



Spices to New Heights: Rising NER through ICAR-AICRPS (2018-23)



भाकूअनुप-अखिल भारतीय समन्वित मसाला अनुसंधान परियोजना ए आई सी आर पी एस

ICAR-All India Coordinated Research Project on Spices

ICAR-Indian Institute of Spices Research

Kozhikode - 673012, Kerala, India

**Spices to New Heights:
Rising NER through ICAR-AICRPS
(2018-2023)**

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Contents

Savouring the Spices of the North East: Unveiling the Unexplored	01
Empowering the North East: ICAR-AICRP'S Pioneering Research on Spices across Seven States	03
Profile of AICRP Spices Centers in North East India	05
Genetic Resources-Hotspot of Variability	07
Improved Varieties-For High Yield and Quality	13
Improved Technologies-For Sustainable Crop Production	15
Quality Planting Material Production	22
Extension Activities	23
Success Stories	25
Assets Creation-Creation of Better Facility	43



Glimpse of NEH activities by ICAR-AICRPS centres

Savouring the Spices of the North East: *Unveiling the Unexplored*

The North Eastern states of India, often celebrated for their rich cultural diversity and breathtaking landscapes, are also a hidden gem when it comes to spice cultivation. This region, blessed with a unique climate and fertile soils, produces some of the most aromatic and sought-after spices in the country. From the fiery Bhot Jolokia (Ghost Pepper) of Assam to the fragrant Lakadong turmeric of Meghalaya, the spice gardens of the North East are a treasure trove for culinary enthusiasts and spice traders alike. Cultivated using traditional and sustainable practices, these spices not only add flavour to dishes but also play a significant role in the local economy, preserving the rich agricultural heritage of the region. Dive into the vibrant world of North East India's spice cultivation, where every spice tells a story of the land it comes from.

The North Eastern Region of India seen steady growth in spice production over the years. Sikkim remains a major hub for large cardamom, consistently cultivating 23,312 hectares with a production rising from 4,779 tonnes in 2019-20 to 5,280 tonnes in 2023-24. Arunachal Pradesh and Nagaland also contribute significantly, with increase in both area and production, especially in Arunachal Pradesh where production climbed from 1,614 tonnes to 1,806 tonnes over the same period. In the chilli sector, Assam stands out, with a substantial area under cultivation that reached over 20,000 hectares by 2023-24, producing around 20,526 tonnes. Nagaland has also seen a notable increase in chilli production, doubling from 1,754 tonnes in 2019-20 to 4,435 tonnes in 2023-24. Turmeric production in Mizoram has been remarkably stable, maintaining a production level of around 29,820 tonnes across the years, while Assam's turmeric output, though fluctuating, remained strong with 21,711 tonnes produced in 2023-24. This consistent rise in both area and production across these states highlights the growing importance of spice cultivation in the North East, contributing significantly to the region's agricultural economy.



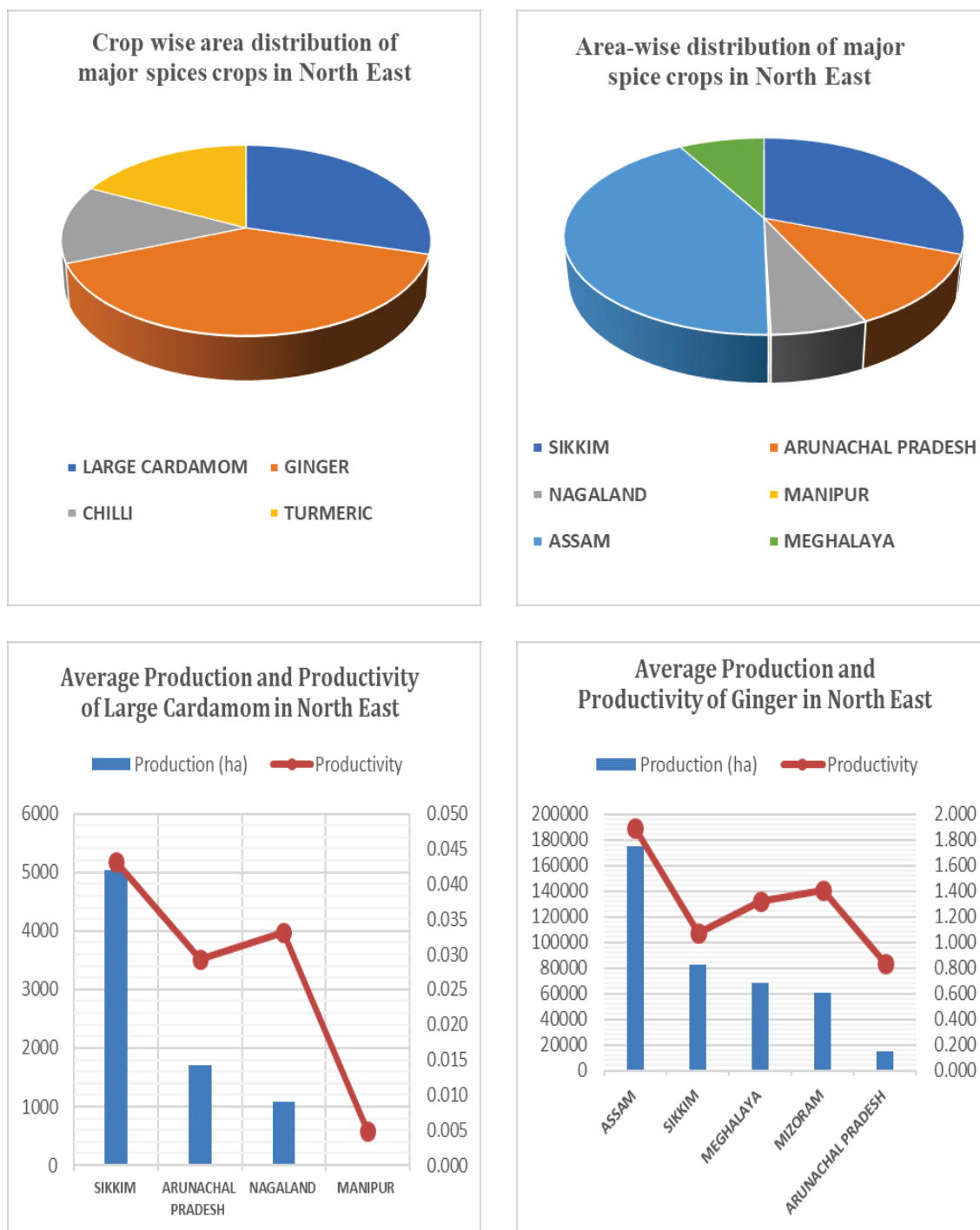


Fig. 1: Production statistics of some important spices of North East Region (2022-23)

Empowering the North East: ICAR-AICRP'S Pioneering Research on Spices across Seven States

The ICAR-All India Coordinated Research Project on Spices (AICRPS) plays a pivotal role in advancing agricultural development across the North Eastern Regions of India. Through its seven strategically located centers across six states, AICRPS is dedicated to the research and development of high-value spice crops such as black pepper, ginger, turmeric, and large cardamom. These crops are not only integral to the region's agricultural landscape but also hold significant economic and cultural importance.

The ICAR-AICRPS operates in collaboration with seven co-opting centers that are meticulously spread across the states of Arunachal Pradesh, Mizoram, Meghalaya, Sikkim, Nagaland, and Assam. These centers serve as hubs of innovation, where scientists and researchers work tirelessly to address the unique challenges faced by farmers in these regions. By focusing on crop improvement, sustainable practices, and technology dissemination, ICAR-AICRPS aims to enhance productivity, improve quality, and ensure the long-term viability of spice cultivation in the North East. Through its coordinated efforts, ICAR-AICRPS not only contributes to the empowerment of local farming communities but also bolsters the region's position as a key player in India's spice production sector. The research outputs and innovations emerging from these centers are instrumental in promoting sustainable agriculture, enhancing income opportunities for farmers, and preserving the rich biodiversity of the North Eastern states.

