INNOVATIVE CLIMATE-RESILIENT FARMING APPROACHES IN THE NORTH EAST HILL REGION OF INDIA: INSIGHTS FROM THE NICRA PROGRAM

ANNUAL REPORT 2022-23

Chief Editor
A. K. Mohanty

Compiled and Edited by
Amrutha, T.
A.K. Singha
R. Borodoloi
Azriel Mervin Tariang
A. Tovinoli Shohe
Emidaka Suting

ICAR-Agricultural Technology Application Research Institute (ATARI)
Zone- VII, Umiam, Meghalaya-793103

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The Director
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Phone: 0361-2570483
Fax: 0364:2570396, 2570483
E-mail: icarzcu3@gmail.com

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PREFACE

Greetings from Team ICAR- ATARI (Zone- VII)!

It is with great pleasure and a sense of accomplishment that I present to you the National Innovations in Climate Resilient Agriculture (NICRA) Annual Report for the year 2022-23. This publication is a testament to the relentless dedication of our scientists, researchers, and the invaluable support from our stakeholders who have collectively contributed to our mission of enhancing climate resilience in agriculture.

The journey of the National Innovations in Climate Resilient Agriculture (NICRA) has been both challenging and rewarding since its inception. We have witnessed the significant impacts of climate change on agriculture, posing formidable challenges to food security and livelihoods. In the face of such adversity, our research and development efforts have aimed at harnessing innovation, technology, and scientific knowledge to develop strategies and practices that empower farmers to adapt to the changing climate.

The Annual Report for 2022-23 serves as a comprehensive record of our achievements, milestones, and ongoing initiatives. It highlights our commitment to advancing the frontiers of climate-resilient agriculture through cutting-edge research, extension activities, and capacity building. The various chapters contained within this report provide detailed insights into our research outcomes, successful interventions, and the positive impact on the lives of farmers across our region.

I thankfully acknowledge the commendable efforts and contributions made by Dr. Amrutha T. (Scientist), Dr. A.K. Singha (Principal Scientist) and Mr. Azriel Mervin Tariang (SRF, NICRA) and all the staffs of the implementing KVKs, including all other administrative and supporting staff, SRFs/YPs/DEOs of the institute in bringing out this document within a stipulated time period. Our scientists and researchers have demonstrated an unwavering commitment to addressing the challenges posed by climate change to agriculture and have consistently delivered innovative solutions.

I would also like to acknowledge the support of our funding agencies, government partners, and the farming community for their unwavering support and collaboration. Without their collective efforts and cooperation, the NICRA program's success would not have been possible.

Place: Umiam, Meghalaya
Date:

Dr. A.K. Mohanty
Director

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The Authors would also like to express their deepest appreciation to the Accounts Section of ICAR-CRIDA, Hyderabad, ICAR-ATARI, Zone-VII, Umiam and all concerned Host Institutes of the KVKs for their timely release of funds without which, the progress, goals and achievements of the project would be extremely difficult to achieve.

Authors

CONTRIBUTORS

The following are the KVKs engaged in implementation of Technology Demonstration Component of NICRA under ICAR-ATARI, Zone-VII, Umiam, Meghalaya during 2022-23 and it is only with their sincere effort, dedication and hard works that made this publication possible.

KVK	Staff
Krishi Vigyan Kendra Chandel, Manipur	Dr. Asem Ameeta Devi, PC and Head (I/c) Dr. K. Sonamani Singh, SMS (Agril Engg.) Hb. Lungni Anal, SRF
Krishi Vigyan Kendra Senapati, Manipur	Dr. N. Jyotsna, PC and Head Shri David Kamei, SMS (Plant Protection) Shri W. Dipin Singh, SRF
Krishi Vigyan Kendra, Ukhrul, Manipur	Dr. Solei Luiram, PC and Head (I/c) Dr. N. Ajitkumar Singh, SMS (Plant Protection) Shri K. Vikramjeet, SRF
Krishi Vigyan Kendra, West Jaintia Hills, Meghalaya	Dr. Dodo Pasweth, PC and Head Smt. Banylla Kharbamon, SMS (Hort.) Dr. R. Suchiang, SMS (Animal Science) Shri Firstborn Sutnga, SRF
Krishi Vigyan Kendra, Ri Bhoi, Meghalaya	Dr. Mokidul Islam, PC and Head Shri Utpal Barual, SMS (Hort.) Shri Bankit Mukhim, SMS (Fisheries) Ms. Elgiva Wanshong, SRF
Krishi Vigyan Kendra, South Garo Hills, Meghalaya	Dr Athokpam Haribhushan, PC and Head Mr. Basu Langpoklakpam, SMS (Hort.) Titus Dalang K Momin, SRF
Krishi Vigyan Kendra, West Garo Hills, Meghalaya	Dr.Tarun Kumar Das, PC and Head (I/c) Dr. J. Mahanta, SMS (Plant Protection) Jakrimra N sangma, YP-II

Krishi Vigyan Kendra, Lawngtlai	Dr.C.Lalfakawma, PC and Head C. Rualthankhum, SMS (Agronomy) Ms. Lalrinmawii, SRF
Krishi Vigyan Kendra, Lunglei	Dr. Henry Saplalrinliana, PC and Head F. Lalthasanga, SMS, (Agronomy) Shri R.Lalrambeiseia, SRF
Krishi Vigyan Kendra, Siaha	Dr. H. Vanlalhmuliana, PC and Head Mrs. S. Sisi, SMS (Hort.) Ms. Lalrinengi, SRF
Krishi Vigyan Kendra, Serchhip, Mizoram	Dr. T. Vanlalngurzauva, PC and Head Shri Kenny Zohmingliana, SMS (Agronomy) Ms. Abisag Lalremruatpuii, SRF
Krishi Vigyan Kendra, Mon, Nagaland	Dr. V. Akashe Zhimomi, PC and Head Bendangjungla.I, SMS (Plant Breedingn) Shri Peiwang, YP-II
Krishi Vigyan Kendra, Phek, Nagaland	Dr. T. Esther Longkumer, PC and Head (I/c) Dr Hannah K, SMS (Agronomy) Veralu Hesuh, YP-II
Krishi Vigyan Kendra, Tuensang, Nagaland	Dr Pijush Kanti Biswas, PC and Head Dr Kerimenla Lemtur, SMS (Hort.) Ms. Watisenla Imsong, SRF
Krishi Vigyan Kendra, Sepahijala, Tripura	Dr Shatabhisa Sarkar, PC and Head (I/c) Dr Joy Kumar Dey, SMS (Agronomy) Mr Pramod Das, SRF

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EXECUTIVE SUMMARY

National Innovations on Climate Resilient Agriculture (NICRA) is a network project of the Indian Council of Agricultural Research (ICAR) launched in February, 2011. The project aims to enhance resilience of Indian agriculture to climate change and climate vulnerability through strategic research and technology demonstration. During the year 2011 to 2015, there were 17 numbers of KVKs representing different agro-climatic conditions with designated problem areas were distributed in the 8 North East States. However, during 2015-16 ATARI in North Eastern Region was split into two zones *viz.,* ICAR-ATARI Zone-VI in Assam and ICAR-ATARI Zone-VII in Umiam, Meghalaya. The total number of KVKs in Zone VII under NICRA is 15 comprising from 5 states.

During the second phase of the programme (2021-25), there has been a shift in how the activities are being implemented in the adopted villages. The interventions conducted by the KVKs in the adopted NICRA villages focused mainly on the identified farming system typologies (FSTs) and how to mitigate climate related problems in the particular location. The FSTs were identified based on the climatic constraints faced by the district so that mitigation techniques could be applicable to all the farming villages in the district. The climate resilient interventions were undertaken based on the identified Farming System Typologies and the activities were further divided into Natural Resources management, Crop Production, Livestock and Fisheries interventions, Capacity Building activities and Extension activities. The details of achievements are as follows

Natural Resource Management – Under this, climate resilient in-situ practices such as mulching, ridge and furrow cultivation method, zero tillage, integrated farming system, crop diversification through raised bed in fallow land, and ex-situ cultivation practices like protected cultivation of crops, farm pond and jalkund, along with soil and water management techniques like growing of cover crops, organic nutrient incorporation, low cost vermicomposting, early sowing to escape moisture stress and slurry method of Phosphorus management in paddy were demonstrated in the adopted NICRA villages. A total of 55 demonstrations were conducted, covering an area of 105.09 ha and benefitting 420 farmers during 2022-23.

Crop Production – The climate resilient technologies pertaining to crop production that were practiced during 2022-23 were cultivation of improved crop varieties that could withstand certain climatic stresses, sequential cropping system, intercropping techniques, mushroom cultivation, community nursery during

unfavourable conditions, paddy-cum-fish culture, maize based cropping system, system of rice intensification (SRI), seed production and safe storage. A total of 42 demonstrations were conducted, covering an area of 135.24 ha under crop production activities and benefitting 384 farmers during 2022-23.

Livestock and Fisheries – Activities that were conducted under livestock and fisheries intervention by the KVKs in the NICRA villages were animal health camps cum vaccination drives, rearing of improved breeds of livestock having stress tolerance, improved feeding methods, improved scientific housing for livestock, composite fish farming instead of mono culture of fish and integrated farming systems with livestock and fisheries. A total of 33 demonstrations were conducted, 650 number of animals were distributed and 152 units under different management practices were covered, thus benefitting 298 farmers under livestock and fisheries intervention.

Capacity Building Programmes – Capacity building programmes conducted by the KVKs in the NICRA adopted villages aims at establishing and strengthening the farmer groups. Programmes such as plant protection techniques, updated farming technologies, food preservation and safe storage, integrated nutrient management, scientific management of raising livestock etc., were conducted during 2022-23. A total of 145 capacity building programmes were conducted, benefitting 3605 individuals.

