Chokpot
District	:	South Garo Hills
Enterprise	:	Cabbage cultivation under polymulch
Name of the Centre	:	KVK South Garo Hills

Background information of the grower: Shri. Kennedy D. Momin, a marginal farmer from Asugre village located in Chokpot block under South Garo hills district of Meghalaya was selected under NICRA Project. His family of 6 members derive their livelihood from 2.0 ha land, where he cultivates Cole crops like Cabbage, Cauliflower, Brocolli along with other crops following traditional practices.

Technology/process intervened: Polymuch for cole crops was introduced under NICRA-TDC by KVK, South Garo Hills, which he recalled as the turning point for him. By implementing polymulching in cabbage, he observed higher yield as compared to his traditional practice.

Effect of the technology /process:

- Production : Poly mulch suppresses weed growth and soil moisture loss. Major insect-pest & disease were also reduced due to plastic mulch. The yield of cabbage under Polymulch was higher as compared to traditional practice without polymulch.
- Productivity: 60 q/ha was obtained in a technology adopted field as compared to non- adopted field where yield was about 46 q/ha.
- Economic gains: The Polymulch in cabbage was found to earn more returns with an impressive B: C ratio of 2.14 as compared to a non-adopters field with B: C ratio of 1.72 during the year (2023-24).

Suitability and adaptability in the existing farming systems: The successful demonstration of this technology, i.e, polymulch in cabbage cultivation introduced under NICRA - TDC by KVK, South Garo Hills, Meghalaya, created an impact among the members of the Asugre to go for extensive adoption of the technology for better income generation.

Acceptance of technology/process in terms of views of the farmers: The Polymulch in cabbage operations greatly impressed and motivated the farmers of Asugre village because it was more economical, required less labor, saved a lot of energy, and increased net revenue while making efficient use of the village's resources.

Out scaling of technology: The remarkable performance of Polymulch in cabbage in the farmer's field encouraged other farmers and rural youth of Asugre village, as well as the nearby villages of Anigre, Bolchimdagre, and Allagre to adopt this technology in their field.

Substitution or replacement of commodities: Before NICRA intervention, he was cultivating cabbage under traditional practice, which did not earn him much profit. However, with NICRA intervention, and under the guidance of KVK, South Garo Hills he adopted polymulching in the cabbage plots, resulting in better yield as compared to traditional practice for his family consumption and income enhancement.

Socio-economic impact: By adopting polymulch in cabbage, his crop is protected from adverse weather conditions, in turn giving him better returns than the non-adopters field. He received an income of Rs. 60,000 from cultivating cabbage under polymulch. He is now a source of inspiration for other farmers of his village and neighbouring villages as well.

Marketing network established: The farmers' produce is sold in local Bazar and chokpot bazaar where a good market price is obtained.

Linkage with technology/ development organizations: He obtained information about crop production, the strategies to improve cultivation practices, and new technologies by attending training, and method demonstrations conducted by KVK South Garo Hills.

2.20 Cultivation of Climate Resilient Paddy Variety

Profile of the farmer:		
Name of the grower	:	Pronilla M Sangma
Village	:	Marapara
Block	:	Dalu, Block
District	:	West Garo Hills
Enterprise	:	Paddy cultivation
Name of the Centre	:	KVK South Garo Hills

Background information of the grower: Mrs. Pronilla M Sangma, a farmer from Marapara village under Dalu Block cultivates paddy for her livelihood. Before the introduction of climate-resilient varieties by KVK West Garo Hills, she grew local paddy varieties where production was less due to the incidence of pests and diseases. It was only after the intervention of KVK under the NICRA project that climate-resilient varieties like Ranjit sub-1 and Gitesh were introduced, that she started to obtain more yield and better returns.

Technology/process intervened : The climate changes harm paddy cultivation in the area. Due to delays in monsoon, the farmer is unable to transplant paddy at the proper time, which in turn affects the yield. To address this issue, KVK West Garo Hills, under the TDC-NICRA project, introduced improved varieties of paddy *var-Gitesh* and *Ranjit sub-1* at Marapara and Bagugre village under Dalu Block of West Garo Hills district. The variety was grown on 5.8ha in 2022 and 7.6 ha in 2023. *Gitesh* is a staggered transplanting variety and is also tolerant of stress caused by floods so it can be grown in dry weather conditions. This variety also matures early compared to the local variety.

Another improved rice variety demonstrated was *Ranjit sub-1* which is a flood tolerant variety. It has the potency to survive up to 15 days under flood conditions, while local varieties cultivated by farmers failed after 5-6 days in water submergence. *Ranjit sub-1* showed better yield performance than other local varieties.

Effect of the technology /process : The introduction of improved varieties brought about increased yield in addition to addressing the problems of flood and stress. Introduced variety 'Gitesh' resulted in a significant increase in yield ranging from 42.02% to 62.16%, accompanied by higher net returns compared to existing varieties and practices.

The performance of climate resilient paddy varieties *i.e.* Gitesh and Ranjit sub-1 along with local variety are provided below:-

Variety	Yield/ha	Cost production/ha	Gross return/ha	Net income/ ha	B:C Ratio
Gitesh	51-54	26800	54000	27200	2.01
Ranjit sub-1	49-51	24500	51000	26500	2.08
Local (Farmer Practice)	22-24	14600	24100	9500	1.65

Suitability and adaptability in the existing farming systems: The paddy variety *Gitesh* and *Ranjit sub-1* introduced by the KVK could withstand stress and frequent flooding as compared to local varieties of paddy cultivated by farmers. As there is a frequent occurrence of floods and changes in rainfall patterns which impact the

cultivation of paddy in the area, hence, these high-yielding and flood-tolerant varieties introduced were suitable and had wider acceptance by farmers from the area.

Acceptance of technology/process in terms of views of the farmers : Due to climate changes, there is a delay in planting which affects the yield of the paddy. But the new varieties like *Gitesh* which is the staggered transplanting variety and *Ranjit sub-1*, the water submerging resistant variety could address these issues. Hence, there is acceptance of these improved and high-yielding varieties which can perform well amid critical weather periods as compared to the local varieties.