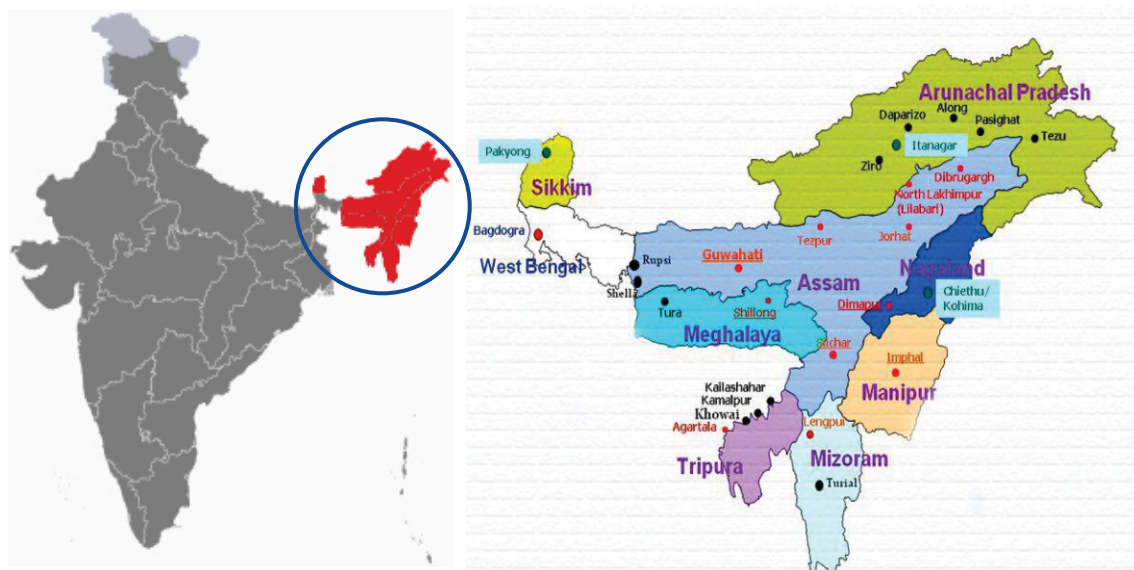


Fig. 2: NER of Indian sub-continent

Table 1: ICAR-AICRPS centers functioning in North East

State	Institution	Centre	Year of start	Crops
Arunachal Pradesh	Central Agricultural University	Pasighat	2008	Large cardamom, Ginger, Turmeric
Assam	Assam Agricultural University	Kahikuchi	2014	Black pepper, Turmeric, Nutmeg
Meghalaya	ICAR Research Complex for North Eastern Hill Region	Barapani	2008	Ginger, Turmeric
Mizoram	ICAR Research Complex for North Eastern Hill Region	Mizoram	2008	Ginger, Turmeric
Nagaland	Nagaland University	Dimapur	2014	Black pepper, Ginger, Turmeric
Sikkim	ICAR Research Complex for North Eastern Hill Region	Tadong, Gangtok	2008	Large cardamom, Ginger, Turmeric
Sikkim	Indian Cardamom Research Institute (Spices Board)	Tadong, Gangtok	2008	Large cardamom



Profile of AICRP Spices Centers in North East India

ICAR Research Complex for North Eastern Hill Region

The ICAR Research Complex for North Eastern Hill (NEH) Region is a leading research institute under the Natural Resource Management Division of the Indian Council of Agricultural Research (ICAR). Since its inception in 1975, the institute has been at the forefront of advancing research, extension, and human resource development in agriculture and allied sectors specifically tailored to the unique hilly and mountainous ecosystems of the North Eastern Hill Region. With its headquarters in Barapani, Meghalaya, the institute operates a network of regional centers strategically located across the North East to address the diverse agricultural challenges of the region.

Indian Cardamom Research Institute

The Indian Cardamom Research Institute (ICRI) was established first at Myladumpara (Kerala) in 1978 by Cardamom Board under the erstwhile Cardamom Act 1965. Later, the Cardamom Act 1965 was replaced by the Spices Board Act 1986. The Act, (section) 7 (2) (xi) among the other provisions, provides to undertake, assist or encourage scientific, technological and economic research. In 1981, a Research Centre for large cardamom was started at Gangtok, Sikkim and the same was also brought under ICRI in 1987 as one of its regional stations. The primary mandate of ICRI, Regional Research Station, Gangtok is to develop suitable production, protection and postharvest technologies for large cardamom and to make Sikkim and Darjeeling district of West Bengal, the premier suppliers of large cardamom.

Nagaland University

The Nagaland University is a Central University established in Nagaland by an Act of Parliament by the Government of India in 1989. Prior to this, Nagaland had been in the catchment area of North Eastern Hill University (NEHU), with Kohima designated as one of the campuses of NEHU along with School of Agricultural Sciences and Rural Development (SASRD), Medziphema. With the establishment of Nagaland University, the two erstwhile campuses inherited from NEHU as well as the colleges affiliated to it fell within the jurisdiction of Nagaland University. The School of Agricultural Sciences and Rural Development, Nagaland University is a premier institute conducting basic, strategic, anticipatory and applied research on all aspects of horticultural crops. The AICRP on Spices centre (co-opting centre) has been approved by the council (ICAR) and accordingly the centre started functioning as co-opting centre, during the financial year 2014-15.

Central Agricultural University, Imphal

The Central Agricultural University has been established by an act of Parliament, the Central Agricultural University Act 1992. The jurisdiction of the University extends to six North Eastern Hill states *viz.*, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Sikkim and Tripura, with headquarters at Imphal in Manipur. The College of Horticulture and Forestry (CHF) is a constituent college of the Central Agricultural University, Imphal, Manipur. The college was established on 7 March, 2001 at Pasighat, Arunachal Pradesh on the bank of the river Siang at the foothills of Eastern Himalayas.

Assam Agricultural University

The Assam Agricultural University is the first institution of its kind in the whole of North Eastern Region of India. The Horticultural Research Station, Kahikuchi, a research station under Assam Agricultural University, is located at the western end of Guwahati city. In 1957, the Department of Agriculture, Government of Assam initiated research in horticulture with a scheme on pineapple at this centre. Thereafter, the station was renamed as Regional Fruit Research Station in 1960-61 and the research works continued. Subsequently, the station was handed over to the Assam Agricultural University in 1973 when it acquired its present identity as Horticultural Research Station. At present, the station is the only one of its kind in the entire North Eastern Region and has been playing a pioneering role in conducting basic and applied research in the field of horticulture.



Genetic Resources-*Hotspot of Variability*

The North East Region is the centre of diversity especially for spices. Lot of explorations have been undertaken by the AICRPS centres to collect unique types and thus enriching spice germplasm.

Table 2: Activities of North Eastern AICRPS centers

Institute	Survey/Collection areas	Crop	Number of accessions/genotypes
ICRI Regional Station, Gangtok	Sikkim, Darjeeling, Arunachal Pradesh	Large cardamom	10 accessions
ICAR Research Complex for NEH Region	-	Large cardamom	7 accessions
CAU, Pasighat	Entire NE Region	Turmeric	75 genotypes
ICAR Research Complex for NEH Region, Barapani	-	Turmeric	32 accessions
ICAR Research Complex for NEH Region, Barapani	-	Ginger	32 accessions

Unique germplasm collections with superior qualities:

Large cardamom

Accession SCC-314 (Seremna): Collected from Naku, West Sikkim during 2020-21, this accession is characterized by its light maroon pseudostem with a green tinge. The plant typically bears 20 spikes per clump, with each spike producing an average of 22 capsules. Each capsule contains approximately 73 seeds, with a dry recovery rate of 23%.



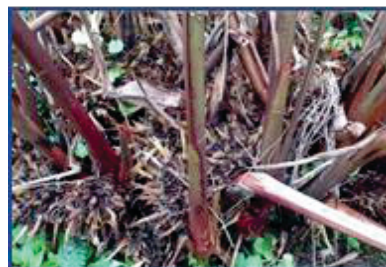
Accession SCC-315 (Seremna): Sourced from Lower Naku, West Sikkim during 2020-21, this accession has a light maroon pseudostem with a green tinge, similar to SCC-314. However, it bears slightly more spikes per clump (26) and has 23 capsules per spike, with 64 seeds per capsule. This accession exhibits a higher dry recovery rate of 26%.



Accession SCC-316 (Varlangey): Originating from Lower Naku, West Sikkim collected during 2020-21, this cultivar is notable for its profuse flowering. Despite the high intensity of flowers, the cultivar does not produce fruit, making it unique in this regard.



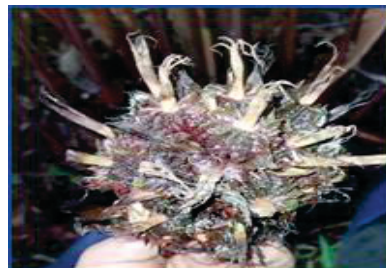
Accession SCC-317 (Regulang): Collected from Lamaten, Rongli, East Sikkim during 2021-22, this accession is recognized for its high yield and disease tolerance. It features an elongated peduncle of the spike and has a hardy pseudostem that helps the plant escape diseases like *Chirke* and *Foorkey*.



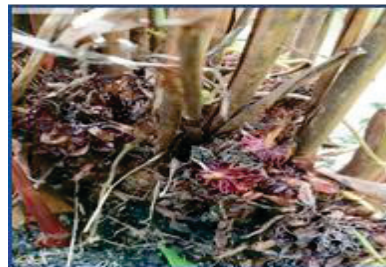
Accession SCC-318 (Uttarey Varlang): Sourced from Simphok, Uttarey, West Sikkim during 2021-22, this accession is known for its high yield and disease tolerance, specifically against leaf blight. It has a remarkable yield of 1150 kg/ha. Suitable for cultivating in mid and high altitudes where it gives exceptional performance when grown under high altitude regions.



