

Spices for Sustainable Development in Northeast Region

The spice crops, which form a unique segment within the agricultural sector due to its high income generation potential and export orientation, is an important part of the agrarian economy of the Northeast Region (NER). A wide variety of spice crops, both indigenous and exotic, are cultivated in diverse agro-climatic conditions across the eight states of the NER. Spices play an important role in the economy and culture of the region. They are a major source of income for farmers and provide employment to a large number of people in the region. Spices are also an essential part of the Northeastern cuisine, adding their unique flavour and aroma to dishes.

INDIA is widely regarded as the land of spices and the country is the largest producer, consumer and exporter of spice commodities. The Northeastern Region of India (NER), with its unique geographical and socio-economic features is a major source of several spices of commercial importance. The agricultural diversity of the region is well documented and supports a wide variety of crops. The climate in NER varies from near tropical in the plains of Assam, Tripura and south Mizoram to near alpine in northern Sikkim and Arunachal Pradesh.

Status of spice production in NER

Spices in the NER are widely recognized as crops with the potential to enhance farm business income of primary producers. About 5% of the area under spice crops in India is located 2,32,087 ha, in across the states of NER during 2020-21. Assam, Sikkim and Mizoram are the major spice growers among the states in NER. Several

spices are grown in these states. The large cardamom (*Amomum subulatum* Roxb.) output in the country comes almost exclusively from the NER. This region is also a significant producer of spices like black pepper, ginger, turmeric, chillies, garlic, coriander and tejpat. Apart from these, major spices, several minor spices are also produced in limited quantity from this unique production environment. The area, production and productivity of spices along with the major spice crops in various states of NER is given in Table 1.

Cultivation of large cardamom is mainly undertaken in the states of Sikkim, Arunachal Pradesh and Nagaland. About 90% of the large cardamom produced in the country comes from originates from the NER. Sikkim is the largest producer of large cardamom followed by Arunachal Pradesh. The production profile of large cardamom for the year 2021-22 is given in Table 2. Apart from the NER significant production of large cardamom is reported from

Table 1. Status of spice production in NER (2020-21)

States	Area (ha)	Production (t)	Yield (kg/ha)	Major spice crops
Arunachal Pradesh	18,205	42,590	2,340	Large cardamom, chillies, ginger, turmeric
Assam	99,511	310,987	3,125	Black pepper, chillies, garlic, ginger, turmeric, coriander
Manipur	6,364	53,497	8,407	Large cardamom, ginger, turmeric, coriander
Meghalaya	13,833	72,558	5,245	Black pepper, garlic, ginger, turmeric, coriander, tejpat
Mizoram	27,726	101,465	3,659	Black pepper, chillies, garlic, ginger, turmeric, coriander
Nagaland	11,237	43,614	3,882	Black pepper, large cardamom, chillies, garlic, ginger, turmeric, coriander
Sikkim	37,425	86,508	2,312	Large cardamom, ginger, turmeric
Tripura	6,734	29,469	4,376	Black pepper, chillies, ginger, turmeric
Total NER	23,2087	755,502	3,351	

Source: Compiled from Directorate of Arecanut and Spices Development, (2021)

Table 2. Production profile of large cardamom (2021-22)

State	Area (ha)	Production (t)	Yield (Kg/ha)
Arunachal Pradesh	11,684	1,695	247
Manipur	201	05	86
Nagaland	6,537	1,079	252
Sikkim	23,312	4,990	290
Total NER	41,734	7769	271
All India	45,039	8,812	279
Share of NER (%)	92.6	88.2	

Source: Annual reports of Spices Board (Various issues)

Table 3. Area expansion in large cardamom

State	Area (ha)	Production (t)	Yield (Kg/ha)
2010-11			
Sikkim	23,679	3,310	205
West Bengal	3,305	608	224
Total	26,984	3,918	208
2020-21			
Sikkim	23,312	4,990	290
West Bengal	3,305	1,044	331
Arunachal Pradesh	11,684	1,695	247
Nagaland	6,537	1,079	252
Manipur	201	05	86
Total	45,039	8,812	279.45

Source: Annual reports of Spices Board

the state of West Bengal. Earlier the crop was grown on a commercial scale, only in Sikkim. Robust growth was recorded in area and output of large cardamom during the last two decades. The spread and adoption of large cardamom cultivation in other Northeastern States were aided by, inter alia, enhanced inter institutional linkages and strengthening of communication channels across the region facilitating information exchange. The economic potential of the crop was leveraged in areas where the agro-climatic conditions favoured the cultivation of large cardamom. According to the data available with the Spices Board, the area under large cardamom in NER increased by 67% between 2010-11 and 2020-21 whereas the output



Cultivation of large cardamom

increased by 125% during the same period (Table 3).