Extension activities – Extension activities conducted by KVKs in NICRA adopted villages contribute to the overall development and well-being of rural communities by equipping them with the knowledgeand tools needed to thrive in a changing climate. Extension activities such as field visits, diagnostic visits, awareness programmes, institutional visits etc., were conducted during 2022-23. A total of 257 programmes were conducted and beneficiaries covered under extension activities during 2022-23 was 3248.

1 Introduction

The National Innovations on Climate-Resilient Agriculture (NICRA), a collaborative initiative under the auspices of the Indian Council of Agricultural Research (ICAR), commenced its inaugural phase in February 2011. The primary objective of the programme is to bolster the resilience of India's agriculture sector against the adversities of climate change and heightened climatic susceptibility. This multifaceted endeavor encompasses strategic research and technology demonstrations aimed at adaptation and mitigation, encompassing crops, livestock, fisheries, and natural resource management. The programme framework is comprised of four pivotal components: Strategic Research, Technology Demonstrations, Capacity Building, and Sponsored or Competitive Grants. This report serves to illuminate the accomplishments achieved under NICRA by the Krishi Vigyana Kendras (KVKs) of ICAR-ATARI, Zone VII, Umiam during the fiscal year 2022-23.

Climate change has brought forth numerous challenges and issues in the global agricultural sector, and there is no question that it will continue to present even more difficulties in the years ahead. Climate anomalies, including rising temperatures, alterations in rainfall patterns and frequencies, as well as various other phenomena, are increasingly burdening agricultural and related systems in numerous regions. These changes are having adverse effects on crops, livestock, fisheries, and other interconnected productive systems. Moreover, they are exerting pressure on the natural resources essential for agriculture and related activities, leading to pollution, water shortages, and widespread soil degradation.

Impact of Climate Change on Agriculture in India

Climate change refers to changes in the earth's environmental conditions like temperature, rainfall patterns, storms, heatwaves, etc. It is caused by many natural and artificial factors, such as volcanic activity, variations in solar activity, deforestation, burning of fossil fuels, mining, and many others. The growing industrial demand in India has created more emphasis on crop production. As a result, more forests are converted into farming lands, resulting in an abnormal change in temperatures and weather patterns. A major impact of climate change on biodiversity is that it leads to the extinction of many species of plants and animals. The shift in climate patterns is a global phenomenon that has badly affected the crop yield in India. It has also influenced the types of crops that can be cultivated in certain regions by affecting the soil, water and pest prevalence in those regions.

Agriculture is one of the largest and most important sectors in the Indian economy. The contribution of agriculture to India's GDP is about 19.9 per cent in 2020-21. Moreover, this sector employs 42.6% of the Indian population. However, it is a major source of hazardous greenhouse gases (methane and nitrous oxide), which contribute to the greenhouse effect and climate change. This climate change leads to higher temperatures and unanticipated rainfall across the country, resulting in reduced crop yields and overall food production. Due to the rise in temperature and changes in water availability, climate change can affect irrigated agricultural production throughout Agro-ecological zones. Climate change has the potential to limit the access, availability, and quality of food. Reduced agricultural yield is due to factors like an increase in temperature, changes in precipitation patterns, changes in extreme weather events, and reductions in water availability. A decline in food production in recent years due to climate change could severely affect revenue from the agricultural sector. Therefore, it is high time to incorporate the climate-resilient agriculture (CRA) approach into our farming methods and also need to implement it more rigorously.

Impact of Climate Change on Agriculture in North East India

The North Eastern Region of India is expected to be highly prone to the consequences to climate change because of its geo-ecological fragility, strategic location vis-à-vis the eastern Himalayan landscape and international borders, its trans-boundary river basins and its inherent socio-economic instabilities. Environmental security and sustainability of the region are and will be greatly challenged by these impacts. The region fall under high rainfall zone with subtropical type of climate. Still, under influence of global climate change even high rainfall areas are facing drought like situations in the current years. Droughts and floods are the adverse climatic conditions arising out of deficit and excess rainfall, respectively. Drought assumes significance mainly in rainfed conditions like in North East India. Unprecedented drought like situation affected very adversely the whole NER in recent years. Floods are equally devastating in the region. The increasing melting of glaciers in Himalayas are great concern for the region. In the absence of scientific data about the vulnerability of the region to climate change, conservation agriculture, afforestaion, rain water harvesting, efficient use of inputs, following proper agro-techniques for management of drought are some of the management options that needs to be immediately popularized among the farming communities to mitigate the impact of climate change.

Fish rearing has been negatively impacted by the drought conditions that are present in practically all fish farming locations. The availability of fish seed and the likelihood of their survival are the two main concerns. The delicate geomorphology of the Himalayan portion of the Brahmaputra basin may be impacted by extreme precipitation events (heavy rainstorm, cloud burst), which might result in more

widespread landslides and soil erosion. Climate change may have a considerable impact on how hydrologic systems, erosion processes, and sedimentation behave in the river basins of the Himalayas. These floods resulted in hundreds of fatalities as well as significant damage to livestock and agricultural production. Floods have caused mayhem in the region, especially in Assam, every year causing tremendous loss to crops, infrastructure, economy, livelihoods and lives of the people. In the wake of such a shift in climate in the region, there is a urgent need for reassessment of the agricultural practices. The foremost important thing *i.e.*, afforestation programme should be taken up by the community, Institutes, NGOs, schools and Governments.

The main objectives of the NICRA project are:

- To enhance the resilience of Indian agriculture covering crops, livestock and fisheries to climatic variability and climate change through development and application of improved production and risk management technologies
- To demonstrate site specific technology packages on farmers' fields for adapting to current climate risks
- To enhance the capacity building of scientists and other stakeholders in climate resilient agricultural research and its application.

The project anticipates delivering both immediate and lasting results, encompassing advancements in crop and livestock varieties, refined management techniques for climate adaptation and mitigation, and valuable insights for policy-making aimed at integrating climate-resilient agriculture into developmental planning. Ultimately, the overarching goal is to bolster the resilience of agricultural production in regions susceptible to climate fluctuations.

This project is structured around four key components.

- Strategic research on adaptation and mitigation
- Technology demonstration on farmers' fields to cope up with current climate variability
- Sponsored and competitive research grants to fill critical research gaps
- Capacity building of different stake holders

The technology demonstration segment focuses on showcasing established technologies aimed at adapting crop and livestock production systems to climate variability. This segment is executed within carefully chosen vulnerable districts across the country, utilizing location-specific interventions facilitated by KVKs in a participatory approach. The project spans 100 districts, encompassing the participation of more than one lakh farm families nationwide.

TDC-NICRA is being executed within specific high-risk districts, with the participation of 15 KVKs in the Agricultural Technology Application Research Institute (ATARI) at Umiam. These KVKs are strategically located to cover diverse agro-climatic zones within the five North Eastern States, namely Manipur, Meghalaya, Mizoram, Nagaland, and Tripura. A range of interventions and adaptive strategies have been devised to tackle the challenges posed by climate change and its impact on agriculture, food security, and the livelihoods of agricultural communities.

The vulnerabilities of the respective KVK districts are mentioned here under:

Table 1.1: State wise details of operational NICRA KVKs along with their climatic 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
Nagaland	Phek	Drought/water stress
	Mon	Drought/ Soil erosion
	Tuensang	Drought/ Cold wave/ Frost
Tripura	Sepahijala	Flood/ Soil erosion

These districts are selected based on the following criteria besides the strength of the KVKs:

- Drought proneness based on 30 years rainfall data (Source : IMD)
- Cyclone proneness based on frequency as recorded by IMD/State Disaster Management agencies.
- Flood proneness based on IMD data and NDMA maps.
- Vulnerability to heat wave and cold wave based on IMD grid data on temperatures.
- Actual incidence of floods and drought as recorded by AICRPAM centers

The interventions are determined through a participatory approach facilitated by the Village Climate Risk Management Committee (VCRMC). This process follows the Participatory Rural Appraisal (PRA) to evaluate climate-related issues within the village and conduct a baseline survey. The program was formally inaugurated across all villages, with the active engagement of state department officials and panchayat leaders. This approach ensures the project's local ownership right from the outset and encourages the alignment of ongoing schemes within the panchayat.

2 Rainfall characteristics during 2022-23

The monthly average rainfall recorded at the NICRA adopted villages during the month of April 2022 – March 2023 in mm is as under:

Table 2.1: Actual rainfall received during April 2022 – March 2023 in mm

KVK/ Month	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar
Chandel	87.5	30.4	238.8	344	149.3	108.9	235.4	0.3	18.2	16.9	8.9	14.7
Ukhrul	140.6	138.5	102.4	116.2	224	332.4	164.3	25	12.1	0	0	21.9
Senapati	66.1	223.8	167.7	125.2	196.2	242.4	207.9	0	13	43.4	31.8	72
Jaintia Hills	222	770	701	214	232	212	322	22	0	65	77	10
Ri Bhoi	109.6	499.2	446.1	278.2	253.6	241.1	313.6	30.4	5	44	29.2	10.8
South Garo Hills	312.4	454.8	1259.2	268	249.6	483.4	284.2	0	0	7.2	38	2.2
West Garo Hills	453.3	533	772.7	321.3	188.6	300.7	326.6	0	0	9.4	60.9	50.2
Lawngtlai	29	230	210	377.1	416.3	428.4	290	0	0	8	2	1
Lunglei	25	152	297	203	179	152	170	0	0	6	7	5
Siaha	26.9	361.6	371.2	399.4	479.8	449.2	371.6	0	0	3.6	11.8	0
Serchhip	18.3	128	204.6	128.7	146.5	134.9	78.6	0	0	15.6	7.6	16.2
Mon	30	250	408	223	219	157	24.2	0	1.8	0	7.9	56
Phek	36	173	311	413	346	219	125	2	51.8	89.4	33.5	19
Tuensang	304	436.4	719.25	744.2	635.23	524.83	291.62	49.21	23.67	51.27	69.82	150.2
Sepahijala	57.1	268.8	466.6	87.9	72.7	213	266	0	0	0	0	35.4