Accession SCC-319 (Ramsey): Collected from Rahung, Bomdila in Arunachal Pradesh during 2022-23, this accession is primarily recognized for its high yield, which averages 1120 kg/ha. It is well suited to high altitude (1515 m amsl) regions and can be cultivated even on steep slopes.



Accession SCC-320 (Seremna): Sourced from Dzongu, Mangan district, Sikkim during 2022-23, this dwarf accession is known for its special character and high yield, producing approximately 1050 kg/ha. This cultivar is suitable for low altitude regions. Tillers are green and leaves are mostly drooping type hence named "Seremna".



Ginger



RCGC-6 is a high-yielding, oleoresin-rich accession, developed through clonal selection from the landrace Nadia. The plants reach a height of 70-80 cm and typically have 5 tillers. The rhizomes produced are bold, with an average yield of 462 grams per plant. The dry matter content is 18.63%, with a crude fiber content of 4.23%. RCGC-6 is particularly noted for its oleoresin content of 5.93% and essential oil content of 2.4%, making it well-suited for ginger paste production. This accession is currently being evaluated under the AICRPS CVT Ginger Bold trials



RCGC-17 is an oleoresin-rich accession, selected from the local landrace Ingmakhir of Meghalaya. The plant typically has 12-15 tillers and reaches a height of 68-75 cm. It produces rhizomes that are thin, with an average yield of 250-300 grams per plant. The dry matter content is 21%, and the oleoresin content is notably high at 7.2%, which is twice as much as the check variety, Nadia. Additionally, the essential oil content is 3.2%. This cultivar is particularly suitable for the extraction of oleoresin and essential oil.



RCVBG-1 is a high-yielding, bold-type with an average clump weight of 388.38 grams and a yield of 24.12 tonnes per hectare. This cultivar has an oleoresin content of 4.86%.



RCMLG-1 is noted for its high essential oil content. It has an average clump weight of 323.73 grams and a yield of 22.05 tonnes per hectare, with essential oil content reaching 3%.



RCGC-2 is known for its high oleoresin content, boasting an average clump weight of 319.92 grams and a yield of 23.02 tonnes per hectare. The oleoresin content of this cultivar is 5.21%.



RCGC-10 is another high oleoresin variety with an average clump weight of 317.15 grams and a yield of 21.82 tonnes per hectare. This cultivar has an oleoresin content of 5.29%.



THINGPUI: IC-0644165 Bold, bigger sized rhizomes with low fiber and high gingerol content with a GI Tag (Mizo Ginger).



THINGLAIDUM: IC-0644166, IC-0644167, IC-0644168 Medium size, blackish ring in flesh, pungent, low fiber, with a GI Tag (Mizo Ginger).

Turmeric



Diengling Selection is recognized for its high curcumin content of 7.19%. It has an average clump weight of 346.93 grams and yield 21.35 tonnes per hectare.



Umsomatam Selection stands out with a high curcumin content of 7.24%, an average clump weight of 446.33 grams, and a yield of 29.71 tonnes per hectare.



Lakadong Selection is also known for its high curcumin content, reaching 7.22%. This cultivar has an average clump weight of 352.84 grams and a yield of 28.44 tonnes per hectare.



NDH-98 turmeric performed well and recorded highest yield and resistance to pests and diseases under Pasighat centre for the past 4 years of experimental trials.

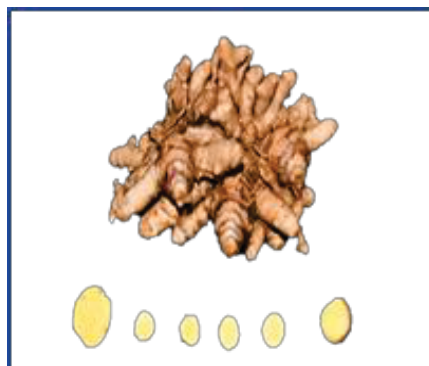
Laskein Selection is another high curcumin selection, with an average clump weight of 323.89 grams and a yield of 28.84 tonnes per hectare. The curcumin content of this variety is 7.16%.

Dhola is a landrace with high curcumin content and yield identified from Kahikuchi.

Others



AIDUM (BLACK GINGER): IC-0647186 Rhizomes are small in size, deep purplish to black in colour.



HAINAM SAWHTHING (MANGO GINGER): IC-0647187 Sweet aroma similar to unripe mango, rhizome is pale yellow in colour.



AILAUDUM (BLACK TURMERIC): IC-0644173, IC-0644174 Bluish ring in flesh, critically endangered (IUCN Red List).

Improved Varieties-For High Yield and Quality

The ICAR-AICRPS has implemented crop improvement programmes utilizing the indigenous and exotic germplasm conserved for the last three decades and has resulted in the development of over 150 improved varieties of spices which can double the farmer's income. The improved varieties are identified for high yield, high quality, resistant/tolerant to major pests and diseases. High yielding varieties enhance income of the farmers as compared to the local cultivars. The industry demands high quality spice varieties for value addition and by growing such varieties, the farmers fetch premium price. Varieties suitable for mixed cropping system ensure higher income from a unit area, which also results in addition of profit to the farmers. Development of pest and disease resistant/tolerant varieties minimize the pesticide residues, reduce the operational expenses and ensures food-safe spice production.

Table 3: Details of varieties introduced and its performance during 2019-2024.

Crop	Varieties introduced	Best performing varieties/Regions
Turmeric	12 high yielding varieties: Rasmi, IISR Pratibha, IISR Alleppey Supreme, Duggirala Red, Kedaram, Roma, Rajendra Sonia, Suranjana, Megha, NDH 1, BSR 2, IISR Pragati	• Megha Turmeric-1: Best in Meghalaya
		• NDH 98: Maximum rhizome yield (22.64 t/ha) in Arunachal Pradesh
		• Mizoram: Megha Turmeric 1, IISR Pratibha, NDH 1, Duggirala Red (high yield)
Ginger	7 high yielding varieties: Nadia, IISR Varada, IISR Rejatha, Surabhi, IISR Mahima, Himgiri, Suprabha	• Mizoram: Himgiri, Nadia
		• Pasighat: Suravi, Nadia
		• Meghalaya: Mahima, Maran, Nadia
		• Arunachal Pradesh: Gorubathan, Bhaise
Black pepper	16 released varieties introduced to Assam and Nagaland	• Assam: Panniyur 1, Panchami (Aimpiriyan)
Large cardamom	-	• Sikkim: Verlange (most consistent across elevations, better than Golsay, Ramsey)
		• Low altitude (Sikkim): Sawney

Some varieties particularly recommended for cultivation in North East are:

IISR Amrit: High yielding mango ginger variety (31 t/ha), having robust, plump rhizome with a light-yellow core. Also features a noteworthy essential oil content of 0.32%, enriched with desirable mango flavour compounds. The variety was identified during XXXIV AGM 2023 and recommended for cultivation in all mango ginger growing regions of India, viz., Kerala, Bihar, Odisha, West Bengal, Chhattisgarh, Gujarat, and the North Eastern Hills.



Kamakhya-1 (KKHP-13): High yielding black pepper variety developed at ICAR-Central Plantation Crops Research Institute Regional Centre, Kahikuchi, Assam. The variety owns a compact spike with an average yield of 6.02 kg fresh yield per vine (2.14 kg dry yield). It has an essential oil content of 3.43%, piperine content of 5.1%, and oleoresin content of 9.36%. The variety was identified during XXXIV AGM 2023 and well suitable for lower Brahmaputra valley zones of Assam.



Improved Technologies-For Sustainable Crop Production

The ICAR-AICRPS has developed crop-specific technologies for varietal improvement, nutrient availability and plant health management in various spice crops. These technologies popularized through demonstrations are adopted by the concerned NE states and propagated through the state agricultural departments.

AICRPS technologies adopted in NER

a. Transplanting technology using single bud rhizome in turmeric and ginger

Traditionally turmeric and ginger are propagated through seed rhizome and seed rate of 2000 to 2500 kg is required per hectare. To reduce the seed rate and main field duration, a novel pro-tray based transplanting technique was developed using single bud sprouts (5 g) raised in soil-less nursery mixture.

This pro-tray technology is adopted in at least 20% of turmeric and ginger cultivated areas, and about 55 and 42 thousand tonnes of seed rhizome requirement of turmeric and ginger could be saved (that amounts to Rs. 75.8 crores).