Among the various spice crops, ginger and turmeric cultivation is spread across all the states of the region. Ginger is the most widely cultivated spice crop in the region. During 2020-21 ginger was cultivated in 66,014 ha with an estimated output of more than five lakh tonnes of fresh ginger. Though the spice crops are widely cultivated in the northeast states, the productivity of most of the crops remains below the national average productivity (Table 4). Except for black pepper, where the NER had higher productivity, the yield level of all other major spice crops was lower than the national average yield levels. The difference in productivity level is also an indication of the latent potential of the spice crops in enhancing the

Table 4. Area, production and yield of spice crops in Northeast Region (2020-21)

Crop	Area (ha)	Production (t)	Yield NER (kg/ha)	Yield All India (kg/ha)	Difference (%)
Black Pepper	4,924	3,663	744.0	460	38.2
Large cardamom	35,515	9,121	257.2	260	-1.1
Chillies	37,206	41,249	1,108.4	2,715	-144.9
Garlic	11,102	70,312	6,333.3	8,099	-27.9
Ginger	66,014	502,079	7,605.8	10,723	-41.0
Turmeric	35,433	81,294	2,294.5	3,741	-63.0
Coriander	30,841	32,970	1,069.0	1,308	-22.4
Total Including other spices	232,087	755,502	3,351.0	2,497	

Table 5. Agro-climatic zones in the Northeast region

State	Agro-climatic Zones
Arunachal Pradesh	Alpine Zone, Temperate Sub alpine Zone, Mid tropical hill Zone, Mid tropical plain zone, Subtropical Hill Zone
Assam	North Bank Plain Zone, Upper Brahmaputra Valley Zone, Central Brahmaputra Valley Zone, Lower Brahmaputra valley Zone, Barak Valley, Hill Zone
Manipur	Temperate Subalpine Zone, Mild Tropical Hill Zone, Sub Tropical Plain Zone
Meghalaya	Sub Tropical Hill zone, Mild Tropical Plain Zone
Mizoram	Humid Mild Tropical hill Zone, Humid Mild Sub-tropical Hill Zone, Humid Temperate Sub-Alpine Zone
Nagaland	Subtropical Hill Zone, Mild Tropical Hill Zone
Sikkim	Tropical, Subtropical, Temperate, Sub-Alpine, Alpine
Tripura	Humid Eastern Himalayan Region

yield levels through application of existing technology packages. The existing yield gap is also indicative of the knowledge gap about cultivation practices, which can be addressed through technology dissemination services and strengthening of input supply chains in agriculture.

Salient strengths of spices sector in Northeastern Region

The eight states in the NER are endowed with the necessary ingredients that can help in propelling their growth and development in the spices sector and in driving the growth of the country's gross domestic product (GDP). It is important to understand the inherent strengths of the spices crop sector in the NER to design effective policy interventions for the sector.

Agroclimatic diversity: One of the major factors favouring the spices sector is the availability of diverse agroclimatic conditions within the NER. The spice crops form a botanically diverse group with specific agro-climatic requirements. Some of them are more suited to humid tropical climate (e.g. black pepper) whereas some of the spice crops have a wider range of agro-climatic suitability (e.g. ginger and turmeric). The Northeastern region is in 6 Agro Climatic zones, harbouring one of the richest reservoirs of genetic variability and diversity of various kinds of fruits, vegetables, spices, ornamental plants and medicinal and aromatic plants. The major agro-climatic zone of the different states in NER is presented in Table 5. This feature of the region allows the primary producers to cultivate a wide variety of spices.