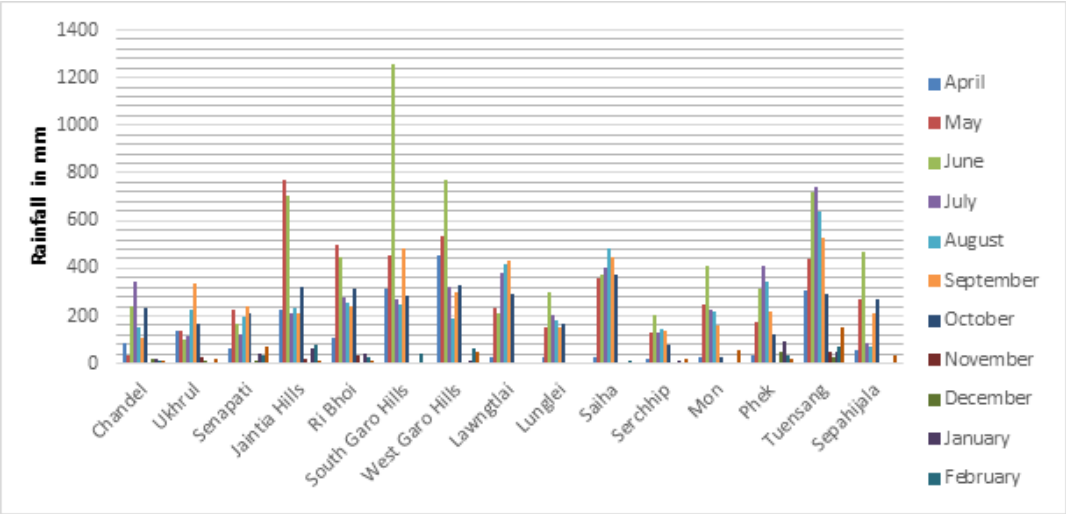

Fig 2.1: Monthly average rainfall data (mm) recorded in the NICRA KVKs

3 Details of interventions undertaken under NICRA project during 2022-23

Since the initiation of the project's second phase spanning from 2021 to 2025, there has been a noteworthy shift in its core focus. The project's approach has evolved from a modular framework to one centered around Farming System Typologies (FSTs). This transition entails the identification of specific FSTs by Krishi Vigyan Kendras (KVKs) of ATARI, Umiam, taking into account a range of predominant factors such as local climate factors, slope, irrigation, livestock potential, and other relevant village-specific characteristics. The climate resilient technologies implemented by the KVKs of ATARI, Umiam in the adopted NICRA villages have been categorized into three main groups: Natural Resources Management (NRM), Crop Production, and Livestock and Fisheries Intervention.

The activities outlined according to the designated Farming System Typology for the year 2022-23 in the NICRA adopted villages are as follows:

3.1. Interventions under Natural Resources Management (NRM)

During the past year, as part of Natural Resource Management (NRM) initiatives, The KVKs of ATARI, Umiam identified a total of nine (9) distinct Farming System Typologies (FSTs). These interventions, carried out in villages adopted under the NICRA program, involve the integration of climate-resilient technologies into farming practices. These technologies are as follows;

- In-situ moisture conservation methods.
- Ex-situ water conservation techniques, such as farm ponds and jalkunds.
- Utilization of mulch (both plastic and plant residue) in crop cultivation.
- Implementation of zero or minimum tillage practices to improve soil health.
- Adoption of intercropping systems to enhance crop diversity and productivity.

Renovation of Farm Pond: KVK, Lunglei

- Utilization of the ridge and furrow method for cultivation in low-lying areas to mitigate flood.
- Conversion of plant-based residue into nutrient-rich compost through cost-effective vermicomposting methods.
- Early planting of rabi crops to minimize moisture-related stress and improve crop productivity.

Polymulching on Cole crops: KVK, Tuensang

These initiatives have played a crucial role in promoting sustainable agriculture and resilience to climate change in NICRA adopted villages of ICAR-ATARI, Zone VII adopted NICRA

The following table provides information about the climate-resilient technologies implemented by the Krishi Vigyan Kendras (KVKs) of ATARI, Umiam in the year 2022-23, as per the identified Farming System Typologies (FSTs). It also includes data on the number of households and the land area (in hectares) covered in both NICRA (National Innovations in Climate Resilient Agriculture) villages and non-NICRA villages

Table 3.1.1: Climate Resilient Technologies adopted under NRM intervention

Farming system typology	Climate resilient technology adopted by the NICRA farmers	Farmers' practice/ traditional method (Non-NICRA)	Number of demonstrations	NICRA household		Non-NICRA household	
				Household (no)	Area (ha)/ units(no.)	Household (no)	Area (ha)/ units(no.)
Rainfed upland with livestock	Ex-situ water conservation - farm pond and jalkund	Without moisture conservation	6	19	5.9	17	6.1
	Mulching (plastic and plant residue)	Without mulch	4	25	8.05	19	11.02
	Zero/ minimum tillage	Cultivation with tillage	3	43	9.34	36	4.85
	Ridge and furrow method of cultivation	Cultivation in flat beds	1	6	1	4	0.5
	Low cost vermicomposting	Without compost	2	6	1.2	5	0.6
	Early planting of rabi crops to escape moisture stress	Traditional method of cultivation	1	4	1	3	0.75
	Protected cultivation	Open field cultivation	1	2	0	1	1
	Cultivation of crops in protected structures	Cultivation of crops in open field conditions	2	4	0.033	4	0.0303
Rainfed upland without livestock	Ex-situ water conservation - jalkund	Without moisture conservation	1	2	0.95	2	2
	Mulching (plastic)	Cultivation of crops in open field conditions	5	37	8.75	30	4.65
	Zero tillage	Cultivation with tillage	1	20	2	20	2
	Low cost vermicomposting	Without compost	1	3	0.01	0	0
	Organic nutrient incorporation for soil health improvement	Without compost	1	10	0.1	10	0.1
	Cover crops	Traditional method of cultivation	1	6	3	4	1
	Direct seeded rice	Traditional method of cultivation	1	17	5.2	7	3.5
	Early planting of rabi crops to escape moisture stress	Traditional method of cultivation	2	23	4.85	17	3.05
	Slurry method of phosphorus management in paddy	Traditional method of cultivation	1	10	2.57	10	2.03

Rainfed lowland with livestock	Low cost vermicomposting	Without compost	2	14	14	0	0
	Zero tillage	Traditional method of cultivation	1	10	4.3	10	4.3
	Cultivation of crops in protected structures	Cultivation of crops in open field conditions	1	3	0	3	0.1
Rainfed Lowland without Livestock	Crop diversification through raised bed in rice fallow	-	1	5	9.5	5	0.5
Rainfed midland with livestock	Micro irrigation (using jalkund)	Without moisture conservation	1	3	0.4	3	0.03
	Integrated farming system	Sole cropping	1	10	3.7	10	0.13
	Ex-situ water conservation - jalkund	Without moisture conservation	1	5	0.25	5	0.3
	Zero tillage	Cultivation with tillage	1	20	2	20	2
Rainfed midland without livestock	Mulching (plastic and plant residue)	Without mulch	1	10	0.5	10	0.5
	Organic nutrient incorporation for soil health improvement	Without compost	1	10	0.1	10	0.1
	Zero tillage	Cultivation with tillage	1	20	2	20	2
	Cultivation of crops in protected structures	Cultivation of crops in open field conditions	1	7	0.08	7	0.1
Irrigated land with livestock	Mulching (plastic and plant residue)	Without mulch	2	15	3.07	15	2.9
Irrigated land without livestock	Early planting of rabi crops to escape moisture stress	Traditional method of cultivation	1	10	1.45	5	1
	Mulching (plastic)	Without mulch	1	20	2.95	15	2.1
Plains in the valleys with livestock	Ridge and furrow method of cultivation	Traditional method of cultivation	1	10	1.8	10	1.2
	Protected cultivation - Walk in tunnel	Cultivation of crops in open field conditions	1	2	0.006	2	0.0006
Plain in the valley without livestock	Ex-situ water conservation - renovation drainage channel	Without moisture conservation	1	5	5	5	5
	Cultivation of crops in protected structures	Cultivation of crops in open field conditions	1	4	0.04	4	0.04
Total			**55**	**420**	**105.09**	**348**	**65.48**

KVK, Siaha in Mizoram reported a significant increase in tomato yield (cv. Arka Samrat) when they employed irrigation from an external water storage structure known as a 'Jalkund.' This approach yielded 56.52% higher tomato yield compared to the traditional farming methods of local farmers who used a Jalkund for irrigation. A similar outcome was observed by KVK, South Garo Hills in Meghalaya when they cultivated improved crop varieties using a Jalkund irrigation system. In this case, the yield difference was highly significant compared to farmers who cultivated local or unspecified cultivars.