Table 4: Comparison between Direct planting & Transplanting method

Characters	Direct planting method	Transplanting method
Propagation through	Whole rhizome	Rhizome single bud
Cost of planting material	2500 kg/ha	750 kg/ha
Crop establishment	Rs. 30,000	Rs. 9,000
Rhizome development	75-80%	95-100 %
Rhizome bulking	Starts from 5 MAP	Starts from 2 MAP
Productivity	30-32 t/ha	40-42 t/ha

Table 5: Cost of production of turmeric plants from single bud rhizome

A) Cost of seedling production (1500 pro-trays/ha)	Cost (Rs.) per hectare
1. Pro-tray (Rs. 4/No.)	6,000
2. Cost of growing media	2,500
3. Cost of rhizome (750 kg @ Rs.10/kg)	7,500
4. Labour charge	2,500
Total	18,500
B) Cost of seed rhizome (2500 kg/ha)	25,000
Benefit from transplant production	6,500
Benefit cost ratio	1.35



This method requires 1/4th of planting material as compares to conventional method and saves 60% of production cost. This technology is popularised among the framers of North Eastern states.

b. Organic farming technology

The North Eastern regions of India adopt organic system of cultivation. Normally they undertake Jhum cultivation. Introduction of AICRPS centres in NER promoted the use of combination of composts, FYM and oil cakes. Also promoted the application of bioagents and PGPRs for managing diseases in NER. Necessary care is taken to ensure that only allowed formulations and botanicals under the organic system are used for pest and disease management.

Organic farming package for ginger and turmeric: Pre-sowing rhizome treatment with GRB 35 (PGPR strain) biocapsule, basal application of organic manures (FYM 25-30 t/ha, neem cake 2 t/ha), top dressing of organic manures (vermicompost 2 t/ha and ash 0.5 t/ha) at 45 and 90 days after planting, foliar spray of micronutrient (IISR ginger/turmeric booster @ 5 g/l water; 3-5 kg/ha) at 45 and 90 days after planting with organic management of pests and diseases using neem oil is suitable under NE regions with BC ratio of 2.5. Preventive measures for storage rot and enhancing sprouting of ginger by priming with Trichoderma.

Organic package for large cardamom: A meeting on large cardamom was organized in collaboration with Spices Board and prepared a guide and organic packages for large cardamom. This package highlights organic methods for pest and disease management in large cardamom which can be adopted in all large cardamom growing areas including Nagaland.



Fig. 3: Organic package for NER

A technology package for the management of insect pests of large cardamom using biopesticides and organically permitted insecticides [Spinosad (45 SC @ 0.3 ml/l) or neem-based oil (Azadirachtin 0.15% EC) 1500 ppm @ 3 ml/l] was recommended under organic protection practice for all large cardamom regions of NE Hills.

c. Crop-specific micronutrient mixtures for spices (black pepper, ginger and turmeric)

The soils of NE state are deficient in micronutrients like zinc and boron. Crop-specific micronutrient mixtures recommended @ 5 g/l water and applied as foliar spray at 60 and 90 days after planting. In the case of black pepper, spraying twice in a year during April-May and August-September are advisable. Yield increase of 15 to 25% and improvement in quality recorded and realized by the farmers in black pepper, ginger and turmeric of NER. These micronutrient mixtures are suitable under organic cultivation also.

d. PGPR formulations for ginger and turmeric

PGPR technology is a talc formulation developed with plant growth promoting rhizobacteria and the same has been encapsulated for growth promotion and disease management in ginger and turmeric. PGPR formulations both in talc and in encapsulated form are found to be advantageous in NER and promoted growth, yield and disease resistance. These are ecologically safe and enhance nutrient mobilization and nutrient use efficiency.

e. Biological management of Phytophthora foot rot of black pepper

Application of antagonistic organisms like *Trichoderma viride* @ 150 g/vine along with 5 kg FYM to the basin of black pepper vine during June helps in managing Phytophthora foot rot. In nursery, solarized potting mixture fortified with *Trichoderma harzianum* (1 g/kg) and AMF (100 cc/kg) added to potting mixture was effective for the management of *Phytophthora* infections. Under field conditions, application of metalaxyl-mancozeb (2.5 g/l), *T. harzianum* (50 g/vine) and neem cake (1 kg) was effective in managing Phytophthora foot rot disease.

f. Integrated pest and disease management in large cardamom

Phytosanitation and application of bioagents manage pest and disease in large cardamom. The technology for management of insect pest of large cardamom using Spinosad (45 SC @ 0.3 ml/l) or neem-based oil (Azadirachtin 0.15% EC) 1500 ppm @ 3 ml/l was developed for Sikkim. This technology is suitable for Nagaland also and can be adopted under organic cultivation.

g. Management of rhizome rot of ginger through biofumigation

Crop residues of mustard and cabbage incorporated in soil (Biofumigation) and rhizome treatment with metalaxyl-mancozeb @ 1.25 g/litre of water for 15-20 minutes helps in managing soil-borne pathogens and is environmentally safe.



Crop-specific micronutrients and PGPR formulations



Trichoderma and PGPR capsules

Fig. 4: Crop-specific micronutrients and PGPR formulations

h. Management of bacterial wilt in ginger

For organic system of cultivation, adopt soil solarization along with the biocontrol agent, *Bacillus licheniformis* (GAP107, MTCC12725) launched as *Bacillich* is recommended to manage bacterial wilt with a BC ratio of 3.23. For inorganic system of cultivation, calcium chloride along with soil solarization manages the disease with a BC ratio of 2.88 when both the treatments are imposed at the time of planting and at 30, 45, 60 and 90 days after planting.

Treating seed rhizomes with streptomycin (200 ppm) for 30 minutes and shade drying before planting and further, drenching the beds with Bordeaux mixture (1%) or copper oxychloride (0.2%) is recommended for bacterial wilt management.



Fig. 5: Solarizing beds for bacterial wilt management in ginger

i. Mechanization in turmeric and large cardamom

With the introduction of mechanization in planting, harvesting and postharvest operations of large cardamom and turmeric, the problems of labour shortage and increased wages can be solved besides ensuring high quality produce.

j. Improved package of practices for black pepper

The black pepper varieties, Panniyur 5 and Subhakara can be suitably used as mixed cropping component in arecanut gardens of Assam with higher yields of green berry of 7.85 kg and 7.56 kg/plant and dry berry yield of 2.53 kg and 2.45 kg/plant, with benefit cost ratio of 4.57 and 4.40, respectively. A potting mixture containing neem cake + silt + cow dung + vermicompost at 1:2:2:2 ratio can effectively be used for growing bush pepper of Panniyur 1 and Karimunda to obtain higher green berry yield with a BC ratio of 1.79 and 1.77, respectively. First week of May is the most suitable period for raising bush pepper cuttings in Assam with highest degree of success in Panniyur 1 (82%) and Karimunda (84.3%).



Large cardamom drier



Harvested large cardamom



New steam boiler



Boiled dried turmeric



Turmeric polisher



Polished turmeric

Fig. 6: Improved processing machineries

Quality Planting Material Production

The production of quality planting material is crucial for boosting agricultural productivity in the North East states, where spices like pepper, ginger, and turmeric play a vital role in the economy. High-quality planting materials ensure better crop yield, disease resistance, and adaptability to local conditions. Preferred varieties like Karimunda and Panniyur-1 for pepper, Nadia for ginger, and Megha Turmeric and IISR Pragati for turmeric have shown excellent performance in the region. These varieties not only improve farmers' income but also contribute to sustainable farming practices and the region's growing reputation for high-value spice production. The production data during 2018-23 is given in the table below:

Table 6: Quality planting material production during 2018-23

Nagaland						
Year/ Seed	2018/19	2019/20	2020/21	2021/22	2022/23	Total
Seed	Nadia (500 kg)	Nadia (650 kg)	Nadia (200 kg) IISR Pragati (1500 kg)	Nadia (225 kg) IISR Pragati (900 kg)	Nadia (150 kg) IISR Pragati (2000 kg) Lakadong (150 kg)	Ginger: 2225 kg Turmeric: 4550 kg
Kahikuchi						
Seed chain	Panniyur1 (30,000 nos.) Karimunda (40,000 nos.)	Panniyur1 (30,000 nos.) Karimunda (40,000 nos.)	Panniyur1 (50,000 nos.) Karimunda (60,000 nos.)	Panniyur1 (1,00,000 nos.) Karimunda (1,20,000 nos.)	Panniyur1 (2,00,000 nos.) Karimunda (3,00,000 nos.)	Panniyur 1 (4,10,000 nos.) Karimunda (5,60,000 nos.)
Seed chain	Megha Turmeric 1 (10 tonnes)	Megha Turmeric 1 (10 tonnes)	Megha Turmeric 1 (30 tonnes)	Megha Turmeric 1 and Rajendra Sonia (50 tonnes)	Megha Turmeric 1, Rajendra Sonia and IISR Pragati (80 tonnes)	180 tonnes

Extension Activities

The key extension activities in the region focus on improving spice cultivation, particularly ginger and turmeric, through training and demonstrations on advanced production technologies. Farmers benefit from capacity-building programs, input distribution, and demonstrations of new technologies like bamboo-based rapid multiplication and black pepper grafting. Frontline demonstrations (FLDs) and seed rhizome distribution are crucial for enhancing productivity, while awareness programs, exhibitions, and media outreach (radio/TV) ensure widespread dissemination of knowledge. Special initiatives like the GI Tag for Lakadong turmeric in Meghalaya and the Clean and Green Village Campaign in Assam highlight the region's unique agricultural potential.