Out scaling of technology : The climate resilient variety introduced under the NICRA-TDC project could address the problems of stress and flood which occurred frequently in the area. Hence, the farmers could better yield by cultivating these varieties. Seeing the good performance of these new varieties, more farmers from within and nearby villages were encouraged to take up these varieties.

Socio-economic impact: With the adoption of climate resilient variety i.e. Gitesh and Ranjit sub-1, there is increased productivity resulting in better returns, hence improving the socio-economic condition of the farmer.

2.21 Harvesting Hope: My NICRA-TDS Transformation

Profile of the farmer:		
Name of the grower/group	:	Smt. Jemnud Marpan
Village	:	Thadnongiaw
Block	:	Bhoirymbong
District	:	Ri Bhoi
Enterprise	:	Agriculture and allied

Background information of the grower : Smt. Jemnud Marpan, a 47-year-old farmer from Thadnongiaw village in Ri-Bhoi District, Meghalaya, makes the most of her 0.5-hectare land through diverse agricultural practices and livestock rearing. Despite limited resources, she successfully cultivate**s** cabbage (0.2 acres), lettuce (0.1 acres), chili (0.1 acres), ladies finger (0.15 acres), potato (0.3 acres), and pea (0.1 acres). Her farm also supports poultry and piggery, contributing to her family's income and food security. Smt. Marpan's dedication and efficient use of resources demonstrate how small-scale farmers can thrive through resilience and innovation

Technology/process intervened:

1. Integrated Fish cum Raised Floor Poultry Farming System: The integrated fish cum poultry farming system is a system where poultry droppings or deep litter materials are utilized by feed as feed material for fish. There is greater significance given its potential role in the recycling of organic waste. The main objective is to produce the optimum level of phytoplankton, zooplankton, and bacteria which are protein-rich natural feed for fish by the livestock excreta. This system helps save fertilizer costs, save supplementary feed costs, and chicken gets its required quantity of water from the ponds, and at the same time meats, eggs, and fish can be produced. The house is constructed utilizing locally available materials like wooden pillars, bamboo side walls, and thatch roofing or with iron pillars and roofing sheets for longer durability. A floor with split bamboo also helps in the easy drop-down of feces which keeps the floor dry and hygienic. It is very suitable for chronologically flooded/flash flood areas. The method decreases mortality rates and prevents other diseases

2. Micro-irrigation through harvested water in Jalkund for multipurpose use: The changing weather, unpredictable rainfall patterns, and drought are the main factors contributing to water stress. Therefore, proper water conservation and efficient utilization of rainwater are needed in the area. Harvesting rainwater during the rainy season and its reuse during the water stress period by constructing a water harvesting structure known as Jalkund is an effective option. In this Jalkund of size 5x4x2 m about 40,000 litre of water can be stored. Farmers may have an option for the capacity according to their water requirement for the crops intended to be cultivated and also for diversified use of water in various farm activities like crop, livestock, and fish production during post rainy season.

Effect of the technology /process:

1. Integrated Fish cum Raised Floor Poultry Farming System: Under this system, fish production was enhanced by 45% and obtained 295 kg of fish per 0.1 ha pond.

From raised poultry which was demonstrated with 30 birds/unit, 4720 eggs could be produced in a year and the farmer could get 175.8 kg of meat. There was an enhanced growth rate of poultry by 208%, egg production by 120% and income was enhanced by 81%. There was no disease incidence, and the mortality rate reduced from earlier 19% to 3%. Additionally, there was resources conserved by 10-15%.by utilizing poultry litters as fish feed.

Integrated Fish cum Raised Floor Poultry Farming System				
Initial cost (Rs)	**Net income (Rs)**	**B:C ratio**	**Growth rate**	**Reduced mortality rate**
30671.00	61825	3.1:1	208%	16% (from 19% to 3%).

2. Micro-irrigation through harvested water in Jalkund for multipurpose use

Crop	**WR(L)/ week/0.1 ha**	**Yield (q/0.1 ha)**	**WUE (q/l)**	**GC (Rs/0.1 ha)**	**NR (Rs/0.1 ha)**	**B:C Ratio**
Ladies Finger	4500	5	0.11	12460	12540	2.00
Cabbage	4500	25	0.55	10250	27250	3.65
Chilli	3500	0.5	0.014	2900	4600	2.59
Cauliflower	4500	18	0.40	14250	39750	3.78
OUTPUT						
Sl. No.	**Intervention**	**Output**	**Gross Income (Rs)**		**Net Income (Rs)**	**B:C Ratio**
1	Fish	30 Kg/jalkund	6000		4870	5.3:1
2	Vegetables	48.5 q/0.1 ha	124000		44000	1.6:1
Total			**130000**		**48870**	**3.4:1**

Suitability and Adaptability in the existing farming systems: The Integrated Fish cum Raised Floor Poultry Farming System is suitable for regions with moderate climates and water access, promoting mutual benefits between poultry and fish farming. Its adaptability is significant, enabling small-scale farmers to diversify income and enhance food security. Micro-irrigation using harvested water in Jalkund is ideal for rain-fed areas, supporting multipurpose use and enhancing farm resilience and sustainability. Both systems provide practical solutions for resource-limited farmers.

Acceptance of technology/process in terms of views of the farmers: Farmers generally accepted the Integrated Fish cum Raised Floor Poultry Farming System and micro-irrigation through harvested water in Jalkund. They appreciate the cost savings, increased productivity, and resource efficiency. These methods enhance food security and income diversification, making them favorable choices for sustainable farming practices.

Out scaling of technology: The technology **is** adopted by ten other farmers/farm women. The technology help farmers to earn extra income, provide employment opportunities to rural youths, farm women and efficient waste utilization as feed materials and fish production.

Socio-economic impact: The Integrated Fish cum Raised Floor Poultry Farming System and micro-irrigation through harvested water in Jalkund improve the socio-economic status of farmers, promoting sustainable and resilient agricultural practices.