Tomato cv. Arka Samrat: KVK, Siaha

Pea cv. England: KVK, Ukhrul

In Manipur, KVK Ukhrul reported increased profitability in pea cultivation (cv. England) by planting it earlier than the recommended planting date, which was the common practice among local farmers. This practice resulted in a 34.11% increase in yield and a substantial improvement in the benefit-cost ratio. Furthermore, KVK Siaha in Mizoram documented a significant intervention involving the cultivation of cabbage (cv. Rareball) using mulch. When compared to other farmers who did not use mulch, there was a remarkable yield difference of over 42%. The details of the highlighted interventions mentioned above are depicted in the table below

Table 3.1.2: Significant Climate Resilient Technologies (CRT) under NRM intervention adopted in NICRA KVKs

KVK	FST	Climate Resilient Technology		Farmer's practice (FP)		Avg. Yield (q/ha)		Yield Diff. (%)	BC ratio		BCR Diff. (%)
		Technology	Crop	Technology	Crop	CRT	FP		CRT	FP	
Siaha	Rainfed upland with livestock	Ex-situ water conservation - jalkund	Tomato (Arka Samrat)	Ex-situ water conservation - jalkund	Tomato (local cv.)	180	115	56.25	4.5	3.41	32.06
South Garo Hills	Rainfed midland with livestock	Ex-situ water conservation – jalkund	Chilli (Arka Meghna F1), Cabbage (Rareball), Tomato (Arka Abhed)	Traditional method of cultivation	Local cultivars of chilli, cabbage and tomato	117.33	82.33	42.51	3.61	2.94	22.84
Ukhrul	Rainfed upland with livestock	Early planting	Pea (England)	Normal planting time	Pea (local cv.)	34.6	25.8	34.11	3.46	2.58	34.11
Siaha	Rainfed upland without livestock	Mulching	Cabbage (Rareball)	Without mulch	Cabbage (Sona solid)	190	133	42.86	3.93	3.33	18.23

Note: FST- Farming System Typology, CRT- Climate Resilient Technology, FP- Farmer's practi

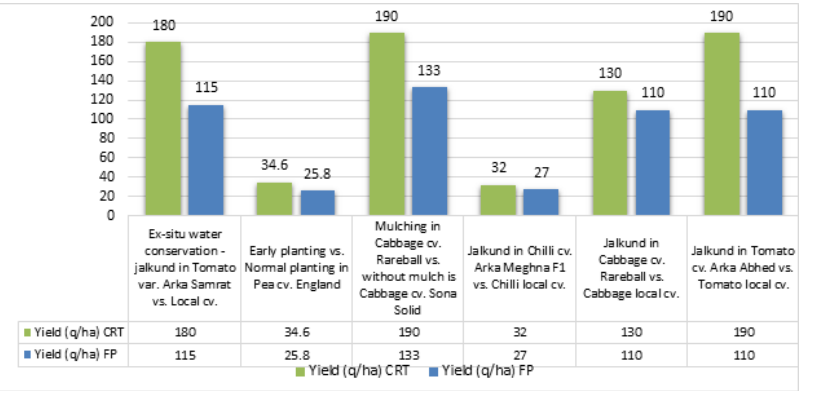

Fig. 3.1.1: Crop Yield Comparison between Intervention and Traditional Farming Practices under NRM Interventions.

3.2. Interventions under Crop Production

In this initiative, the KVKs in the selected NICRA villages are implementing climate-resilient technologies with the primary objective of enhancing overall crop production and productivity using sustainable practices that have minimal environmental impact. Farmers in the targeted villages are adopting effective and well-established techniques, including the cultivation of improved crop varieties, early sowing in rice fallow areas to mitigate moisture stress during the rabi season, implementing intercropping systems, managing crop residues through mushroom cultivation to generate year-round income, practicing sequential cropping, adopting improved methods of paddy cultivation like the System of Rice Intensification (SRI), and cultivating crops with minimal or zero tillage to promote healthier soil conditions, to name a few.

French bean cv. NRC French: KVK, Sepahijala

Round the year production of off season vegetables under poly house: KVK, Serchhip

The details of the climate resilient technologies adoped by the KVKs, as per the identified FSTs, during the year 2022-23 along with the number of household and area covered (ha) by the NICRA villages and non-NICRA villages is as per the table below:

Table 3.2.1: Climate Resilient Technologies adopted under Crop Production interventions

Farming System Typology	Climate resilient technology adopted by the NICRA farmers	Farmers' practice/ traditional method (Non-NICRA)	Number of demonstrations	NICRA household		Non- NICRA household	
				Household (no)	Area (ha)/ units(no.)	Household (no)	Area (ha)/ units(no.)
Rainfed upland with livestock	Cultivation of improved crop varieties	Local cultivars	5	63	29.1	67	17.4
	Intercropping system	Sole cropping of crops	4	17	14.7	17	12.35
	Sequential cropping	Sole cropping of crops	1	10	3.2	10	3.2
	Mushroom cultivation	-	2	2	2 units	0	0
	Community nursery during unfavourable conditions	-	1	3	0.15	3	0.15
	System of Rice Intensification (SRI)	Traditional method of paddy cultivation	2	26	6	18	3.7
	Seed production and safe storage	-	1	20	5	20	5
	Paddy cum fish culture	Sole paddy	1	6	3	6	1.5
Rainfed Upland without livestock	Cultivation of improved crop varieties	Local cultivars	4	32	13.75	36	12.85
	Maize based cropping system	Sole cropping of crops	1	4	2.5	4	2.5
	Site specific intercropping system	Sole cropping	3	15	6.5	15	7

	Mushroom cultivation	-	1	1	1 unit	0	0
	Sequential cropping system	Traditional method of cultivation	1	22	5.2	12	2.5
	System of Rice Intensification (SRI)	Traditional method of paddy cultivation	1	10	1	10	1
Rainfed Lowland with Livestock	Cultivation of improved crop varieties	Local cultivars	4	43	20.36	43	20.02
	Mushroom cultivation	-	1	10	10 units	0	0
Rainfed midland with livestock	Cultivation of improved crop varieties	Local cultivars	1	7	2	7	2.6
	System of Rice Intensification (SRI)	Traditional method of paddy cultivation	1	10	1	10	1
Rainfed midland system without livestock	Cultivation of improved crop varieties	Local cultivars	2	30	4.3	30	3.8
Plains in the valleys with livestock	Mushroom Cultivation	-	1	1	1 unit	-	-
	Seed production and safe storage	-	1	20	5	20	5
	Cultivation of improved crop varieties	Local cultivars	1	15	5.48	15	5.42
Plain in the valley without livestock	Cultivation of improved crop varieties	Local cultivars	1	5	5	0	0
Rainfed upland terrace rice cultivation	Cultivation of improved crop varieties	Local cultivars	1	12	2	6	0.5
TOTAL			**42**	**384**	**135.24** **14 units**	**349**	**107.49**

Among the various interventions mentioned earlier, a few particularly noteworthy outcomes emerged. One remarkable initiative was spearheaded by KVK, Ukhrul in Manipur, which introduced a climate-resilient farming model involving the integration of fish with paddy cultivation. This innovative approach was aimed at enabling paddy to thrive in waterlogged conditions. The results of this intervention were truly impressive, with paddy yields soaring by a remarkable 121.2%.

In another instance, KVK, Siaha in Mizoram initiated a project centered on the adoption of an improved cabbage variety known as "cv. Ryozeki." They compared the performance of this improved variety with that of local varieties grown by other farmers. The outcome of this comparison revealed that the improved cabbage variety outperformed the local ones, yielding an impressive 49% increase in production and generating higher income returns for farmers. Community nursery was also initiated at KVK Siaha for seedling production of tomato var. Arka Abhed. The result was impressive as damping off seedlings was not found and germination rate of seedlings increased by 40-60%. The crop yield also increased by 69.64% as compared to conventional practice.

Meanwhile, KVK, Mon in Nagaland adopted the System of Rice Intensification (SRI) by employing improved variety like SARS-5. The results showed a significant improvement compared to traditional cultivation practices, yielding an impressive 34% increase in production. In summary, these interventions exemplify innovative and effective agricultural practices that have led to substantial improvements in crop yields and income for farmers in their respective regions.

The details of the highlighted interventions mentioned above are depicted in the table below:

Cabbage cv. Ryozeki: KVK, Siaha

Community nursery at Tisopi village, Siaha

Table 3.2.2: Significant Climate Resilient Technologies (CRT) under Crop Production intervention adopted in NICRA KVKs

KVK	FST	CRT		Farmer's practice (FP)		Avg. Yield (q/ha)		Yield Diff. (%)	BC ratio		BCR Diff. (%)
		Tech.	Crop	Tech.	Crop	CRT	FP		CRT	FP	
Ukhrul	Rainfed upland with livestock	Paddy cum fish	Paddy (RC Maniphou – 13)	Conventional practice	Paddy (Local cv.)	56.33	25.47	121.2	2.44	1.14	113
Siaha	Rainfed Upland without livestock	Improved variety	Cabbage (Ryozeki)	Local variety	Cabbage	185	124	49.2	3.6	3.1	14.54
Sepahijala	Rainfed Upland without livestock	Early sowing in rice fallow	French bean (NRC French)	Conventional practice	French bean (NRC French)	57.19	38.43	48.9	3.5	2.8	22.75
Siaha	Rainfed upland with livestock	Community nursery	Tomato (Arka Abhed)	Conventional practice	Tomato (Local variety)	190	112	69.64	4.3	3.2	34.38
Mon	Rainfed upland with livestock	SRI	Paddy (SARS-5)	Traditional practice	Paddy (Local var.	24.8	18.4	34.78	2.22	1.81	22.65

Note: FST- Farming System Typology, CRT- Climate Resilient Technology, FP- Farmer's practice

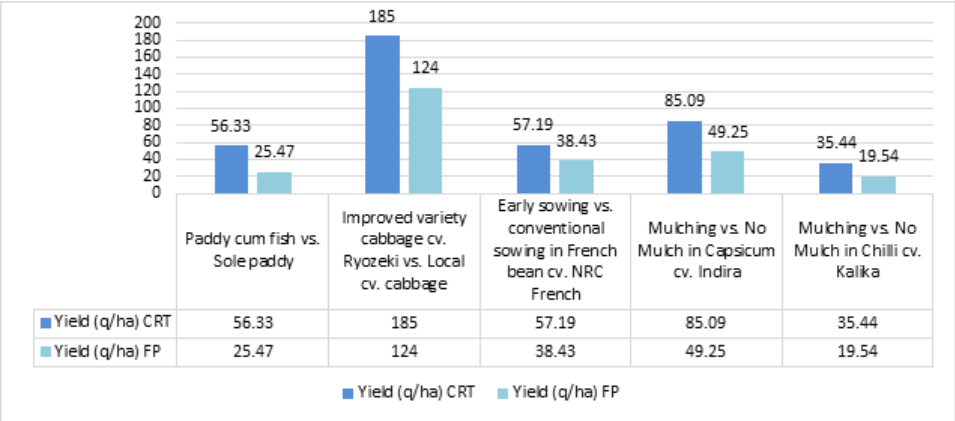

Fig. 3.2.1: Crop Yield Comparison between Intervention and Traditional Farming

3.3. Interventions under Livestock and Fisheries

Within the realm of livestock and fisheries intervention, KVKs are tasked with addressing the challenges posed by climate change in the management of livestock and fisheries. These interventions encompass activities such as:

Breeding improved livestock breeds for increased farmer profitability and resilience to adverse climate.