Spice biodiversity: The NER is endowed with rich biodiversity in spice crops. Several unique spice crop relatives and Heirloom varieties have been reported from this region. Some of them find applications in traditional medicine and local cuisines. Though germplasm conservation has received considerable attention from research institutions, the entire spice germplasm wealth of NER is yet to be studied. This rich natural repository of spice germplasm is a source of latent potential for the spices sector in NER and yielded a unique spice flavour

like Naga mircha (the hottest chilli in the world), Mizo chilli (with high pungency and unique flavour), Karbi Anglong ginger (low fibre and high oleoresin type) and Lakadong turmeric (high curcumin with specific profile) that are issued with GI tags. The possibility of new applications across pharmaceutical, nutraceutical and wellness industries along with appropriate branding and marketing strategies could enable commercial exploitation of several of these spices.

Technology availability and access: The spice crop research in the country has a long history and over the years, the National Agricultural Research System has generated significant research technology outputs. These outputs in the form of improved varieties, more efficient inputs, plant protection strategies and agronomic practices have paved the way for enhancing spice productivity across the country. The existence of a significant yield gap between the NER and rest of the country is indicative of the poor technology penetration in the region. The ready availability of a cafeteria of proven technology can act as a catalyst for enhancing spice productivity in NER. The improved connectivity and advances in ICT realized in the region will also enable easy access to these existing technologies. Based on the existing levels of yield gap and the attainable yield level with existing technologies, an enhancement in productivity by 30-70% is attainable in the short run with simple technology dissemination strategies alone.

Institutional support and enabling policy environment: The natural endowments and availability of technological solutions are necessary ingredients for a strong spices sector. But they can make effective changes only in the catalytic presence of institutional support and enabling policy environment. The strong institutional canvas established in NER over the years both in agriculture and other sectors is a critical component in nurturing a vibrant spices sector. The major objectives and intervention areas of some of the important institutions like Non-Lapsable Central Pool of Resources (NLCPR), North East Special Infrastructure Development Scheme – Other than Roads infrastructure (NESIDS-OTRI), Prime Minister's Development Initiative for North-East Region (PM-DevINE), Science and technology Initiatives in the North Eastern Region (STINER), North Eastern Regional Agricultural Marketing Corporation Ltd. (NERAMAC), North Eastern Region Farm Machinery Training & Testing Institute (NERFMTTI), etc., are to give comprehensive support to the horticultural development of the region. The list is not exhaustive and is illustrative of the range of institutional support available in the region. Apart from these, there is a strong network of 84 Krishi Vigyan Kendras, working at the forefront of technology transfer in these states. The strong institutional canvas and the enabling policy environment act as a critical driving force in strengthening the spices sector of the Northeast Region.

Technology options for the spices sector

Based on the strengths of the sector, it can be seen that the region is poised to leverage the geographical, institutional and policy related advantages available. The availability and adoption of technology shall be critical

Table 6. Varietal options in spice crops for Northeast Region

Crops	Varieties
Black Pepper	IISR Thevam, IISR Girimunda, IISR Malabar Excel, Panniyur-5, 8
Ginger	IISR Varada, IISR Rejatha, IISR Mahima, IISR Vajra, Suprabha, Nadia
Turmeric	IISR Pratibha, IISR Pragati, BSR-2, Megha Turmeric-1, Rajendra Sonia & Rajendra Sonali
Large Cardamom	Ramsey, Varlangey (high altitude); Sawney (mid altitude); Golsy (low altitude); Bebo (Arunachal)
Coriander	Sadhana, Swathi, Hisar Sugandh, Hisar Anand, Pant Haritima
Cinnamon	IISR Navasree, IISR Nithyasree
Nutmeg	IISR Keralasree, IISR Vishwasree,

in deploying a broad based and inclusive growth and development strategy for the spices sector in the NER. The key technology components which can play a vital role in the spices sector are outlined below.

Varietal technology: The modern varieties developed in spice crops by various agricultural research institutions are capable of delivering higher yields in the region. Some of the traditional varieties have a low inherent genetic potential and these varieties need to be replaced with modern varieties. Some of the potential varietal options for the region are given in Table 6.