Table 7: Major activities conducted by North Eastern AICRPS centers during 2018-23.

Activity/ Training	Number of programs conducted					
	Nagaland	Kahikuchi	Barapani	Mizoram	ICRI Gangtok	Pasighat
TSP/NEH Activities	11	5	3	-		-
Farmers-Scientist Interaction	5	-	-	-		-
Frontline Demonstrations (FLDs)	10	-	-	7		2
Training given	11	10	10	7	20	6
Demonstration of New Technologies	-	1	-	-		-
Popularization of Megha Turmeric 1	-	1	-	-		-
Input Distribution programmes	-	-	4	-		6
Seed Distribution Programmes	-	-	4	-		-
Exhibitions, Seminars, Symposia	3	47	-	-		-
Radio/TV Programs	3	16	1	1		-
Leaflet Published	-	3	-	-		-
Clean and Green Village Campaign	-	1	-	-		-
Field Demonstration and Field Day	-	3	-	1	16	1



Fig. 7. Various Training programs conducted

Success stories

Transforming Challenges into Prosperity: The Remarkable Success of Drush Kr. Sangma in Black Pepper Farming

Mr. Drush Kr. Sangma, a subsistence farmer from Santipur village in the Boko Agricultural Sub Division of Assam's Kamrup district, faced a challenging agricultural scenario. Owning 3 bighas of land, he cultivated arecanut intercropped with black pepper. Despite the black pepper reaching productive age, his returns were far from satisfactory. Black pepper was sold fresh immediately after harvest, fetching him only minimal prices. The lack of proper management practices further compounded the issue, leaving Mr. Sangma with little hope for improving his income.



Fig. 8: Field prior to intervention from AICRPS

In January 2015, seeking a solution to his problems, Mr. Sangma reached out to the All India Coordinated Research Project on Spices (AICRPS) team through the local NGO Gramin Sahara. Upon visiting his farm, the AICRPS team identified several issues hindering productivity. The intercropping system was chaotic, with bamboo, banana, and other forest trees planted haphazardly within the arecanut-black pepper plot. This disorganization, coupled with the absence of structured farm management practices, severely limited the potential yield of the black pepper.

The AICRPS team recommended a series of targeted interventions to help Mr. Sangma optimize his farm's productivity:

- **Clearing and pruning:** He was advised to uproot the bamboo, banana, and other forest trees in phases, clearing the garden for better growth conditions for black pepper and arecanut.
- **Soil enrichment and mulching:** Mr. Sangma was instructed to apply dry leaves from the nearby forest to the soil. This organic matter, rich in macro and micronutrients, would not only enhance soil fertility but also act as mulch, aiding in water conservation.
- **Plant management:** The team suggested maintaining the trees at an optimum height to make harvesting easier and more efficient.
- **Black pepper drying technique:** Instead of selling the black pepper fresh, Mr. Sangma was taught the technique of drying the produce, which would significantly increase its market value.

Following the AICRPS team's advice with dedication and consistency, Mr. Sangma embarked on a journey of transformation. Over the next four years, his once underperforming black pepper garden was transformed into a highly productive plantation. The combination of better crop management, soil enrichment, and the adoption of drying techniques resulted in a dramatic increase in yield and income. By 2018-19, Mr. Sangma's efforts bore fruit. From 500 black pepper plants, he earned an impressive sum of Rs. 2,17,000. This remarkable turnaround not only improved his financial stability but also ensured that he could comfortably support his four-member family.

Mr. Drush Kr. Sangma's story is a testament to the impact of strategic agricultural interventions and the power of perseverance. With the right guidance and his unwavering commitment, he was able to transform a struggling farm into a thriving enterprise. Today, Mr. Sangma is self-sufficient, running his farm successfully, and providing a better life for his family. His journey from struggle to success serves as an inspiration to other farmers facing similar challenges, demonstrating that with the right approach and dedication, significant improvements are within reach.



Fig. 9: Mr. Drush Kr. Sangma (left) in his plantation after intervention

From Shifting Cultivation to Prosperity: How Spice-Based Farming Transformed Lives in Mizoram

In Mizoram, agriculture has long been the backbone of rural livelihoods, with most farmers practicing shifting cultivation, known locally as "Jhum." While deeply ingrained in the region's culture, this traditional method has resulted in low productivity, especially with mixed cropping of local cultivars like paddy, maize, and pulses under rainfed conditions. The unpredictability of rain and the limitations of traditional farming methods meant that farmers often struggled to earn a stable income. The challenges such as soil degradation, poor yields, and limited access to quality seeds and irrigation added to the woes. Recognizing the need for a sustainable and profitable alternative, the Indian Council of Agricultural Research (ICAR) Mizoram Centre in Kolasib launched an intervention aimed at transitioning farmers from traditional practices to a spice-based integrated farming system. The region's favourable climate and fertile soil, rich in organic matter, provided the perfect conditions for cultivating high-value spices such as ginger and turmeric alongside traditional crops like maize, sweet corn, rice, and legumes.

The intervention included several key components:

- **Introduction of high yielding varieties:** Farmers were provided with new varieties like RCT-1 turmeric, which performed exceptionally well in the region, yielding 69.85 quintals across 4800 m² of land. This variety was favoured for its high curcumin content and appealing colour.
- **Supplementary irrigation:** The introduction of Jalkund, a rainwater harvesting system, allowed farmers to irrigate their crops during the Rabi season, enabling year-round farming and income generation.
- **Support and training:** Farmers received technical support, quality seed rhizomes, and training under the All India Coordinated Research Project (AICRP) on Spices.



Fig. 10: Turmeric cultivation at Marpara South, Lunglei and Thingdawl village, Kolasib district

The success of these interventions has had a ripple effect across the region. In the three villages where the RCT-1 turmeric was introduced, average productivity reached 29.23 quintals per 2000 m² (~14.61 t/ha), more than triple the average productivity of turmeric in Mizoram (3.85 t/ha). The cost benefit ratio for these farmers ranged from 2.9 to 3.54, indicating a highly profitable venture.

Table 8: Yield of turmeric cultivation in three different villages of Mizoram

Village	No. of beneficiaries	Area covered (m ²)	Total fresh rhizome yield (q)	Productivity (q/2000 m ²)
Marpara South	14	2100	29.87	28.45
Kamalanagar-II	9	1350	17.94	26.58
Thingdawl	9	1350	22.04	32.65

Turmeric is consumed majorly in the form of turmeric powder in Mizoram. The cultivation of RCT-1 has impacted other farmers also to take up turmeric cultivation in these villages. However, problem arises on processing of turmeric into high end products. In order to address this problem and improve the livelihood of turmeric farmers, Thingdawl Farmer's Society received an automated grinding machine during the Kisan Mela in 2022. The introduction of turmeric processing has opened up new income streams for farmers, with the potential to earn double the price from turmeric powder compared to fresh rhizomes. This has not only improved the financial stability of individual farmers but has also contributed to the overall economic development of the region.

Table 9: Economics of turmeric processing

Important post harvest activities and processing	Amount in Rs.
Postharvest operation (sorting, washing, cutting) for 1 kg turmeric	10
The cost for processing 1 kg dried turmeric	40
Packaging cost per 1 kg of powdered turmeric	120
Total cost of processing of 1 kg powdered turmeric	170
The total cost of processing for one hectare produce (Rs. 170/kg)	2,37,490
Total yield of processed powdered from 4800 sq. m of land (approx. 15.2 t fresh weight and 20% dry recovery)	1397 kg
Selling price for 1397 kg @ Rs. 400/kg in local market	5,58,800
Net benefit from 4800 sq. m produce (Rs. 5,58,800-2,37,490)	3,21,310
Benefit cost ratio of turmeric powder processing	1.35



Fig. 11: Handing over of turmeric grinder to Thingdawl farmers

With the scientific interventions and adoption of RCT-1 turmeric, the farmers could increase their turmeric production by three folds and this success has opened new venture for the farmers to garner more income through processing of turmeric into powder. The farmers could earn nearly double the price from turmeric powder than fresh rhizomes. Turmeric processing could substantially increase farmers income amounting to Rs. 3,21,310 net profit and a cost benefit ratio of 1.35. The economic feasibility of investment on turmeric processing unit, marketing costs, margins, price spread in marketing of turmeric powder products are yet to be calculated after continual use of the processing unit.