- **Increased Productivity and Income:** These systems diversify farm outputs, leading to higher overall productivity and income.
- **Cost Reduction:** Utilizing poultry waste as fish feed significantly lowers production expenses. This cost-effective practice maximizes resource efficiency and boosts profitability.
- **Water Conservation and Efficient Irrigation:** The Jalkund system conserves rainwater for use during dry periods, ensuring consistent irrigation during scarce times.
- **Employment Opportunities:** The need for labor in maintaining integrated systems and managing irrigation structures provides employment for residents, reducing rural unemployment rates.
- **Environmental Sustainability:** Improved resource management, such as recycling poultry waste and conserving water, contributes to environmental sustainability, thus, reducing the environmental footprint of farming activities.
- **Enhanced Well-Being of Farming Households:** The economic benefits and increased food security resulting from these systems enhance the overall well-being of farming households.
- **Resilience Against Climate Challenges:** Efficient water use, diversified farm outputs, and sustainable resource management help mitigate the adverse effects of unpredictable weather patterns and climate change.

Marketing network established: A robust marketing network for the Integrated Fish cum Raised Floor Poultry Farming System and Jalkund micro-irrigation includes local markets, cooperatives, and agribusinesses. This network ensures efficient distribution and sales of fish, poultry, and crops, boosting farmers' incomes and market access.

Linkage with technology/ development organizations: Linkages with technology and development organizations are vital for the Integrated Fish cum Raised Floor Poultry Farming System and Jalkund micro-irrigation. Partnerships with agricultural universities and research institutes provide access to advanced farming techniques and innovations. Development organizations, such as NGOs and government agencies (KVK), offer training, financial support, and resources to implement these systems. Collaboration with technology providers ensures the availability of efficient micro-irrigation equipment and sustainable farming tools. These linkages enhance farmers' knowledge, improve productivity, and promote the adoption of sustainable practices, ultimately leading to increased income, food security, and environmental conservation.

2.22 Income enhancement through improved cultivation practices of Stress Tolerant Dragon fruit

Profile of the farmer:		
Name of the grower	:	H.Lalnunmawia
Village	:	Hnahthial
Block	:	Hnahthial
District	:	Lunglei
Enterprise	:	Dragon fruit cultivation
Name of the Centre	:	KVK Lunglei District, Mizoram

Background information of the grower: Mr. H. Lalnunmawia of Hnahthial village began cultivating dragon fruit in 2017 but initially struggled with low yields and small fruit sizes due to a lack of knowledge of proper management practices. After attending training and demonstrations by KVK Lunglei under the NICRA project, he learned about improved cultivation and nutrient management. The knowledge gained empowered him to adopt proper practices, resulting in better returns from his dragon fruit cultivation.

Technology/process intervened: Selection of stress-tolerant fruit crops like dragon fruit, proper site selection and layout, proper

nursery and land preparation, proper spacing, water management, IPM, IDM, weed management, mulching with straw, intercropping with soybean and other vegetables, nutrient management with FYM or compost @15kg/plant, N:P:K@70:90:40 g/ plant at the time of planting and 6 and 12 months for new crops and 50:50:100g/plant in the month of April-May, July-August and December for bearing fruit crops, postharvest handling of fruits and processing.

Effect of the technology /process (with facts and figures):

Year	Crop	Production (q/ha)	Gross cost (Rs)	Gross return (Rs)	Net return (Rs)	B:C ratio
2022	Dragon fruit	56.25	1,35,000	2,81,250	1,46,250	2.08:1
2023	Dragon fruit	145	1,08,500	4,80,000	3,71,500	4.4:1

Suitability and adaptability in the existing farming systems: Keeping in view the adverse climatic condition of Hnahthial village, cultivation of stress-tolerant crops like dragon fruit following improved cultivation practices has shown significant changes in yield resulting in increased return.

Acceptance of technology/process in terms of views of the farmers: The training programmes and demonstrations conducted by KVK Lunglei under the NICRA project on improved cultivation practices, nutrient management, and plant protection measures in dragon fruit have equipped the cultivators and encouraged them to adopt proper management practices in their field, in turn, resulting in higher returns. The technology was easily accepted by the farmers in other villages as well.

Out scaling of technology: By seeing the success of Mr. H.Lalnunmawia, other villagers are being motivated to incorporate the new technological concept on their farm as well. He not only motivated his fellow farmers from his village but other farmers from nearby villages to start their firms using the new technology to generate better returns.

Substitution or replacement of commodities: Mr. H. Lalnunmawia became aware of the cultivation of stress-tolerant crops with improved cultivation practices. This has helped him to overcome most of the problems that he faced earlier in raising his crops which include the incidence of different pests and diseases and nutrient deficiencies. Due to this technology, he was able to double his income.

Socio-economic impact: The technology imparted by KVK Lunglei through the NICRA project has fostered a positive attitude among farmers in Hnahthial village and has spread to neighboring villages, demonstrating a significant impact in the district. After

adopting this technology, farmers experienced higher yields compared to previous years, generating sustainable income year-round. Last year, dragon fruit cultivation yielded an impressive ₹4,80,000 with an average yield of 145 q/ha, resulting in a net income of ₹3,71,500.

Marketing network established: The farmer usually sells his produce in local markets, nearby villages, and other districts within the state. Dragon fruit wine was prepared which fetched a higher price than fresh fruit.

Linkage with technology/ development organizations: After KVK Lunglei intervention through the NICRA project on improved cultivation technology of dragon fruit, the farmers got recognition from different agencies like ATMA, MzSRLM, NEIDA and the State government and became one of the best progressive farmers in the district and he was awarded as Best Horticulture farmer 2022 by the State Horticulture Department.