Resource conservation practices: Several technologies with a focus on resource conservation have been developed for spice crops. The technologies are often based on identification of critical phases of crop growth and their nutritional requirement.

Non-monetary technologies: Some of the interventions like selecting the correct time of planting, timing of the harvest, timing and spacing of fertilizer application, etc., involve no additional cost. For example, the fertilizer application in crops like ginger and turmeric has to be

Table 7. Beneficial micro-organisms used in spice cultivation

Beneficial Micro-organism	Application/uses
PGPR microbial consortium for black pepper	Used for promoting growth and establishment of black pepper in nursery and in the field
<i>Trichoderma harzianum</i>	Used as a prophylactic measure against quick wilt of black pepper and rhizome rot of cardamom and ginger
<i>Pochonia chlamydosporia</i>	For control of root knot nematode in black pepper
<i>Bacillus licheniformis</i>	Used as a component in integrated management of bacterial wilt in ginger
<i>Bacillus amyloliquefaciens</i>	Enhances nutrient mobilization and use efficiency, protection against diseases
<i>Lecanicillium psalliotae</i>	Used in control of cardamom thrips
<i>Metarhizium pingshaense</i>	For management of shoot borer in ginger, turmeric and large cardamom
<i>Bacillus safensis</i>	Zinc & Phosphorus solubilizer

completed within 150 days after planting. Any fertilizer application after this period might not be economically viable. Interventions and choices which are not linked to availability of financial resources can result in significant changes in productivity.

Soil fertility management technologies: The edaphic factors have emerged as one of the major yields limiting factor in several spice crops. The deficiency of micronutrients has also been reported, especially in areas where use of straight fertilizers was regular and addition of organic matter was low. Site specific nutrient management can mitigate the yield limiting soil factors. The crop specific designer micronutrient mixtures for various spice crops like ginger, turmeric, and black pepper offer an easy solution for addressing the micronutrient deficiency.

New generation beneficial micro-organisms: several beneficial micro-organisms have been identified with specific applications in spice crop cultivation. The identification of novel beneficial micro-organisms along with the development of innovative delivery mechanisms can enhance the productivity of spice crops. The microbial encapsulation technology developed by ICAR-IISR has been regarded as a path-breaking approach for the delivery of beneficial micro-organisms. This technology has implications for the geographically challenged areas within NER as the technology facilitates easy transport, storage and application of beneficial micro-organisms. Details of selected beneficial micro-organisms with specific application in spice crops are given in Table 7.

Strategies for sustainable development of the spice sector in the NER

Sustainable development of the spices sector in the NER is important, not only for the agricultural economy but for the overall development of the region. As high value commodities, spices can deliver a higher output value from unit area of land, thereby increasing the farm business income of the primary producers. This would require critical policy stimulus encompassing research and extension focusing on the spices sector. Some of the key elements of the policy framework are discussed below.

Initiate innovative research programmes to harness the power of advanced genetic tools: The use of advanced genomics can help in utilizing the existing germplasm resources in innovative ways to enhance the genetic potential of the crops through fast breeding programmes. This will also promote the development of trait specific designer varieties with preferred traits by transferring the target traits from wild relatives to modern varieties.

Mission mode area expansion in black pepper: While it is difficult to increase area under different crops, there is ample opportunity to increase the area under vertical and mixed farming conditions. Black pepper is a potential crop that must be attempted in a mission mode approach. There are about 4 lakh ha under tea, 45 thousand ha under coconut and 1 lakh ha under arecanut majorly grown in Assam, Tripura, Mizoram and Manipur states. Under each of these systems, there is ample scope to introduce black pepper as an intercrop (arecanut/ coconut and shade trees of tea) thereby to increase the production and productivity. Even to cover the area by 2% under these potential

systems, we may require about 52 lakh number of black pepper cuttings and increasing the area in tea plantations alone will increase the black pepper production to the tune of 50% of the country's total production from the NER.