Mrs. Lalsangpuui: *A Model of Innovation and Success*

Mrs. Lalsangpuui, a 62-year-old farmer from Venglai, Thingdawl village in Kolasib district, is a shining example of the success brought about by this intervention. Previously engaged in traditional “Jhum” cultivation, she faced numerous challenges, including poor crop yields and a lack of resources. Her annual income was a modest Rs. 2,58,560, barely enough to support her family.

After participating in the ICAR Kolasib programmes, Mrs. Lalsangpuui adopted spice-based integrated farming, cultivating high yielding varieties like ginger (Bold Nadia) and turmeric (IISR Pragati and RCT-1). She also integrated other crops such as sweet corn, upland rice, and *Acacia pennata* into her farming system. With the establishment of a Jalkund for irrigation and a vermiculture unit for organic farming, her productivity

soared. Today, Mrs. Lalsangpuii processes her turmeric into powder and markets it under the brand name "Sangpuii Aieng." Her annual income has increased to Rs. 3,68,243, and she has significantly reduced her farming costs, now saving Rs. 2,61,115 compared to Rs. 1,76,500 in 2019-20. Her innovative approach earned her the "Best Innovative Farmer Award" at the North East Krishi Kumbha in 2023, and her success has inspired many others in her community to take up turmeric cultivation and processing.



Fig. 12: Mrs. Lalsangpuii from Venglai, Thingdawl village, Kolasib district

Mrs. Lalbiakzuali: *Expanding Horizons with Spice Farming*

Another success story is that of Mrs. Lalbiakzuali, a 45-year-old farmer from the same village. Like many others, she initially faced issues such as water scarcity, poor soil fertility, and lack of quality seeds. Her annual income was Rs. 93,400, and she struggled to make ends meet. With technical support and inputs from ICAR, including the introduction of RCT-1 turmeric and Bold Nadia ginger, along with the construction of a Jalkund, Mrs. Lalbiakzuali's fortunes changed. She now earns Rs. 1,94,190 annually,

with significant cost savings, reducing her expenses from Rs. 4,94,000 in 2019-20 to Rs. 1,43,700 today. Her success in cultivating and processing turmeric has led to increased demand for her products, further boosting her income and encouraging other farmers in the area to follow her lead.

Looking forward, there is significant potential for further growth in the spice-based integrated farming system in Mizoram. As more farmers adopt these practices, the region could become a major producer of high-quality turmeric and other spices, leading to increased income, better livelihoods, and sustainable agricultural practices. The transformation of traditional farming practices in Mizoram through the introduction of spice-based integrated farming is a powerful example of how targeted interventions can lead to significant economic and social benefits. The success stories of farmers like Mrs. Lalsangpuii and Mrs. Lalbiakzuali demonstrate the potential for innovation and resilience in the face of challenges, offering a blueprint for sustainable rural development in the region.

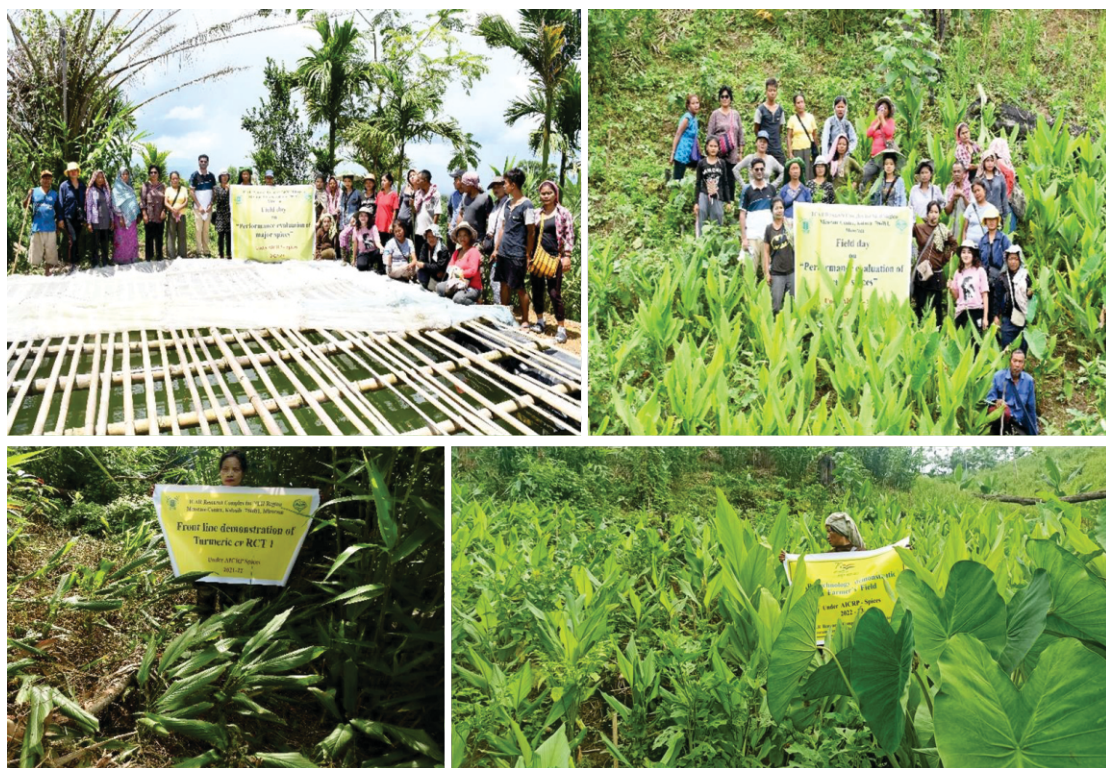


Fig.13: Mrs. Lalbiakzuali from Venglai, Thingdawl village, Kolasib district

Livelihood Enhancement of Tribal Farmer of Meghalaya through Cultivation of Megha Turmeric-1

Mr. Dominic Syiem, a 45-year-old farmer from Sarikushi, Marngar, in Ri-Bhoi district of Meghalaya, was struggling with declining yields after years of cultivating turmeric in his farm. He had been using seed rhizomes saved from previous seasons, leading to poor crop performance, low yield, disease incidence, and inferior quality rhizomes. The uncertainty in crop quality and the resulting financial strain left Mr. Syiem in a state of distress. Recognizing the challenges faced by farmers like Mr. Syiem, the ICAR Research Complex for NEH Region, Umiam, Meghalaya, in collaboration with AICRP on Spices, Kozhikode, Kerala, launched an initiative to promote scientific turmeric cultivation. Mr. Syiem was selected to participate in this programme and received training on various scientific aspects of turmeric farming, including site selection, land preparation, seed rhizome selection and treatment, proper spacing, intercultural operations, harvesting, postharvest handling, and storage.

The scientists introduced Mr. Syiem to modern cultivation practices such as soil solarization, crop rotation, and proper spacing techniques. They also provided him with quality Megha Turmeric-1 seed rhizomes, farmyard manure (FYM), and small agricultural tools for cultivating turmeric in his one-acre farm. Armed with new knowledge and resources, Mr. Syiem adopted the scientific methods recommended by the experts. The results were remarkable. His turmeric yield increased to 7-8 tonnes per acre, compared to his previous yield of just 3-5 tonnes per acre. The Megha Turmeric-1 variety, a stable and released variety developed by ICAR Research Complex for NEH Region, proved to be a game-changer. This variety is known for its high curcumin content and resistance to leaf blight disease, ensuring both quality and quantity in production.

Before adopting these scientific practices, Mr. Syiem struggled to sell his surplus produce, often fetching only Rs. 30/kg in the local market. However, after the intervention, he was introduced to Univeg Seed Technologies Private Limited, Hyderabad, where he was able to sell his fresh seed rhizomes at a premium price of Rs. 60/kg. This significant increase in price, combined with the higher yield, substantially boosted his income. The major outcomes include,

- **Improved yield:** The adoption of scientific cultivation methods and the use of the Megha Turmeric-1 variety led to a significant increase in turmeric yield, from 3-5 tonnes per acre to 7-8 tonnes per acre.
- **Increased income:** Mr. Syiem's earnings from turmeric farming doubled, thanks to better yields and access to a premium market for his produce.
- **Sustainable farming:** The introduction of crop rotation and soil solarization has improved soil health, ensuring long term sustainability of turmeric farming on Mr. Syiem's land.