2.23 Intercropping of Maize + Soybean for efficient utilization of resources and higher return under rainfed farming system

Profile of the farmer:		
Name of the grower	:	Shri. FR Lalnundika
Village	:	S.Vanlaiphai
Block	:	Hnahthial
District	:	Lunglei
Enterprise	:	Intercropping of Maize var. RCM 76 with Soybean var. JS 335
Name of the Centre	:	KVK Lunglei District, Mizoram

Background information of the grower: Shri F.R. Lalnundika, a maize grower from S. Vanlaiphai village, cultivates maize and vegetables on his 1.8 ha land. Initially, he used local maize varieties with longer durations and lower yields, leaving little surplus beyond family needs. As one of the first to practice intercropping, he adopted maize var. RCM 76 and soybean var. JS 355 under the NICRA project, following a 1:2 intercropping ratio. This technology significantly improved yields, allowing for increased grain production for both food and fodder purposes, resulting in positive outcomes for his farming practice.

Technology/process intervened: The earlier practice of sole cropping resulted in land and soil degradation, which in turn hampers the yield of crops. In addition, this practice also increases the risk of crop failure due to diseases, insect infestation, etc. To address these issues, the intercropping system was introduced by KVK Lunglei under the NICRA project. The intercropping allows diversified farming which has a positive effect on the soil as well as the environment. In addition, higher yields are obtained with the use of improved crop varieties, the risk of crop failure is reduced, and there is increased crop intensity and highly efficient utilization of resources by following the new practice.

Effect of the technology /process : Intercropping of maize and soybean has a positive impact on the yield, soil, and environment. It reduces the risk of crop failure, and increases cropping intensity and efficient utilization of resources.

Production:

Sl. o	Indicators	Before intervention (2020)	After invention (2023)
1.	Variety	Local	RCM 76 + JS 335
2.	Seed rate(kg)	20	20 + 30
3.	Sowing	Traditional method	Line/row sowing
4.	Spacing	Traditional method	75x30
5.	Yield(kg/ha)	9.67	11.21 + 8.3

Productivity:

Sl. no	Indicators	Before intervention (2020)	After invention (2023)
1.	Cost of Production (Rs.)	22000	30000
2.	Gross Return (Rs.)	33845	58530
3.	Net Return (Rs.)	11845	28530

Economics gains:

Cost of Production (Rs.)	Gross Return (Rs.)	Net Return (Rs.)	BC Ratio
30000	58530	28530	1.95

Suitability and adaptability in the existing farming systems: Farmers in the region traditionally cultivated maize as a sole crop in upland and lowland areas, relying on local varieties for food and feed, which resulted in low yields and soil degradation due to continuous single-crop farming. The introduction of an intercropping system with improved maize varieties under the NICRA intervention yielded positive results. Farmers were able to harvest both maize and soybean from the same land, enhancing soil fertility through the inclusion of leguminous crops as intercrops, thus promoting sustainable agricultural practices.

Acceptance of technology/process in terms of views of the farmers: Intercropping of maize and soybean in the ratio of 1:2 yields positive result and got good feedback from the farmers. In the NICRA adopted village, most of the farmers are practicing intercropping of maize with leguminous crops. Some of the farmers also intercrop maize with other vegetables as well.

Out scaling of technology: The practice of intercropping of maize and soybean in the adopters' field showed better results as compared to sole cropping of maize. This positive result motivated the farmers not only in the NICRA adopted village but also in surrounding villages to adopt intercropping in maize fields with leguminous crops or vegetables as intercrop. The practice is followed in 8 villages surrounding Hnahthial district, with 97 farmers practicing this technology till date.

Substitution or replacement of commodities: Before the NICRA intervention, farmers practiced sole cropping of maize, focusing on either food or fodder. They cultivated local varieties for food and obtained fodder seeds from agricultural departments, but they needed a high-yielding, shorter-duration maize variety suitable

for both purposes. The introduction of a maize variety RCM 76 under the NICRA project successfully met these requirements. Intercropping RCM 76 with leguminous crops like soybean not only provided additional income and reduced the risk of crop failure but also enhanced soil fertility.

Socio-economic impact: Intercropping of maize and soybean gives additional income to the farmers; they get higher yield by adopting new and improved varieties. The practice of sole cropping of maize not only yielded lower returns due to old varieties and improper soil management but this practice was detrimental to the soil and environment in the long run. After the NICRA intervention, farmers became aware of the positive results of intercropping practice, and they also obtained higher yield and income by adopting this practice.

Marketing network established : Maize harvested is sold both as green cobs for food and grains for feed purposes, while, Soybean is harvested as grain and sold for food in the local market. The maize grains after grinding are also sold in the surrounding villages as animal feed.

Linkage with technology/ development organizations: KVK Lunglei works in convergence with the Department of Agriculture and ATMA-Lunglei District in the dissemination and popularization of this technology. In convergence with these departments, the training and awareness programs were also conducted, and inputs were distributed to the farmers, to achieve the purpose and to benefit the farmers.

2.24 A transformation journey of resilience in pig sty

Profile of the farmer:		
Name of the grower	:	F. Biakthangpuia
Village	:	Tuipui D
Block	:	Hnahthial
District	:	Lunglei
Enterprise	:	Piggery
Name of the Centre	:	KVK Lunglei District, Hnahthial

Background information of the grower: Mr. F. Biakthangpuia, a 48-year-old farmer from Old Tuipui D village, Mizoram, left school after the 8th grade to support his family through farming. Dissatisfied with low returns from his Jhum field, he started piggery with two piglets but faced high mortality and slow growth due to traditional housing. In 2020, he lost all his piglets during extreme summer conditions. KVK Lunglei intervened, demonstrating improved housing systems and providing technical support under the NICRA project. After attending training, Mr. Biakthangpuia expanded his piggery to 10 sows, ensuring better productivity and profitability.

Technology/process intervened: Under the traditional housing system, the pigs were reared in a compact area without any concrete and raised floor. Timber was used as a pole and side wall. The roofing was made of tin and placed at a low height, which made the pigs suffer from intense heat during the summer season and more dew during the winter months.