- Providing enhanced shelter facilities for livestock to mitigate the impacts of extreme weather.
- Promoting composite fish culture as an alternative to predominant mono-culture, practice in the region.
- Implementing Integrated Farming Systems (IFS) for a more sustainable approach to agricultural production.
- Administering preventive vaccinations and anthelminthic treatments for livestock, Ahead of the Wet Season Vulnerability.

Demonstration on deworming and mineral supplementation: KVK, West Garo Hills

KVKs are actively engaged in implementing these interventions in the NICRA adopted villages. The details of the climate resilient technologies adopted by the KVKs, as per the identified FSTs, during the year 2022-23 along with the number of household and area covered (ha) by the NICRA villages and non-NICRA villages is as per the table below:

Table 3.3.1: Climate Resilient Technologies adopted under Livestock and Fisheries intervention

Identified Farming System Typology	Climate Resilient Technology	Farmers' practice/ Traditional method (Non-NICRA)	No. of demonstrations	NICRA household		Non- NICRA household	
				Household (no)	Animals distributed (No.)/Units (No.)	Household (no)	Animals distributed (No.)/Units (No.)
Rainfed Upland with Livestock	Rearing of improved breed of livestock	Local non-descript breeds	9	99	163 nos.	74	153 nos.
	Rearing of livestock in improved shelters	Traditional shelters	6	16	57 nos.	16	27 nos.
	Composite fish culture	Without proper stocking of fish	2	8	1 unit	5	0.4
	Integrated Farming System	No integration of farming interventions	2	5	9 units	5	7
Rainfed Lowland with Livestock	Rearing of livestock in improved shelters	Traditional shelters	1	10	10 units	6	6 units
	Rearing of improved breed of livestock	Local non-descript breeds	2	30	120 units	20	30 units
	Composite fish culture	Without proper stocking of fish	1	10	2 units	10	1.2
	Scientific management of raising cattle	Without scientific management	1	10	10 units	10	10 units
	Preventive vaccination	-	1	20	-	10	-

Rainfed midland with Livestock	Anthelmentic treatement	Without Anthelmentics	2	30	40 nos.	20	40 nos.
	Rearing of improved breed of livestock	Local non-descript breeds	2	20	200 nos.	20	250 nos.
	Scientific management of raising cattle	Without scientific management	1	10	10 nos.	10	10 nos.
Irrigated land with Livestock	Rearing of improved breed of livestock	Local non-descript breeds	2	20	170 nos.	20	180 nos.
	Scientific management of raising cattle	Without scientific management	1	10	10 nos.	10	10 nos.
TOTAL				**298**	**650 nos & 152 units**	**236**	**8.6**

To highlight a few notable achievements from the year, KVK Lunglei in Mizoram, reported a significant outcome when they embraced advanced poultry farming techniques, specifically focusing on rearing improved breeds like Vanaraja and implemented similar strategies in the field of piggery with Hampshire cross breeds in NICRA villages. This initiative resulted in a substantial boost in livestock productivity, leading to a remarkable increase in returns for every rupee invested. Additionally, KVK in Ukhrul, Manipur, took on the challenge of implementing composite fish culture technology in households that typically did not maintain proper fish stocking densities. After just one year of implementation, the results were remarkable, showcasing a remarkable 50% increase in fish yield.

The details of the highlighted interventions mentioned above are depicted in the table below:

Dual purpose Vanaraja poultry: KVK, Lunglei

Table 3.3.2: Significant Climate Resilient Technologies (CRT) under Livestock and Fisheries adopted by NICRA KVKs

KVK	FST	Climate Resilient Technology		Farmer's practice (FP)		Measurable indicators		BC ratio		BCR Diff. (%)
		Tech.	Livestock	Tech.	Livestock	CRT	FP	CRT	FP	
Lunglei	Rainfed Upland with Livestock	Rearing of improved breed	Poultry (Vanaraja)	Rearing of local breed	Poultry (Local)	140 egg/ bird/ year Average male birds weight:3.01 kg	85 eggs/ bird / year Average male birds weight:2.5 kg	5.56	3.75	48.26
Lunglei	Rainfed Upland with Livestock	Rearing of improved breed	Piggery (Hampshire cross)	Rearing of local breed	Piggery (Local)	Mortality rate:8 %	Mortality rate: 14%	5.12	2.88	77.78
Ukhrul	Rainfed Upland with Livestock	Composite fish culture	Fishery (IMC)	No proper stocking density of fish	Fishery	1200 kg after 1 year	800 kg after 1 year	3.3	2.9	12.50

Note: FST- Farming System Typology, CRT- Climate Resilient Technology, FP- Farmer's practice

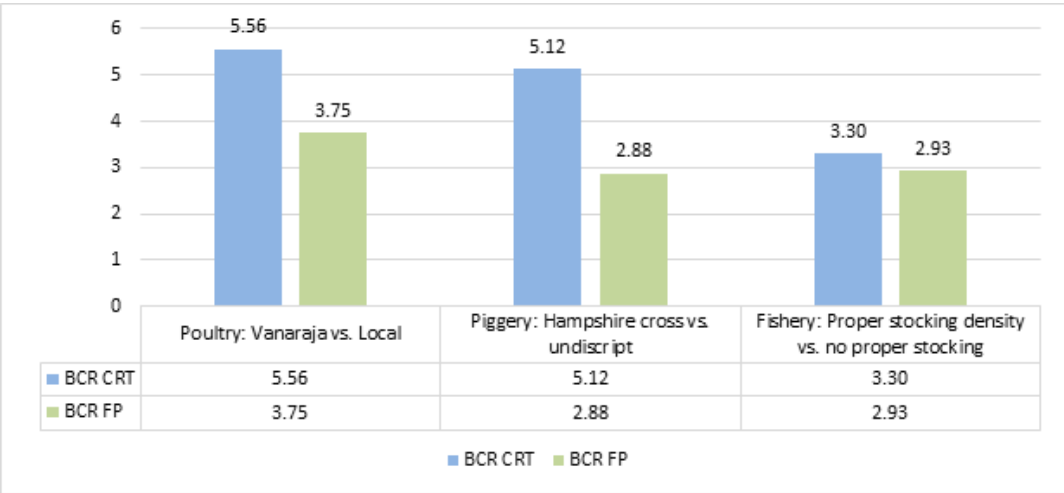

Fig. 3.3.1: Comparison of BCR between the intervention and traditional practice

4 Status of established Custom Hiring Centers (CHCs) in NICRA adopted villages during 2022-23

Custom Hiring Centers (CHCs) have been an integral part of the project's success in the adopted NICRA villages and have benefited the farmers in the villages. These centers are crucial in improving the livelihoods of farmers and ensuring food security in the face of changing climate conditions.Some of the key benefits of the established CHCs in the villages are as follows:

Custom Hiring Centre at Asugre Village, South Garo Hills

- **Access to Modern Farm Machinery:** CHCs provide farmers with access to mechanized farm equipment, such as tractors, harvesters, and irrigation pumps. This reduces the dependence on traditional and labor-intensive farming methods and helps farmers to increase their productivity and efficiency.
- **Cost reduction:** By sharing the cost of machinery and equipment through CHCs, farmers can significantly reduce their production costs. This cost-sharing model makes it more affordable for small and marginal farmers to adopt mechanized farming practices.
- **Time saving:** Mechanized farming equipment available at CHCs allows farmers to complete tasks more quickly and efficiently. This not only saves time but also enables farmers to carry out multiple operations during critical periods like sowing and harvesting.
- **Improved crop quali**ty: The use of modern machinery can lead to better crop quality and reduced post-harvest losses. Timely operations like harvesting and threshing are crucial for preserving the quality of crops, and CHCs facilitate these activities.
- **Enhanced productivity:** Mechanization through CHCs can significantly increase agricultural productivity. Farmers can cultivate larger areas of land and achieve higher yields, contributing to food security and income generation.

- **Climate resilience:** NICRA villages focus on climate-resilient agriculture, and CHCs play a pivotal role in this regard. Mechanized farming allows for better adaptation to changing weather patterns and helps mitigate climate-related risks.
- **Skill development:** CHCs also provide training and capacity-building opportunities for farmers. They learn to operate and maintain modern machinery, improving their technical skills and knowledge.
- **Rural employment:** CHCs create job opportunities in rural areas. Apart from those directly employed at the centers, there is a ripple effect as increased productivity and mechanization can generate demand for related services and jobs.
- **Income diversification:** Access to modern machinery can encourage farmers to diversify their crops and adopt new agricultural practices. This diversification can lead to additional income sources.
- **Environmental benefits:** Mechanized farming, when done sustainably, can reduce the environmental impact of agriculture. Efficient machinery can use resources like water and fuel more judiciously, contributing to environmental conservation.