Table 10: Economics of turmeric cultivation

Economics	Amount (Rs.)
A. Fixed Cost	
Labour cost for land preparation, planting, interculture operation and harvesting (156 man days @ Rs. 500/day)	78,000
Planting materials @ Rs. 30/kg seed rhizome	30,000
B. Recurring cost (Rs.)	
Manures and fertilizers (8000 kg FYM @ Rs. 13000/cft)	30,000
C. Expenditure (A+B)	1,38,000
D. Gross income	
Sale of turmeric seed rhizome @ Rs. 50/kg (8000 kg fresh rhizome seed)	4,00,000
Gross income	4,00,000
E. Net Income = D-C	2,62,000
Cost benefit ratio (Net income: Total cost)	1.89

Key results and impact:

- **Enhanced livelihood:** The scientific cultivation of Megha Turmeric-1 has significantly improved the livelihood of Mr. Syiem, setting an example for other tribal farmers in the region.
- **Yield potential:** The success of this intervention highlights the potential for increasing turmeric yields in Meghalaya through the adoption of scientific farming practices.
- **Future opportunities:** Establishing small processing units at the village or block level could further enhance the value of turmeric production, providing additional income opportunities for farmers.



Fig. 14: Performance of Megha Turmeric-1 variety in farmer's field (Mr. Dominic Syiem) field

Transforming Barren Land into a Profitable Seed Spices Farm

Mrs. Phripty Khardewsaw, a 52-year-old farmer from Ri-Bhoi District in Meghalaya, has always been a dynamic and progressive individual. With a large family of eleven children and a supportive husband, she sustained her household through the cultivation of rice, ginger, broom grass, poultry, and piggery. However, despite her hard work, these traditional farming practices were not sufficiently remunerative to meet the growing needs of her family.

In Meghalaya, it is common for farmers to leave their paddy fields dormant after the harvest, allowing the land to remain unused until the next sowing season. Mrs. Khardewsaw saw this as an opportunity. She was determined to utilize the barren land more effectively by introducing seed spices, a crop not widely cultivated in her area. Her motivation was driven by the potential economic benefits and the value of seed spices.

Mrs. Khardewsaw's interest in seed spices led her to participate in a training programme organized by the ICAR Research Complex for NEH Region, Umiam. The programme was part of the project titled "Collaborative Research and Development Activities for Promotion of Seed Spices Varieties/Technology in NEH Region" funded by ICAR-NRC on Seed Spices, Ajmer. This training provided her with the knowledge and skills needed to successfully cultivate seed spices. The programme also included demonstrations of advanced technologies, distribution of inputs, tools, planting materials, and technical guidance through regular monitoring by scientists. After receiving training, Mrs. Khardewsaw began cultivating fenugreek, fennel, coriander, and dill on 1000 m² of land each.

The results were impressive: Coriander seeds: 33.12 kg, Fennel seeds: 42.66 kg, Dill seeds: 56.93 kg, Fenugreek: 33.68 kg

The yields were comparable to the experiment trials conducted at ICAR for NEH Region, Umiam, with fennel yielding 5.70 q/ha, dill 7.85 q/ha, fenugreek 5.56 q/ha, and coriander 3.28 q/ha. Mrs. Khardewsaw was delighted to see that these crops performed well in her region and fetched good prices, both as seeds and for their leaves. The economic analysis revealed that the total expenditure on seed spices cultivation was Rs. 9,900. However, the gross income generated was Rs.19,865, resulting in a net profit of Rs. 9,965. The crops were sold at rates ranging from Rs. 60-120 per kilogram, and the green leaves of coriander and dill were sold at Rs.50 per kilogram. Coriander powder was sold at Rs.10 per 50 grams. The key outcomes can be summarized as:

- **Diversification:** The introduction of seed spices helped avoid monocropping, which is common in the region.
- **Increased income:** Mrs. Khardewsaw earned additional income from the sale of both green leaves and dry seeds, along with value-added products.
- **Sustainable farming:** By making optimal use of her land, Mrs. Khardewsaw created a sustainable farming model that could be replicated by other farmers in the region.



Fig. 15: Performance of fennel in farmer's field



Fig. 16: Performance of coriander in farmer's field



Fig. 17: Performance of fenugreek in farmer's field



Fig. 18: Performance of dill in farmer's field

From Cultivator to Community Leader: Usha Rabha's Inspiring Journey in Black Pepper Farming

Smt. Usha Rabha, a 50-year-old resident of Hanapara village in the Rani Development Block, faced numerous challenges that many rural families in her area encounter. Living with her husband, three daughters, and a son, Usha's family was dependent on traditional farming methods, which provided only a meager income. The lack of stable and substantial income made it difficult for her to meet the basic needs of her family, let alone save for the future or invest in her children's education. The family's home was modest, and they faced daily struggles to make both the ends meet. In 2014, Usha's life took a significant turn when she was introduced to a new opportunity through the combined support of the Assam Agricultural University, Kahikuchi, a centre of All India Coordinated Research Project (AICRP) on Spices, ICAR along with Diya Foundation. She was encouraged to start cultivating black pepper, a crop that was relatively new to her but held the potential for higher income. Usha received training, resources, and on-going support to help her transition from traditional farming practices to black pepper cultivation. This intervention included technical guidance on the good agricultural practices, access to quality planting materials, and continuous monitoring to ensure the successful growth of the crop.

With determination and the support, she received, Usha successfully planted 350 black pepper plants. Over the years, her efforts have paid off significantly. Today, Usha realizes a yield of 1.5 to 2 quintals of dry pepper annually, which she sells for an average income of Rs. 75,000 per year. Recognizing the potential of diversifying her income streams, Usha also started a pepper nursery, earning an additional Rs. 50,000 to 60,000 annually through sale of planting materials.

The financial boost from these activities transformed Usha's life and her family. With her newfound income, Usha was able to build a decent pucca house, providing her family with a secure and comfortable living environment. The impact of her success didn't stop there; Usha also managed to buy a scooter for her daughters, ensuring they could travel to college in Mirza safely and conveniently, a luxury that seemed out of reach before her venture into black pepper cultivation.

Usha's achievements extended beyond her immediate family. Her success in black pepper cultivation and nursery management earned her recognition in the community, and she was eventually appointed as the Director of the Rangsang Agro Producer Company Limited, a Farmer Producer Company based in Loharghat. In this role, she now leads other farmers, sharing her knowledge and experience, and helping them improve their livelihoods through similar agricultural initiatives.



Fig. 19: Mrs. Usha Rabha in her farm field

Usha's story is a testament to the power of targeted interventions in transforming lives. Provision of right resources, training, and support can enable individuals to overcome poverty and achieve sustainable livelihoods. Usha's success has not only improved her family's standard of living but has also inspired others in her community to explore new opportunities in agriculture.

Looking ahead, Usha plans to expand her cultivation and nursery operations, potentially exploring additional high-value crops. She is also committed to mentoring other women in her village, helping them follow her footsteps and achieve their own success. The story of Usha Rabha is a powerful example of how agricultural interventions can create lasting change. From struggling to provide for her family to becoming a community leader, Usha's journey highlights the potential for growth and prosperity when individuals are given the tools and support they need to succeed. Her story is not just about personal success but about the ripple effect of empowerment and the positive impact it can have on an entire community.

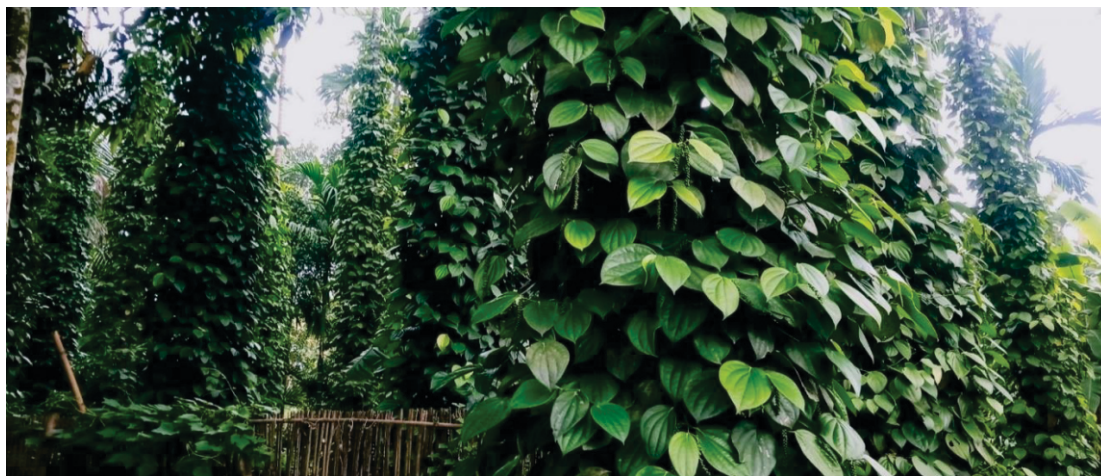


Fig. 20: Mrs. Usha Rabha's improved farm

Reviving Livelihoods: The Transformation of Bade Village's Turmeric Farmers through AICRPS Intervention

In the remote village of Bade in Chumukedima District, Nagaland, four dedicated farmers, Venuh Evotso H. Keyho, Vekhruneyi Venuh, Khosato H. Keyho, and Ranu Khamo had been cultivating organic turmeric on 5 acres of land since 2000. Initially, they relied on a local turmeric variety, which yielded about 10 tonnes annually. However, the onset of COVID-19 pandemic in 2020 drastically changed their fortunes. The lockdown brought a sharp decline in market demand, leaving the farmers with a large quantity of unsold fresh turmeric. Without proper storage and processing facilities, their harvest began to rot, resulting in significant financial loss. The local variety's low productivity and susceptibility to diseases only added to their woes, making turmeric farming increasingly unprofitable.