Under the NICRA intervention, he was instructed to construct a recommended size of deep litter housing for the pigs, with a recommended floor space area of the sty at 35 sq.ft. To cope with the extreme heat and cold weather, bamboo was fixed below under the roof, and corners of the side wall at 2 ft and the floor were cemented. Large White Yorkshire (LWY) was introduced for breeding purposes. The piglets were vaccinated against Classical swine fever @ 1 ml intramuscularly and timely and regular deworming was done with Albendazole @ 5-10 mg per kg body weight. The feed consists of concentrate feed mixed with kitchen waste and locally available fodder and leaves to minimize the feed cost. Clean drinking water is always kept available. The pigs were also supplemented with vitamins, minerals, and anti-stress oral medicines and supplements for protection against heat stress. Regular cleaning of the pig shed was done with disinfectants to reduce the chance of infection.

Impact of Thermo regulation

Technology demonstrated	Measurable indicators of output		% increase
	Demo	Local	
Thermoregulation in pig sty using Bamboo ceiling during the summer month	28.5^{0}C	32.3^{0}C	Heat reduced by 3.8^{0}C

Effect of the technology /process: The effect of improved housing in pig stys in terms of output and economic gains is provided in the Table below.

Productivity

Indicators	Year		
	2020	2021	2022
Breed	LWY	LWY	LWY
Weight at weaning (kg)	7-8	11-12	12-15
Age at maturity (months)	8-12	7-8	6-7
Body weight at 12 months (kg)	32-38	75-85	85-110
Mortality (%)	13	5	-
Breeding Management	Inbreeding	Crossbreeding	Crossbreeding
Breeding practice	Natural	A.I	A.I

Economic gains

Indicators	Year		
	2021	2022	2023
Gross cost	37500	2,76,923	5,29,411
Gross return	60,000	7,20,000	18,000,00
Net Return	22500	4,43,077	12,70,589
B:C Ratio	1.6	2.6	3.4

Suitability and adaptability in the existing farming systems: The improved housing for piggery is suitable for adaptation as it suits local conditions and farming practices. It contributes to faster growth, higher litter size, higher meat yield, and disease resistance resulting in higher productivity compared to traditional housing systems.

The optimized feeding programs and health management protocols enhance efficiency in pig production thereby, leading to higher profitability.

Acceptance of technology/process in terms of views of the farmers: Improved housing methods in pig farming reduce environmental impacts, especially heat stress, and improve animal welfare. These methods meet market demands for quality piglets and regulatory standards while boosting productivity, disease resistance, and profitability. High farmer adoption of these techniques is driving innovation, sustainability, and resilience in the piggery industry.

Out scaling of technology: There is a significantly higher rate of adoption and expansion of scientific technology for rearing pigs in other villages within the district. This innovative approach has not only improved the livelihoods of local communities but also enhanced agricultural productivity. Through proper training and support, farmers have embraced these techniques, leading to increased yields and economic growth. As this initiative continues to expand, it promises a brighter future for sustainable piggery farming and rural development.

Substitution or replacement of commodities: The scientific low-cost housing system has replaced the traditional housing for the rearing of pigs, as it protects pigs from diseases and climate-induced stress and enhances the efficiency of pig production and better meat yield. This has encouraged more farmers to take up piggery for additional income thus, resulting in an increased supply of piglets and meat for the community.

Socio-economic impact: Farmers using scientific crossbred pig rearing in improved housing saw higher income from increased productivity and market value. It resulted in larger litter, faster growth, and more employment opportunities, especially for youth and women. The expansion of pig farming also boosted demand for services like veterinary care, benefiting the local economy and enhancing farmers' income, nutrition, and social empowerment.

Linkage with technology/ development organizations: He has a link with Resource centers such as the College of Veterinary Sciences & Animal Husbandry, CAU, Mizoram, Department of Animal Husbandry and Veterinary, Government of Mizoram, ICAR Kolasib, Mizoram through which he can access resources and technical support. For marketing linkages, he seeks help from the Block Development Officer, Block Mission Director, and State rural livelihood mission to assist and help the pig farmers within the state to market their produce at fair prices and access wider markets.

2.25 Renovation of defunct ponds for multipurpose use

Profile of the farmer:		
Name of the grower	:	Dinsangi
Village	:	Tisopi
Block	:	Siaha
District	:	Siaha
Enterprise	:	Cabbage cultivation
Name of the Centre	:	KVK Siaha

Background information of the grower : Dinsangi, a marginal farmer from Tisopi village in Siaha district, Mizoram, relies on her 2 ha land to support her family of six. Previously, her Rabi crops, like cabbage and tomato, did not yield stable returns due to poor management practices and adverse weather conditions. Under the NICRA project, KVK Siaha introduced the renovation of defunct farm ponds for multipurpose use, addressing water stress and crop failures during winter. This intervention enabled her to cultivate additional crops such as French beans, cabbage, tomatoes, and green leafy vegetables while also taking up livestock farming. As a result, her income significantly increased, inspiring other farmers in the village to adopt this technology.

Technology/process intervened: The renovation of the non-functional farm pond has ensured maximum utilization of land and allowed farmers to conserve the excess runoff during the rainy season, and store excess water from irrigation channels, and other sources. Under this intervention, a farm pond is dug out with a definite shape and size having proper inlet and outlet structures for collecting the surface runoff flowing from the farm area. It is one of the most important rainwater harvesting structures constructed in the lowest portion of the farm area. This water is used for irrigating crops and for livestock during periods of dry season.

KVK Siaha has also provided training and technical guidance to the farmers. They also assisted the farmer and demonstrated in farmers' fields the Soil Solarization, Pit digging method for sloppy areas, Manures and Fertilizers application, Intercultural operation, Identification of pests and diseases management, etc which has benefitted the farmer. In addition, cabbage seeds (var. Rareball) were also distributed to the farmer.

Effect of the technology /process : By adopting this technology, the farmer could get a good cabbage production (46 q/ha) and increased productivity of 185 q/ha from her 0.25 ha area.