The list of established CHCs during the year along with the number of farming household benefited during the year is depicted in the table below:

Table 4.1.: Status of established CHCs in the NICRA Villages

KVK	Village(s)	No. of equipment's	Household covered
Senapati	T Khullen	20	389
Ri Bhoi	Thadnongiaw	168	-
South Garo Hills	Asugre	1	-
West Garo Hills	Marapara	7	46
Lawngtlai	Chawnhu	59	42
Lunglei	Hnahththial and Tuipui D	22	258
Siaha	Tisopi	19	137
Mon	Ngangching, Langmeing, Totok Chingha and Sowa Changle	9	All households
Phek	Thipuzu	12	7
Tuensang	Chendang	11	203
Sepahijala	Golaghati GP	5	37

5 Capacity Building Activities Conducted by the KVKs of ATARI, Umiam during 2022-23

Capacity building activities conducted by the KVKs of ICAR-ATARI, Umiam in NICRA adopted villages offer a range of benefits that contribute to the overall development and resilience of the agricultural sector. These activities are designed to enhance the knowledge, skills, and capabilities of farmers, agricultural professionals, and stakeholders in the context of climate change and sustainable agriculture. Here are some of the key benefits of these capacity building initiatives:

- **Climate resilience:** Such activities help the farmers to understand the impacts of climate change on agriculture and equip them with strategies to build resilience. This knowledge empowers farmers to adapt to changing weather patterns and minimize losses due to extreme weather events.
- **Improved farming practices:** Capacity building activities introduce participants to modern and sustainable farming techniques. Farmers learn about the latest agricultural technologies, crop varieties, and practices that can increase productivity and reduce environmental impacts.
- **Enhanced crop productivity:** By adopting improved farming methods, participants can increase crop yields and livestock production. This leads to higher income and improved food security for farming communities.

Capacity building programme conducted by KVK, Chandel

Training on Improved Backyard Poultry, Totok Chingha, KVK, Mon

- **Agricultural diversification:** KVKs of ATARI, Umiam encourage diversification of agricultural activities. Farmers are exposed to new crops and livestock species that are better suited to changing climatic conditions, reducing the risks associated with monoculture.
- **Resource management:** Capacity building activities focus on efficient use of resources such as water, soil, and energy. Participants learn how to manage these resources sustainably, leading to better resource utilization and reduced environmental degradation.
- **Entrepreneurship development activities:** NICRA KVKs often include training in agri-entrepreneurship and value addition. This encourages farmers to explore value-added products, agribusiness opportunities, and market linkages, ultimately increasing their income.
- **Gender inclusivity:** These initiatives often promote gender-inclusive practices in agriculture. Women are empowered with knowledge and skills, fostering gender equality in rural areas.
- **Technology adoption:** Farmers and agricultural professionals are introduced to modern agricultural technologies, including ICT tools, which can streamline farming operations, improve decision-making, and enhance overall efficiency.
- **Research and innovations:** KVKs facilitate the exchange of ideas and research findings. They encourage participants to engage in applied research and innovation, leading to local solutions and advancements in agricultural practices.
- **Community building:** Capacity building activities foster a sense of community among farmers and stakeholders. Knowledge sharing, networking, and collaboration among participants can lead to collective action for addressing common challenges.
- **Sustainable development:** By promoting sustainable agricultural practices, NICRA KVKs contribute to the long-term development of rural communities. Sustainable agriculture is the key to preserving natural resources and ensuring food security for future generations.

The list of activities conducted by the KVKs along with participants during the year is as follows:

Table: 5.1: Capacity building activities for Human Resource Development programmes conducted during 2022-23

KVK	Programmes Conducted	Participants/ Beneficiaries		
		Male	Female	Total Beneficiaries
Chandel	11	281	260	541
Senapati	7	86	89	175
Ukhrul	6	103	72	175
Jaintia Hills	5	61	23	84
Ri Bhoi	9	24	95	119
South Garo Hills	7	106	56	162
West Garo Hills	5	67	161	228
Lawngtlai	10	170	156	326
Lunglei	11	136	94	230
Siaha	10	147	86	233
Serchhip	5	55	50	105
Mon	9	71	109	180
Phek	34	224	513	737
Tuensang	8	100	29	129
Sepahijala	8	100	81	181
Total	**145**	**1731**	**1874**	**3605**

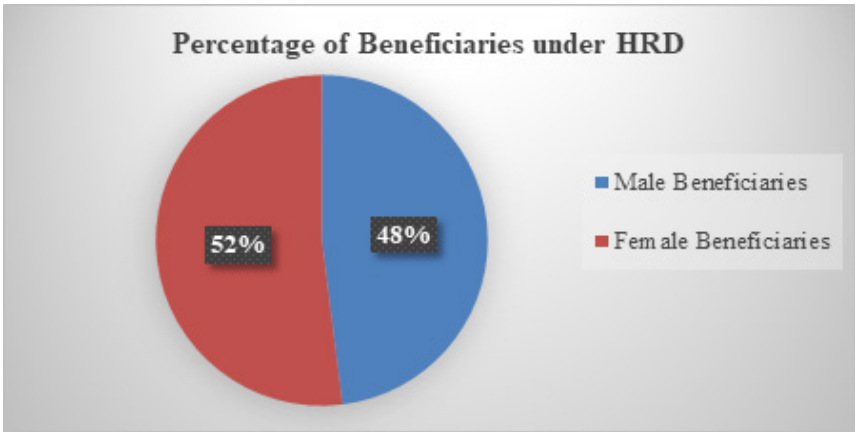

Fig. 5.1: Percentage share of beneficiaries under capacity building activities for Human Resource Development during 2022-23

6 Extension Activities Conducted by the KVKs during 2022-23

Extension activities conducted by KVKs in NICRA villages play a pivotal role in building climate resilience, improving livelihoods, and fostering sustainable agriculture. They contribute to the overall development and well-being of rural communities by equipping them with the knowledge and tools needed to thrive in a changing climate. Some key benefits of the extension activities are as follows:

Field Day conducted by KVK, Ri Bhoi on Potato in convergence with ICAR-CPRS, Upper Shillong

- **Climate Resilience:** NICRA villages are often vulnerable to climate change-related challenges like erratic rainfall and temperature fluctuations. KVKs help farmers adopt climate-resilient agricultural practices and technologies, making them better prepared to cope with adverse weather conditions.
- **Increased Crop Productivity:** Through the dissemination of improved farming techniques and technologies, KVKs help farmers enhance crop yields and overall agricultural productivity. This leads to higher income levels for rural communities.
- **Diversification of Agriculture:** KVKs encourage farmers to diversify their agricultural activities by introducing them to new crops and practices suited to changing climate conditions. This reduces their dependence on a single crop and spreads risk.
- **Resource Management:** Extension activities educate farmers on sustainable natural resource management, including water conservation, soil health, and efficient use of inputs. This helps in preserving the environment and ensuring the long-term viability of farming.
- **Livelihood Enhancement:** By imparting training in non-farm income-generating activities like animal husbandry, agribusiness, and food processing, KVKs contribute to the overall improvement of livelihoods in NICRA villages.
- **Technology Transfer:** KVKs act as intermediaries between research institutions and farmers, facilitating the transfer of cutting-edge agricultural technologies and practices to the grassroots level. This bridges the gap between scientific research and practical application.

- **Capacity Building:** Extension activities include training programs, workshops, and demonstrations that empower farmers with knowledge and skills. This builds their capacity to make informed decisions and adapt to changing agricultural scenarios.
- **Market Access:** KVKs assist farmers in accessing markets and value chains by connecting them with buyers, processors, and marketing networks. This ensures that farmers receive fair prices for their produce.
- **Community Development:** These activities promote community cohesion and cooperation as farmers come together to learn and share experiences. This can lead to the development of stronger social networks and community support systems.
- **Resilience to Climate Variability:** Through climate-smart agriculture practices, KVKs help farmers reduce the risks associated with climate variability, such as crop failures and income loss. This ultimately leads to a more secure and sustainable agricultural sector.

The list of extension activities conducted by the KVKs along with number of participants during the year is as follows:

Table: 6.1: Extension activities conducted during 2022-23

KVK	Programmes conducted (no.)	Participants/ Beneficiaries
Chandel	6	224
Senapati	21	96
Ukhrul	3	91
Jaintia Hills	91	399
Ri Bhoi	6	93
South Garo Hills	16	395
West Garo Hills	45	507
Lawngtlai	6	171
Lunglei	5	317
Siaha	5	82
Serchhip	0	0
Mon	25	292
Phek	19	377
Tuensang	4	76
Sepahijala	5	128
Total	**257**	**3248**

7 Extreme Climatic Events Observed during 2022-23

Extreme climatic events have left an indelible mark on the villages participating in the National Innovations in Climate Resilient Agriculture (NICRA) program. These villages have witnessed a notable increase in the frequency and intensity of extreme weather events, including droughts, floods, heatwaves, and cyclones. These events have disrupted traditional agricultural practices, leading to crop failures, livestock losses, and food security challenges. In response, the project has played a pivotal role in introducing climate-resilient agricultural practices and technologies, empowering these communities to adapt and mitigate the impacts of extreme climatic events. Through research, capacity building, and community engagement, NICRA has been instrumental in enhancing the resilience of these villages to the growing threat of climate change.