In 2021, as the world began to emerge from the pandemic, a beacon of hope arrived in the form of the All India Coordinated Research Project on Spices (AICRPS) Nagaland Centre under the Tribal Sub-Plan Programme. Recognizing the farmers' plight, AICRPS introduced a popular variety of turmeric called IISR Pragati to 60 selected growers

across Nagaland, including the Bade Organic Turmeric Growers (OTG). The four farmers from Bade eagerly embraced this new opportunity.

The intervention didn't stop at providing the new turmeric variety. AICRPS also supplied essential farm inputs, including spades, sprayers, garden rakes, neem oil, *Trichoderma* formulations, and micronutrients. Additionally, the farmers received hands-on training on good cultivation practices, pest and disease management, seed rhizome storage techniques, and home-scale processing methods. This comprehensive support equipped them with the knowledge and tools needed to improve their farming practices.

In 2022, armed with 500 kg of IISR Pragati seed rhizomes and new-found expertise, the Bade OTG group experienced a remarkable turnaround. They produced an impressive 25 tonnes of fresh turmeric from the same 5 acres of land. Switching to the IISR Pragati variety, coupled with improved farming practices, resulted in a significant increase in the yield and profitability. The farmers earned a net profit of Rs. 2,80,500 by selling fresh rhizomes.

Beyond the immediate financial gains, the farmers gained a deeper understanding of sustainable cultivation and storage practices! Thanks to the AICRPS training sessions. This knowledge has empowered them to further enhance their productivity and resilience in the face of future challenges. The success of the Bade OTG group highlights the transformative impact of targeted agricultural interventions. With continued support, including the establishment of a small-scale processing unit in the village, these farmers could further capitalize on their produce by processing unsold turmeric into turmeric powder to satisfy the market requirements. The journey of these four farmers is a testament to the power of innovation and support in revitalizing rural livelihoods.



Fig. 21: Farmers in their turmeric field

Organic turmeric cultivation: A profit driven venture for the small and marginal farmers in Sikkim Himalaya

Background: Sikkim's organic endeavour became a prosperous hymn composed by the hand of nature's wisdom. Traditional organic farming is practiced in subsistence with low external input systems in Sikkim Himalaya. The native Lepcha tribal inhabitants of Dzongu region, North Sikkim (designated as Lepcha heartland/reserve of Sikkim) practices chemical-free ride of rainfed mixed cultivation, for maintaining their daily livelihood and conserve traditional forest based agro-ecology, with limited farm profitability. Heavy weed infestation in the high rainfall (>3000 mm) receiving regions of Sikkim Himalaya became one of the biggest challenges for organic agriculture in Sikkim. Local turmeric is widely cultivated in the domestic household of Lepchas in Sikkim.

Type of intervention: With this background, ICAR Research Complex for NEH Sikkim centre conducted farmer's field demonstration with RCT-1 (Megha Turmeric-1) variety having high curcumin (6.5-6.8%) and dry matter contents (18-20%) for increasing farm productivity. A total of 18 farmers were selected for field demonstration trial. The crop was sown in early April and harvested in next late January. Soil application of well decomposed FYM (5 t/ha), coupled with vermicompost (0.5 t/ha) was undertaken during field preparation. Rhizomes with 25-30 g weight were treated with hot water (48°C for 15 minutes) before planting at 30 cm x 30 cm spacing.

Results and impact: RCT-1 secured sizable profit to the farmers. The final harvesting operation was performed using traditional sickling followed by pit digging. Turmeric grown in terraced land yielded 181 kg/1200 m² while 139 kg/1200 m² from the sloppy land. The cost of cultivation was Rs. 1285 for the terraced land and Rs. 1460 per 1200 m² for the sloppy land. Net return from the terraced land cultivation, was about Rs. 4145 per 1200 m² while it was Rs. 2710 per 1200 m² in the sloppy lands. Labour intensive cultivation of turmeric in the sloppy lands fetched less profit as compared to the terraced land cultivation. Benefit cost ratio for the terraced land cultivation was 3.22 while 1.86 in sloppy cultivation of turmeric and realizing the potential, farmers from nearby villages are also showing their interest for large scale turmeric cultivation.

Beneficiary details:

Mr. Tshering Wangchuk Lepcha (Noom, Lower Dzongu)

Mr. Sarkey Lepcha (Lingdong, Lower Dzongu)

Mr. Lhendup Lepcha (Shagyong, Lower Dzongu)

Table 11: Yield performance and cost of cultivation of turmeric in terrace at Sikkim

Agro-Ecosystem	Yield (kg/1200m ²)	Cost of cultivation/1200m ² (Rs.)	Gross returns/ 1200m ² (Rs.)	Net returns/1200m ² (Rs.)	B:C ratio
Terrace land*	181	1285	5430	4145	3.22
Sloppy land*	139	1460	4170	2710	1.86
SEm±	0.30	0.12	0.05	0.10	0.07
CD (p=0.05)	0.85	0.33	0.14	0.29	0.21

Lessons learnt: The ignition towards community scale turmeric cultivation will have further scope to establish custom hiring centre for postharvest processing of turmeric at Dzongu.

**Fig. 22: Organic turmeric cultivation at Dzongu, North Sikkim**

Assets Creation-*Creation of Better Facility*

Table 12: Assets created at various ACRPS centers.

Location	Infrastructure/Asset	Year	Details/Cost
Kahikuchi	Agro Shade-Net House	2019-2020	Rs. 10,00,000 (Ten Lakhs) provided under NEH Contingency for black pepper multiplication. Three houses constructed
	Chemicals, Pesticides, Fertilizers and Minor Implements Distribution	2019-2020	Rs. 2,50,000 provided under SCSP for distribution to SC farmers
	Vermicompost Unit (9 concrete chambers)	2020-2021	Constructed from NEH Contingency fund
	Minor Implements	2020-2021	Rs. 69,000 procured under NEH Capital
	Desktop Computer with Printer	2021-2022	Rs. 89,000 provided under NEH Capital for office works
Barapani	Hot Air Oven (1000W, 150L Capacity)	2022	Infrastructure procured for laboratory use
	UV-Visible Spectrophotometer (Model UV 1780)	2022	-
	Double Door Refrigerator (500L)	2022	-
	Soxhlet Apparatus (Manual)	2022	-
Mizoram	Turmeric Grinding Unit	2022-2023	Installed at Thingdawl, Kolasib
	Mist Chamber	2022-2023	Installed at ICAR Research Centre, Mizoram Centre
ICAR-Gangtok	Three Polyhouses	2020-2021	Established at ICRI farms
	Dellmarc Electric Dryer (2 Units)	2020-2021	Installed at ICRI Pangthang
	Anti-Hail Net	2020-2021	Installed at ICRI farms
Pasighat	Polyhouse	2020	Infrastructure for agricultural use
	Processing House	2021	Established for postharvest processing

Budget Details

This report provides an overview of the budget allocations for the North Eastern Hill (NEH) region programs under the All India Coordinated Research Project (AICRP) on Spices from 2018 to 2023. The funds were distributed over five years to support research and development in spices at key centres in Nagaland, Barapani, Mizoram, Gangtok, and other locations. The table below shows the annual allocations and total amounts received by each centre. These budget allocations reflect a significant investment in spice research and development in the NEH region, with substantial funding going to Pasighat, Gangtok, and other important centres. This financial support will strengthen the research capacity of these centres, contributing to the growth and sustainability of the spices sector in these areas.

Table 12: Annual Budget Allocations (Rs. in Lakhs) for NEH Programmes of AICRP on Spices (2018-2023) across Various Centers.

Centre	2018-19	2019-20	2020-21	2021-22	2022-23	Total (Rs. in lakhs)
Nagaland	4.49	12.71	11.98	13.52	9.00	51.70
Barapani	4.50	4.76	14.60	10.50	9.40	43.76
Mizoram	4.00	4.26	16.06	14.08	11.54	49.94
ICAR-Gangtok	9.50	14.50	21.39	2.00	4.40	56.26
ICRI-Gangtok	5.50	14.50	21.39	6.46	4.40	52.25
Kahikuchi	4.50	16.64	9.54	10.89	8.00	49.57
Pasighat	14.50	27.00	4.04	7.50	8.35	61.39



**ICAR-All India Coordinated Research Project
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