- Production :46q/0.25ha
- Productivity : 185q/ha
- Economic gains : Benefit: Cost (B: C) : 3.5

Suitability and adaptability in the existing farming systems: The construction of farm ponds was a suitable intervention for underutilized land on Dinsangi's farm. This cost-effective technology significantly enhanced crop productivity. Before implementing this technology, her profits from crops were minimal. However, the farm pond addressed issues of heat and moisture stress, allowing for lifesaving irrigation during water scarcity. As a result, Dinsangi and other farmers were encouraged to cultivate more Rabi crops, utilizing the conserved water to irrigate their fields during dry periods, leading to increased agricultural output and income.

Acceptance of technology/process in terms of views of the farmers : After seeing improved yields, larger cabbage heads, and strong crop performance in the demonstration plot, farmers accepted the technology and adopted various practices introduced by the KVK. Farm pond construction for irrigation also spread to neighboring villages, as it saves costs and boosts productivity.

Out scaling of technology: After a successful demonstration in the Cabbage field, the farmers of Tisopi village adopted the technology and started cultivating different crops under this technology. The village also acts as a model village for farmers from other villages of the district, whereby KVK Siaha conducts method demonstrations in the farm school. This has led to the horizontal spread of the technology within the district to a huge extent.

Substitution or replacement of commodities: Before the introduction of the technology, the traditional practice of cultivation was followed, and crop failure was a common phenomenon observed particularly for winter crops due to moisture stress as no irrigation was provided. The introduction of farm ponds has brought about improvements in farmers' fields as it addresses the climate change issues faced by

the farming community. Higher crop yields are obtained thus resulting in increased income for the farming community.

Socio-economic impact: The construction of farm ponds has helped farmers obtain good yield and in turn good income. As the farmer has taken up more crops under this technology, there is more output enhancing the income and thus uplifting the socio-economic status of the farmer. Through her success, she has influenced the non-farming community to take up farming as well.

Impact in terms of income before and after intervention:

Crop	CRT			FP		
	Gross cost	Gross return	B:C Ratio	Gross cost	Gross return	B:C Ratio
Cabbage (Rareball)	155000	590000	3.8	115000	366000	3.18

Marketing network established: The farmers sell their fresh produce to retailers in Siaha town at the rate of Rs.20/kg, excluding the transportation cost. The cost of cabbage in the market varies from Rs.50 during the peak season and can reach up to Rs.100 during the lean season.

Linkage with technology/ development organizations : KVK Siaha has established a good link with IARI, New Delhi, and the National Seed Corporation of India regarding the procurement of quality seeds and there is also a direct link with State Agriculture and Horticulture Departments as well as ATMA, Mizoram for the supply of IPM inputs and technology dissemination through which farmer is benefited.

2.26 Community nursery of winter vegetables to supply seedlings during water stress conditions – Tomato (ArkaAbhed)

Profile of the farmer:		
Name of the grower	:	A. Nosi
Village	:	Tisopi
Block	:	Siaha
District	:	Siaha
Enterprise	:	Tomato cultivation
Name of the Centre	:	KVK Siaha

Background information of the grower: A. Nosi, is a farmer from the village Tisopi in the Siaha district, Mizoram. She owns a cultivable land of 1.5 ha from which her family comprising four members derives their livelihood. She cultivates mustard, lettuce, brinjal, and green leafy vegetables but the returns from selling these crops were not enough to sustain her family. She also incurs heavy losses during times of natural calamities. But with assistance and guidance received from KVK under the NICRA project and a provision of improved varieties of crops, she could get better returns and support her family through farming.

Technology/process intervened: KVK Siaha under the NICRA project introduced nursery management to obtain maximum seed germination with disease and pest-free seedlings. Community nursery was introduced to address the problem of crop loss in the early stage due to natural calamities like scanty rains, drought, and heavy rainfall in the rainy season.

With the assistance of KVK Siaha, 2 community nurseries were prepared through which healthy seedlings were supplied to the selected beneficiaries for the cultivation of winter vegetables. In addition, training and demonstrations were also conducted on improved nursery management like fertilization, raised beds, pest and disease management, post-harvest management and value addition, etc.

Effect of the technology /process: The farmer obtained uniform and healthy seedlings for planting raised under the nursery. For seedlings raised under nursery, a high germination rate of 85-95% was observed, damping off seedlings was reduced and there was sufficient moisture and aeration obtained for seedlings growth. Also, yield and production of crops increased by 60%. The farmer obtained a tomato yield of 180q/ha by adopting the technology as compared to traditional practice where the yield was only 112q/ha.

Suitability and adaptability in the existing farming systems: Before KVK's intervention, the farmers faced losses in the Rabi season due to heat stress and water scarcity. After KVK training, she adopted nursery raising and improved practices, boosting crop protection and returns. Regular KVK guidance on crop care enhanced farm productivity, and new tomato varieties like Arka Rakshak and Arka Samrat became popular. Using nylon rope for staging also reduced production costs.

Acceptance of technology/process in terms of views of the farmers: The nursery raising of crops has helped the farmers to address climate issues faced and brought improvements in farmers' fields, resulting in improved crop yields and helping to increase the income of the farming community.

Out scaling of technology: Witnessing the result of nursery raising in the demonstration field, many farmers in the village adopted this technology. More farmers have started to take up tomato cultivation. Her success has drawn the attention of other neighboring farmers in this area; as a result, more farmers have come forward for assistance and technical guidance from Kendra.

Substitution or replacement of commodities: The adoption of nursery raising, and improved tomato varieties has largely replaced traditional tomato growing methods, with 80-90% of villages switching to new varieties. After seeing the high yields of Arka Abhed and Arka Samrat, these varieties gained popularity in the farmer's village, motivating other nearby farmers to grow tomatoes and earn significant income.

Socio-economic impact: The farmer's demonstration plot successfully generated extra income from fallow land in addition to rice cultivation. By introducing the Arka Abhed variety, tomato yield tripled compared to the local variety, with high-quality fruits fetching good market prices. The nursery was raised between late July and early August, allowing harvest during peak market demand for higher profits. Her success has inspired others in the community, proving that farming with proper knowledge and techniques can be a profitable livelihood option, potentially reducing labor migration for employment elsewhere.