Mission mode approach for planting material production and seed system development: One of the major challenges in varietal dissemination of spices is the non-availability of quality planting material. Though transport logistics have improved, it is not advisable to promote large-scale movement of planting material from other regions of the country due to the risk of introduction of new pests and diseases. Decentralized and planned planting material production should be undertaken in NER with focus on black pepper, ginger, turmeric and large cardamom in the first phase. Validation, refinement and scaling up of plant propagation techniques suited for the region also need to be undertaken.

Establish an agency for comprehensive resource mapping in agriculture: Mapping various resources using spatial/digital mapping techniques can enhance the efficiency of planning for the region. Profiling of underutilized crops, real time data on area under various spice crops, watershed regions, soil characteristics, rainfall and other parameters is important for developing comprehensive production plans and market support activities including price support. A dedicated agency, without any conflict of interest needs to be entrusted with this responsibility.

Focus on Market-led crop promotion: The NER is home to several niche spice commodities which have considerable market potential. The market demand should form the basis of crop promotion and planned development of production clusters. The production clusters should be linked to specific value chains, ensuring market access and fair prices for the primary producers.

Promote heirloom varieties of NER through branding and marketing: While stressing the importance of varietal replacement, it is also important to leverage the traditional varieties of spices cultivated in NER, especially those varieties with unique traits. These heirloom varieties are a part of the rich tradition of the region. They also have a commercial value in niche markets, which can be explored through suitable branding and marketing strategies.

Facilitate Geographic Indication (GI) for potential candidate spice crops: There are several spice crop commodities with potential for GI registration. The GI registration is one way to create a market demand for the produce and to create awareness about the unique qualities and exclusiveness of some of the spices. At present five spices from the NER have obtained GI certification. These include Naga mircha (chilli), Mizo chilli, Sikkim large cardamom, Assam Karbi Anglong ginger and Lakadong turmeric. Along with the registration of the GI's, the producer registration has to be facilitated so that the primary producers in the region can use the GI tag for marketing.

Establish efficient inter-institutional linkage among agricultural R&D institutions: The strong institutional canvas of the region can nurture the development initiatives only when efficient and functional networks

are established among them. This would need a proactive approach from various institutions to identify critical problems, develop measurable indicators for baseline and target scenarios and work in time-bound manner to address the identified problems. The inter-institutional platform can be used to provide comprehensive technology backstopping services for the line departments engaged in implementing development and technology dissemination initiatives.

Targeted infrastructure development for value addition and post-harvest management: Value addition activities, such as processing and packaging, can help to increase the income of farmers and create employment opportunities in the region. Infrastructure development with a special focus on facilitating such activities needs to be targeted. Availability of a strategically located network of packhouses and cold storage facilities in major production zones can attract more interest in such value addition activities. This will also facilitate the establishment of food processing industries based on spice commodities and development of entrepreneurship.

Provide handholding services to producer collectives and promote market linkages: The farmer collectives across the country, are playing an increasingly important role in enhancing the efficiency of input sourcing, aggregation of produce and finding more attractive markets for the produce. There should be a dedicated agency for handholding development and establishment of farmer collectives. The channelling of institutional support to these farmer collectives should be seen as 'partnerships for progress'. Networking among the farmer collectives should also be facilitated.

Stakeholder network for promoting market linkages: The public institutional stakeholders like MDoNER, The Spices Board, ICAR-IISR, etc., can play a crucial role in promoting market linkages between spice farmers and buyers, both domestic and international. Strategic deployment of spice parks, organizing buyer-seller interface meetings, promotion of Northeast brand at the global level, handholding farmer for adopting Good Agricultural Practices (GAP) for production of clean and food safe spices, facilitating exports etc., can help the NER to emerge as a preferred global destination for sourcing high quality spices.

The spices sector in the NER is characterized by its versatile nature and ability to adapt to changing technology and market landscape. The spices sector has several inherent strengths, which can be further leveraged for making this sector, the engine of agricultural growth in the region. Cohesive policy design, commitment to technology-based spice production and efficient support from public funded institutional stakeholders along with innovative approaches for providing support for entrepreneurship development and marketing will transform the spices sector in the Northeastern Region of India.

For further interaction, please write to:

¹Director, ICAR-Indian Institute of Spices Research, Kozhikode, Kerala 673 012

Email: director.spices@icar.gov.in