Lodging in paddy due to heavy rainfall at Ngangching village, Mon District

The details of the events observed in the districts and their impact on agriculture is listed in the table below:

Table 7.1: Extreme climatic events observed in NICRA adopted villages during 2022-23

KVK	Nature of event	Date	Impact on crop yield/ Livestock
Chandel	Dry spell	1-31 January, 1-20 February, 1-15 March, 1-10 & 24-29 April, 26-30 September, 14-18 & 25-31 October, 1-28 November, 2-26 December	● Yield of vegetable crops was considerably reduced. ● Paddy season started late

Chandel	Heavy rain	4-13 & 25 May, 8-20 June, 21-28 July, 2-6 & 24 Oct	The heavy rains were received during the paddy season, so there was not much adverse impact on the crops.
Senapati	Frost	26 December, 2022-3rd Feb, 2023	Yield decrease due to drying up of extreme frost and cold weather condition
Ukhrul	High rainfall 223.8 mm according to Normal 130 mm in the month of May (with a positive deviation of 72.1%)	May	Early field preparation
Ukhrul	Low rainfall 167.7 according to Normal 360 mm In the month of June (with a negative deviation of 53.4 %)	June	Delay in nursery rising
Ukhrul	Low rainfall 125.2 mm according to Normal 293 mm In the month of July (with a negative deviation of 57.2)	Dry spell on July 3 to 7 & 9 to 19	Delay in transplanting

Ukhrul	Low rainfall 196.2 mm according to Normal 260 mm In the month of August (with a negative deviation of 52.6)	Dry spell on August 18 to 22	Delay in vegetative growth
Jaintia Hills	Drought	1st - 20th Jan, 2023	Reduction in yield
Jaintia Hills	Flash floods	-	Reduction in yield
Ri Bhoi	Intensive rain spells (169.4 mm)	25th Oct 2022	Paddy crop affected during flowering stage
South Garo Hills	Flash Flood	1-6-22 to 31-7-22	Damage on Paddy
South Garo Hills	Heat Stress	1-3-22 to 31-5-2022	Parasitic infection, Haemorrhagic septicaemia in cattle, Loss of appetite
West Garo Hills	Flash flood	7th -9th June,2022	Reduction of yield (40%)
Lawngtlai	Dry spells (>2.5 mm/day)	6th -31st Jan, 2022	Cabbage, Field Pea Potato – affected during flowering stage
Lawngtlai	Dry spells (>2.6 mm/day)	1st-19th Feb, 2022	Cabbage, Field Pea Potato – affected during flowering stage
Lawngtlai	Dry spells (>2.7 mm/day)	21st -27th March, 2022	Cabbage, Field Pea Potato – Flowering stage

Lawngtlai	Dry spells (>2.8 mm/day)	Mar 29th -19th April,2022	Cabbage, Field Pea Potato – Flowering stage, upland rice, upland vegetables - Sowing, germination, Rice, maize, vegetables – Harvesting
Lawngtlai	Dry spells (>2.9 mm/day)	24th April- 1st May, 2022	Upland rice, upland vegetables - Sowing, germination
Lawngtlai	Dry spells (>2.10 mm/ day)	26th Oct - 30th Nov, 2022	maize, vegetable crops - growth stage, Maize, Bean, vegetable crops – tillering, flowering, Rice, maize, vegetable crops – flowering, silking, Mustard, toria, cabbeage - sowing and transplanting
Lawngtlai	Dry spells (>2.11 mm/ day)	1st - 31st December, 2022	Field pea, Toria, Mustard - flowering
Lawngtlai	Heavy Rain (>60mm)	26th August, 2022	Rice, maize, vegetables - milking stage, silking, pod forming
Siaha	Erratic rainfall, Heavy rain	During August, 2022	Rice, maize, vegetables - milking stage, silking, pod forming
Siaha	Heavy rainfall	(22nd -27th) August, 2022	Rice, Maize, kharif vegetables
Siaha	Dry spell	(1st – 19th) March, 2022	Upland rice, upland vegetables - sowing and germination
Mon	Dry spell	01/11/22 to 25/12/22 and 01/01/23 to 14/03/23	Affected the germination & vegetative stage of rabi crops like Field Pea, Garlic & Toria.

Mon	Heavy rain	19/06/22 to 23/06/22	Damage paddy crop resulting in reduction of yield and increased disease occurrence and irrigation channel.
Mon	Frost	27&28/12/22	Injury to rabi crops. Affected the flowering stage and vegetative growth stages resulting in reduction of yield.
Phek	Dry Spell	30 days (Nov), 12 days (1st – 12th Jan), 13 Days (17^{th} - 29^{th} March)	Stunted growth at vegetative stage in field pea, Stunted growth in field pea and garden pea
Tuensang	Frost	3/01/22 to 11/01/22	Vegetative stage of cole crops affected
Tuensang	Intensive rainfall	During July, 2022	Crop lodging, stagnation of water in the field affecting the crops.
Sepahijala	Flood	18-06-2022	Delay in paddy nursery raising due to flood
Sepahijala	Flood	03-10-2022	Sprouting of harvested paddy
Sepahijala	Flood	24-10-2022	Sprouting of harvested paddy

8 Prominent Visitors Visited NICRA KVKs and Adopted Villages During 2022-23

During the 2022-23 period, several prominent personalities paid visits to National Innovations in Climate Resilient Agriculture (NICRA) villages, demonstrating their commitment to sustainable agriculture and climate resilience. These visits included renowned agricultural scientists, government officials, and other institutions. These prominent individuals engaged with farmers and communities in NICRA villages, gaining firsthand insights into the innovative agricultural practices and climate-resilient techniques being implemented. Their visits not only provided valuable encouragement and support to the local farmers but also highlighted the importance of NICRA's initiatives in addressing the challenges posed by climate change in agriculture. These interactions served as a catalyst for knowledge sharing and collaboration, further promoting the adoption of climate-smart agricultural practices across the region.

Interaction of Scientists from CRIDA-Hyderabad with farmer during ZMC visit at NICRA village

The details of the visits made by important personnel along with their remarks are listed in the table below:

Table 8.1: Details of visitors during 2022-23

KVK	Name of visitors	Date	Remarks
Ukhrul	Joint Director ICAR, Imphal	22.09.2022	-
Ukhrul	NABARD	12.08.2022	-
Jaintia Hills	ZMC visit	1.05.2022	Expansion of NICRA program is needed so that it would benefit the farmers

Lunglei	J.Hmingthanmawia Secretary, Agriculture and I&PR, Govt.of Mizoram	10-08-2022	Visited the KVK and demonstration under NICRA of KVK Lunglei. Highly impressed with the programmes under various modules of the project. Suggested to make more linkages with other department.
Lunglei	Lawmawma Tochhong. Vice Chairman, High Power Committee, Lunglei.	28-11-2022	He is highly impressed and appreciate the work done by the KVK Lunglei. Suggested to extend and promote more target farmers after NICRA villages especially in dual purpose birds to address the issues of vulnerability mitigation mechanism.
Serchhip	C. Lalrinsanga, Minister, Agriculture etc.	7.4.2022	He release their approved technology and inaugurate hatchery unit. The entire scientist is keen in their job which makes me happy.
Serchhip	James Lalsiamliana, Director of Agriculture, Mizoram	7.4.2022	The staffs at KVK are all active and interested in their work. I wish them all the best in their hard work and future.
Phek	Dr Imsunaro, DDM NABARD, Phek and Mr Vizol Kera, BM, NSctBPfutsero.		Field visit, financial literacy camp and village level programme
Tuensang	District Agriculture Officer(DAO)	05.05.2022	More climate resilient varieties need to be introduced

Sepahijala	Prof. Ratan Kumar Saha (Dean, College of Fisheries, Lembucherra)	12-10-2022	"Under the leadership Hon'ble vice-chancellor Dr Anupam Mishra, KVK Sepahijala is working very efficiently and scientific manner to materialized the goals and objective of the NICRA Project in Golaghati GP."
Sepahijala	Dr Bijoy Sarkar (Assistant Professor, College of Veterinary Sciences & Animal Husbandry, Tripura)	12-10-2022	"The technological interventions at Golaghati GP under KVK Sepahijala are really impressive as they are focusing on the climate resilient technologies in agri and allied sectors which are very timely for the current situation of the village."
Sepahijala	Shri Biswajit Saha (President Agri Standing Committee, Sepahijala, Tripura)	12-10-2022	"Impressive works is going on at Golaghati GP under KVK Sepahijala. We are hoping that such kind of scientific work will implement not only in Golaghati GP but also across the district."

9 Most significant achievements observed under NICRA project during 2022-23

In 2022-23, the National Innovations in Climate Resilient Agriculture (NICRA) program witnessed several significant achievements in its target villages across the region. One of the most noteworthy accomplishments was the successful adoption of climate-smart agricultural practices by farmers. Through the implementation of improved cropping patterns, precision farming techniques, and the use of resilient crop varieties, these villages experienced enhanced agricultural productivity and reduced vulnerability to climate change impacts.

Additionally, the promotion of sustainable water management practices, such as rainwater harvesting and efficient irrigation methods, played a pivotal role in ensuring water availability for agriculture. Furthermore, capacity-building initiatives and farmer education programs led to increased awareness and knowledge sharing within these communities, empowering them to adapt and thrive in the face of changing climatic conditions. Overall, the NICRA villages demonstrated remarkable progress in building climate resilience and fostering sustainable agricultural practices during 2022-23.

The details of the significant observed in the NICRA villages along with their impact is depicted in the table below:

System of Rice Intensification: KVK, Phek

Khaki Campbell Ducks: KVK, Sepahijala

Table 9.1: Significant Achievements by the KVKs of ATARI, Umiam during 2022-23

KVK	Description	No. of farmer household covered	Impact
Chandel	Demonstration of improved rice var RC Maniphou-13	11	The farmers received better yields than from the traditional rice varieties
	Demonstration of improved medium duration rice var RC Maniphou-8	8	The farmers received better yields than from the traditional rice varieties & also the shorter crop duration further motivated the farmers
	Demonstration of improved maize var. RCM-1-76	3	The yield of maize was enhanced as compared to the traditional variety. So farmers could use the excess maize as fodder
Ri Bhoi	Micro irrigation through harvested water in jalkund for multipurpose use	5	Increased yield, availability of water for irrigation purpose during winter
	Round the year vegetable cultivation under protected condition	7	Increased yield, protection from cold and heat wave
	Crop diversification through raised bed in rice fallow	5	Increased cropping intensity
	Climate resilient integrated fish cum deep litter pig housing system for sustainable income	3	Less stress during winter as the temperature is maintained, increased growth rate and less mortality rate
	Climate resilient fish cum raised floor poultry housing system for sustainable income	28	Increased growth rate and less mortality rate and increased in protein rich feed for fish by poultry excreta

South Garo Hills	Vermibed	10	Vermibed – For making Vermicomposting
	Polyhouse	3	Polyhouse – cultivation of off season vegetables
	Jalkund	1	Jalkhund- Rainwater harvesting for multi use
	Imprved Planting Materials & Seeds	30	Planting materials & Seeds – For better crop Yield
	Integrated Farming System Model	3	Sustainable Agriculture system for better increasing input Efficiency
	Distributions of Ducklings	5	For IFS Model
	Cultivation of Oyster Mushroom	5	Increase Annual income of Farmer
	Soil health card distributed	73	To assess the Status of Soil health & recommends appropriate dosages of fertilizers for crop production
West Garo Hills	Gitesh is a staggered transplanting Variety. Gitesh is also a stress tolerant to flood and can be grown in dry weather condition. The climatic condition does not affect the production of this variety and this variety mature early than the local variety.	10	The yield recorded in Gitesh is 51-54.10q/ha comparing with local was 19 - 21.2q/ha.
Siaha	Rainfed upland with animals (Hills with steep slopes)	3	Through provision of 3nos. of Jalkund at Tisopi village, 3 families were able to cultivate winter vegetables and hence, locally produced vegetables were made available as never before in the village.