Impact of adopting improved variety

Sl. No	Particulars	CRT	Farmer's Practice
1	Variety Name	Arka Abhed	Local Variety
2	Season	Rabi	Rabi
3	Area cultivated in hectares	0.15	0.15
4	Yield	180q/ha	112q/ha
5	The gross cost of cultivation	1,60,000	1,40,000

6	Gross return	7,20,000	4,48,000
7	Net income	5,60,000	3,08,000
8	B:C ratio	4.5	3.2

Marketing network established: With increased production, she could sell tomatoes in Siaha market at a good price. Her produce is sold to middle -man at a rate of Rs. 40/ kg.

Establishment of process/ units: KVK Siaha has assisted the farmers and trained them on the preservation of the shelf life of the crop. Her product is processed into tomato sauce and ketchup with the assistance of KVK SMS (Home Science).

2.27 Success on Integrated fish cum duck farming

Profile of the farmer:		
Name of the grower	:	Mr. Swini
Village	:	T. Khullen
Block	:	Senapati
District	:	Senapati
Enterprise	:	IFS
Name of the Centre	:	KVK-Senapati

Background information of the grower: Mr. Swini, a farmer from T. Khullen village under Senapati district is one of the beneficiaries of the NICRA Project. His family comprising 5 members was engaged in duck rearing in their farm pond before the NICRA intervention. Under the advice of KVK Senapati, he integrated fishery into the existing system, *i.e*, duck rearing to utilize the available resources. This intervention enabled him to diversify his income.

Technology/process intervened: Mr. Swini after receiving training on IFS conducted by KVK Senapati, incorporated a fishery unit in his existing duckery. KVK Senapati not only assisted him but also provided him with 1000 fish fingerlings to be reared in the existing pond along with 30 birds.

Effect of the technology /process:

- Production : NR: Duck- Rs.22600/-, NR: Fish-Rs. 48000/-
- Productivity : Duck : 2.78kg per bird / 4 months
  Fish: 0.400kg per fish /8 months
- Economic gains : Benefit : Cost (B: C) :Duck: 1.87:1
  Fish: 2.5:1

Suitability and adaptability in the existing farming systems: The model is well adapted to the existing farming system with complementary effects from different components. As ducks are commonly reared by the farmers, incorporating fish components in the existing system becomes suitable.

Acceptance of technology/process in terms of views of the farmers: The IFS was well received by the farmers in the NICRA-adopted villages as well as by farmers from the neighboring villages due to its good return. As this system provides practical solutions for resource-limited farmers, hence it is easily accepted by the farmers.

Out scaling of technology: After witnessing the success of this model, about 21 Integrated Fish cum Duckery farming has been established by the farmers using different breeds of fish and duck. The model has spread to many new villages.

Substitution or replacement of commodities: Prior to intervention by KVK Senapati, fishery and duckery units were taken up by farmers as a separate component. However, under the NICRA project, the integrated farming system was introduced where the fishery unit was integrated with the existing duckery unit.

Socio-economic impact: The integration of fish cum duck farming allows farmers to generate revenue from more than one source, enhancing economic stability. As a fish unit is introduced in the existing duckery system, resource use is efficient. With additional components, there is increased output and higher incomes thereby resulting in better nutrition and improved living standards of the households.

Marketing network established: The produce is either sold at the weekly village market or the district main market.

Linkage with technology/ development organizations: The farmer is linked with both KVK Senapati and state departments for assistance in upscaling the technologies. His integrated fish cum duck farming has been selected as a model by the State Department for further dissemination to other farmers.

2.28 Slurry Method of Phosphorus Management in Paddy

Profile of the farmer:		
Name of the grower/group	:	Mr. Pradip Bhowmik
Village	:	Golaghati
Block	:	Bishalgarh
District	:	Sepahijala
Enterprise	:	Paddy
Name of the Centre	:	KVK Sepahijala

Background information of the grower: Mr. Pradip Bhowmik, is a farmer from Golaghati village located in Bishalgarh block under Sepahijala District of Tripura. He owns 0.6 ha of land, from which his family comprising five members derive their livelihood by cultivating rice and winter vegetables following a traditional practice. He was one among the selected farmers where the Slurry Method of Phosphorus Management in Paddy was administrated by KVK Sepahijala under the NICRA project during 2022-2023

Technology/process intervened: In 2022-2023, KVK Sepahijala implemented the Slurry Method of Phosphorus Management in Paddy over 2.57 ha, benefiting 20 farmers in Golaghati GP, Sepahijala District, Tripura.

1. Step 1: A mud slurry with 7 kg SSP was prepared in a 45 sq m area for 1 ha, and paddy seedlings were soaked overnight in this slurry (112.5 mg of P per kg of soil mud).

2. Step 2: A second mud slurry was prepared with 5 kg cow dung and 4 kg or 500 ml of MC bio-fertilizers, where seedlings were dipped for 2 hours.
3. Step 3: Before transplanting, 50 kg/ha Rock Phosphate, 44 kg Urea, and 66.4 kg Murate of Potash were applied.

Effect of the technology /process: The Slurry Method of Phosphorus Management administered in the Paddy field saw a reduction in phosphatic fertilizer requirement by 50% compared to normal practices. There was improvement in yield of paddy by 36% and the farmer could earn an additional income of Rs.32785 from one hectare area.

- Production :7.68q/ha
- Productivity :4.5ton/ha
- Economic gains (Gross) : Rs.16765/kani
- Benefit : Cost (B: C) : 1.76

Suitability and adaptability in the existing farming systems: This technology is cost-saving hence, making it suitable for farmers depending on paddy cultivation for their livelihood. In addition to saving costs from fertilizer purchases, it enhances the yield of paddy enabling farmers to get better returns.

Acceptance of technology/process in terms of views of the farmers: The farmers appreciate the slurry method of phosphorus management in paddy as it is cost-saving and at the same time improves the yield. The additional income earned also encouraged more farmers to take up this technology.

Out scaling of technology (Horizontal spread): After witnessing the success of this technology in the Pradip Bhowmik field, 20 farmers from Golaghati and 13 farmers from Baidhadighi GP adopted this technology in their paddy field.

Substitution or replacement of commodities: With the introduction of this technology, there is a replacement of the traditional practice of paddy cultivation by most of the paddy cultivators in the area.

Socio-economic impact: The slurry method of phosphorus management in paddy has profound socio-economic impacts on farmers with reduced cost, improved productivity, and additional income.

2.29 Off season Cauliflower Cultivation with variety SAVAC-7209

Profile of the farmer:		
Name of the grower	:	Mr. Bijoy Debnath
Village	:	Golaghati GP
Block	:	Bishalgarh
District	:	Sepahijala
Enterprise	:	Cauliflower
Name of the Centre	:	KVK Sepahijala

Background information of the grower: Mr. Bijoy Debnath is a marginal farmer from Golaghati GP village under Bishalgarh block of Sepahijala district. Before the introduction of the improved cauliflower variety SAVAC -7209 by KVK Sepahijala, he was cultivating long-duration cauliflower variety. His lack of knowledge regarding proper management practices in a crop, in addition to the variety grown, did not provide him with the yield he expected. In 2022, he joined and actively participated in various activities conducted by KVK Sepahijala under the NICRA intervention, through which he was exposed to new technologies and implemented in his farming.

Technology/process intervened: Prior to intervention by KVK Sepahijala, he was relying on chemical fertilizers for his crop as he was unaware of the ill effects the chemicals can cause to soil health. But with KVK intervention, he was introduced to short-duration cauliflower var. SAVAC -7209 and adopted Integrated nutrient and diseases & pest management. He relied on natural fertilizers like vermicompost for his crops.

Effect of the technology /process: The short-duration cauliflower variety SAVAC 7209 introduced to him by KVK Sepahijala, enabled him to market during seasons when supply is less, and hence, he received good prices for his produce. Before the intervention of this technology, his net income was only Rs. 215882/ha but after the intervention, his income increased to Rs. 287145/ha.

- Production :1027.00 kg
- Productivity :128.45/ha
- Economic gains: Rs.287145/ha
- Benefit : Cost (B: C): 2.67

Acceptance of technology/process in terms of views of the farmers: The improvement in yield and the short duration of crops enabling farmers to target market during the lean period of the crop has encouraged the farmers to adopt this variety.

Out scaling of technology: After witnessing the success of short duration cauliflower variety SAVAC 7209 in Bijoy Debnath's field, 15 farmers from Golaghati and 12 farmers from Baidhadighi GP village adopted this variety in their field. Technology has also spread to other villages like Charilam and Latiacherra under Sepahijala district.

Substitution or replacement of commodities: The performance of short duration cauliflower variety SAVAC 7209 has encouraged farmers to adopt this cultivar and replace the earlier variety which with low productivity and is more prone to pest and disease.

Socio-economic impact: The adoption of short-duration cauliflower variety has profound socio-economic impacts on farmers with its increased yield and better returns. There is an increase in income by Rs. 71263 per ha after adopting this technology.

Marketing network established: The fresh harvest is sold in local markets and Bishalgarh markets.

2.30 Cultivation of Mustard under minimum tillage

Profile of the farmer:		
Name of the grower	:	Mr. Krishna Shil
Village	:	Golaghati
Block	:	Bishalgarh
District	:	Sepahijala
Enterprise	:	Mustard
Name of the Centre	:	KVK Sepahijala

Background information of the grower: Mr. Krishna Shil is a farmer from village Golaghati located in Bishalgarh block under Sepahijala District of Tripura was selected under the NICRA Project during 2023-2024. He owns 0.5 ha of land, from which his family comprising four members derives their livelihood by cultivating paddy followed by mustard and other winter vegetables in rice fallow. After attending a training program on mustard cultivation under minimum tillage by KVK Sepahijala, he implemented it in his field.

Technology/process intervened: Oilseed cultivation in the NEH region faces several constraints such as water scarcity during the winter season, lack of irrigation facilities, short time lag after paddy harvest for seed sowing of mustard, and high incidence of pests and diseases in late sown mustard. To overcome this issue KVK Sepahijala introduced minimum tillage for mustard variety M -28 immediately after paddy harvest to utilize residual soil moisture after rice harvest. During 2022-23, KVK Sepahijala demonstrated this technology in a 1.2 ha area involving 20 farmers at Golaghati GP of Sepahijala District, of which Mr. Krishna Shil was also selected.

Effect of the technology /process: The adoption of minimum tillage in mustard demonstrated by KVK Sepahijala, saw a reduction in the rate of irrigation water by 30-40% as compared to normal practices, and the effect of moisture stress was also

reduced. Income increased by Rs.15,423 per ha by cultivating mustard under minimum tillage.

- Production: 205 kg
- Productivity: 12.84 q/ha
- Economic gains: Net income Rs. 29,887/ ha
- Benefit: Cost (B: C) : 1.77

Suitability and adaptability in the existing farming systems: This technology is suitable as it solves the problem of moisture stress for winter crops.

Acceptance of technology/process in terms of views of the farmers: The farmers appreciate the cultivation of mustard under minimum tillage in rice fallow as it addresses the issue of water stress and helps them to obtain a good yield.

Out scaling of technology (Horizontal spread): Seeing the success of mustard cultivation under zero tillage in Mr. Krishna Shil's field, 16 women from Golaghati village have started this practice. He is an emerging role model for other farmers in his area.

Substitution or replacement of commodities: Minimum tillage has addressed the problems of water stress during winter and the high incidence of pests and diseases in late-sown mustard under traditional mustard cultivation practices.

Socio-economic impact: The adoption of this technology brought about **a** reduction in irrigation by 30-40%, thus saving the cost. The improvement in yield also brought about additional income uplifting the socio-economic condition of the farmer.

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