Mon	Use of Paddy Straw Mulching in Rabi Crops for Moisture Conservation.	9	Enhanced moisture conservation, increased crop yield, improved climate resilience, enhanced soil health, knowledge sharing, and economic growth.
	The success of Aman variety and paddy straw mulching in Pea.	8	Increased crop yield, improved climate resilience, enhanced soil health, knowledge sharing, and economic growth for the community.
	Impact of rearing dual-purpose poultry, Kuroiler.	20	Empowerment of women, climate resilience, improved livelihood providing source of income, food security & nutrition.
	Zero tillage in Rapeseed/ Mustard	8	Improved climate resilience, increased crop yield, enhanced soil health, climate resilience, knowledge sharing.
Phek	Zero Tillage in field pea	70	With the adoption of Zero tillage technology, we could observe that the crop showed better performance as compared to the traditional method of cultivation. The farmer could achieve a yield of 14.75 q/ha and 12.60 q/ ha in the year 2020-21 and 2021-22 respectively as compared to the traditional method which was 10.92q/ ha and 9.08 q/ha.

	Straw mulching in garden pea	50	Before KVK intervention in the village, the total area under garden pea cultivation was 1.4 ha in 2013-14 and after the intervention there was horizontal spread of this crop and at present farmers are growing this crop in an area of 5.5 ha which was otherwise remain fallow after paddy. The yield under straw mulching plot in Garden pea was 78.57 q/ha whereas under the control plot it was 44.8 q/ha. Looking into the benefits of using paddy straw, farmers of nearby villages have also adopted the technology and they are cultivating not only garden pea butalso other winter vegetables like cabbage, potato etc. Farmers have accepted this technology under soil moisture stress due to dry spell during winter season.
Tuensang	Polymulching	2	Moisture conservation, weed management
	Low cost Polyhouse	2	Off season production of crops
	Vermicomposting	1	Source of manures for the crops
	Jalkhund	1	Irrigation of crops from the water harvesting structure Jalkhund during lean period
	Rareball, HQPM-1 and All rounder	20	Increased production due to use of high yielding varieties
Sepahijala	Stress tolerant duck breed Khaki Campbell	10	After seeing the performance as compare with local breed more numbers of farmers are interested to take up this breed instead of local breed.

10 Awards Received by NICRA KVKs and Farmers of Adopted NICRA Villages during 2022-23

In the year 2022-23, the National Innovations in Climate Resilient Agriculture (NICRA) Krishi Vigyan Kendras (KVKs) and dedicated individual farmers across the region achieved remarkable recognition and acclaim through awards and honors. These accolades not only underscore the dedication and innovative spirit of KVKs in promoting climate-resilient agricultural practices but also highlight the outstanding contributions of farmers who have pioneered sustainable and adaptive farming techniques. These awards serve as a testament to the pivotal role that NICRA KVKs and farmers play in mitigating the challenges posed by climate change and ensuring food security in India, showcasing their commitment to fostering agricultural resilience and sustainable practices in the face of evolving environmental conditions.

The details of awards received by the KVKs and farmers during the year are as follows:

Table 10.1: Awards received during 2022-23

KVK	Name of award(s)/ recognition(s)	Given by	Date
Ukhrul	Best Poster Presentation during International Conference on "Re-imagining Rainfed Agro-ecosystems: Challenges & Opportunities.	Indian Society of Dry-land Agriculture.	22nd to 24th Dec. 2022
West Garo Hills	Role of Women in development of North East.	Social welfare and Social Education Government of Tripura.	02nd March, 2023
Lawngtlai	Best Innovative Farmer Award	ICAR-CRIDA	12th April, 2023

11 Publications by the NICRA KVKs of ICAR-ATARI, Zone VII, Umiam during 2022-23

During 2022-23, the National Innovations in Climate Resilient Agriculture (NICRA) Krishi Vigyan Kendras (KVKs) have continued to make significant contributions to the agricultural landscape of the region. Their publications in the form of research articles, folders, leaflets, video films, etc., during this period reflect a wealth of knowledge, research, and practical insights aimed at promoting climate-resilient agricultural practices. These publications serve as valuable resources for farmers, researchers, policymakers, and stakeholders interested in sustainable farming methods, crop diversification, and adaptation strategies in the face of climate change. Through their diligent efforts and commitment to innovation, they are actively shaping the future of Indian agriculture by equipping stakeholders with the tools and information needed to address the challenges posed by a changing climate. The details of publications made during the year are listed in the table below:

Table 11.1: Publications made during 2022-23

KVK	Description of the publication
South Garo Hills	International Conference on Reimagining Rainfed Agro systems Challenges and Opportunities: Performance evaluation of ghungroo under backyard piggery farming in South Garo Hills , Meghalaya – an approach for climate change adaptation
	International Conference on Reimagining Rainfed Agro systems Challenges and Opportunities: Vermicomposting-a module for sustainable soil management in South Garo Hills, Meghalaya, India
	Success stories: A Profitable And sustainable Farming System (Livestock + Horticulture + Vermicompost)
	Success stories: Organic farming for enhancing Livelihood.
	Folder: Piggery Management
	Folder: Oyster Mushroom Cultivation
	Folder: Kitchen Garden and its importance
	Folder: Cucumber Cultivation under Polyhouse

Lawngtlai	Video Film on success story of Poultry (Rainbow Rooster): Rainbow Rooster (Ar) Vulh Hlawhtling || Pi F. Kapmawii Link: https://youtu.be/rXXQmMedIOA
	Leaflets/Folders/Info sheets: Backyard raising of poultry – Rainbow Rooster
	Leaflets/Folders/Info sheets: Cultivation of Maize
	Leaflets/Folders/Info sheets: Vermicomposting
	Leaflets/Folders/Info sheets: Mizoram a buh kan thar tlem chhan
	Leaflets/Folders/Info sheets: Storage and priming of soybean seeds
Siaha	Research paper: Improved Jhum in southern part of Mizoram
	Success stories: Integrated Farming System and Inter-cropping of Vegetables
Tuensang	Research Abstract: Pijush Kanti Biswas, Kerimenla and Watisenla Imsong. 2022. Impact of climate resilient practices on Cabbage productivity in NICRA villages of Tuensang district in Nagaland. International Conference Reimagining Rainfed Agro ecosystems-Challenges & Opportunities.
	Leaflets: Backyard Poultry Farming Scientific Cabbage Cultivation Scientific Maize Cultivation Vermicomposting
Sepahijala	Folder: Slurry method of phosphorus management in paddy
	Folder: Package and practices for Mustard and Rapeseed

12 Budget details during 2022-23

(Rupees)

S. No.	STATE	KVK	Opening Balance	Revised RE 2022-23				Expenditure during 2022-23				Closing Balance
				GENERAL		CAPITAL	Total	GENERAL		CAPITAL	Total	
				Operaional	TA	Equipment		Operaional	TA	Equipment		
1	ATARI, Zone-VII, Umiam		0	465023	31477	0	4,96,500	465020	31477	0	4,96,497	3
2	Manipur	Chandel	0	590339	64661	200000	8,55,000	590339	33736	200000	8,24,075	30,925
3		Senapati	0	625000	95000	200000	9,20,000	625000	95000	200000	9,20,000	0
4		Ukhrul	0	627639	62361	250000	9,40,000	627639	29725	250000	9,07,364	32,636
5	Meghalaya	Jaintai Hills	0	615000	95000	250000	9,60,000	615000	95000	250000	9,60,000	0
6		Ri Bhoi	0	855730	14270	300000	11,70,000	855730	14270	300000	11,70,000	0
7		West Garo Hills	0	505000	60000	200000	7,65,000	505000	35243	200000	7,40,243	24,757
8		South Garo Hills	0	650000	126000	200000	9,76,000	650000	126000	200000	9,76,000	0
9	Mizoram	Lunglei	0	550000	95000	250000	8,95,000	550000	95000	250000	8,95,000	0
10		Serchchip	0	549000	63000	250000	8,62,000	549000	63000	250000	8,62,000	0
11		Lawngtali	0	664000	100000	200000	9,64,000	664000	100000	200000	9,64,000	0
12		Siaha	0	690000	105000	200000	9,95,000	690000	105000	200000	9,95,000	0
13	Nagaland	Mon	0	610500	95000	300000	10,05,500	610500	95000	300000	10,05,500	0
14		Phek	0	565989	29011	200000	7,95,000	565902	29011	199995	7,94,908	92
15		Tuensang	0	595000	110000	200000	9,05,000	595000	110000	200000	9,05,000	0
16	Tripura	Saepahijala	3751	785700	44300	200000	10,30,000	785700	44300	200000	10,30,000	3,751
Total			**3751**	**9943920**	**1190080**	**3400000**	**14534000**	**9943830**	**1101762**	**3399995**	**14445587**	**92164**