



# Annual Report

## (2016-17)



**CENTRAL INSTITUTE OF HORTICULTURE**

**Department of Agriculture Cooperation & FW**

**Ministry of Agriculture & FW, Government of India**

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भारत सरकार  
कृषि एवं किसान कल्याण मंत्रालय  
कृषि, सहकारिता एवं किसान कल्याण विभाग  
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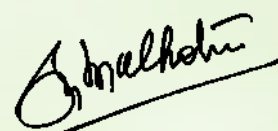


## FOREWORD

The North East region despite its immense scope for horticulture development, its potential still remains to be fully tapped. Being identified as one of the major hot spots for cultivation of a varied number of fruits, vegetables, flowers and spices, the North East region of India can no doubt be at par with the other countries in terms of quality of horticulture produce as well as production and productivity. However, lack of sufficient volume of quality planting materials, proper technical know-how, awareness on latest improved production technologies, improved varieties, post harvest management practices and marketing linkage has been one of the major factors contributing to the slow growth rate of horticulture produce in the region.

With its 11<sup>th</sup> year of establishment, the Central Institute of Horticulture has come a long way contributing tirelessly for the development of horticulture sector in NER. I am happy that the Central Institute of Horticulture, Medziphema, Nagaland has created a momentum in the field of horticulture, imparting trainings of transfer of modern technologies to the rural mass, production and supply of quality planting material, setting up demonstration farms in different areas of North East region so as to change the attitude of the farming community by seeing and believing. The institute has also actively coordinated with different organization for promoting organic farming in the region. The nursery certification and accreditation programme, certificate course and skill development course, agri- business promotions and marketing initiatives taken by the institute in collaboration with various organizations is commendable. Such a venture has not only exposed and encouraged the growers to compete with the farmers of other states but also made realization about the quality of their produce. The Director with his team has been appreciably putting all effort in achieving the objectives of the institute.

It gives me immense pleasure that CIH is bringing out its annual report 2016-17 highlighting achievements made during the reported year. I commend the Director and CIH team for their sincere effort in providing technical support for improving the horticulture sector in this region. I wish the institute all success in its future endeavor.

  
(S. K. Malhotra)

## EXECUTIVE SUMMARY



The Central Institute of Horticulture presents its 8<sup>th</sup> Annual Report with its targets and achievements during the period 2016-17. The Institute has played a vital role for effective dissemination of technology i.e technology demonstrations, imparting training to the growers and officials in NER, production of quality planting materials, protected cultivation, organic farming, introduction of three months certificate courses for the less privileged youth of the region, nursery accreditation and certification, post harvest management activities and agri-business promotion. In this direction, the Institute has developed sustainable and profitable integrated crop production and protection systems, including quality planting material, organic farming, protected cultivation, value addition and marketing aspects.

During the reported year, CIH has made some significant contribution towards horticulture development in the region. In terms of technology demonstrations, various on farm activities such as cultivation of organic turmeric and ginger, demonstration of vegetables, plantation of Assam lemon, pomegranate, strawberry, pineapple, orchids, gap filling of fruit crops were undertaken. Under protected cultivation, activities such as cultivation of high value vegetables, plantation of orchids were done. The off farm demonstrations activities implemented at farmers field are new plantation of mango and litchi at Zubza, Kohima district, Nagaland and Thoubal district of Manipur in an area of 2 ha each, new plantation of mango and Khasi Mandarin at Karbi Anglong district of Assam in an area of 2 ha.

In the field of human resource development, the institute has organized 40 farmers training which were attended by 2036 farmers and four trainers training (161 officials) were conducted in identified areas of horticulture in the region. The Institute has also organized two capacity building for CIH staff and four numbers of exposure trips cum training for the officials and farmers of North East Region besides participation in various exhibitions and trade fairs. With the growing consciousness for efficient, judicious and quality production, adoption of modern production technologies has become a felt need for the farming community. Realizing the importance, the Institute also extended its reach through mass media and publications for the farmers and extension functionaries in the NER.

During the period of 2016-2017, the Institute as the nodal agency for providing accreditation and certification of nurseries in the region have assessed/monitored a total of 23 nurseries which includes both fresh application and renewal applications and out of which 19 nurseries were accredited and issued certificate

The Institute have also completed three courses of certificate course (three months duration) on protected cultivation, organic farming and modern nursery management for the less educated youth of NER so as to provide self employment and entrepreneurship in focused courses. In addition, the Institute has initiated and completed one month skill development course on floriculture and another course on Gardener was commenced from 31<sup>st</sup> March 2017.

With regard to Agri-business promotion, the Institute has participated in four exhibitions/ Expo/ trade fairs during the reported year in different place such as Delhi, Guwahati, Nagaland and Noida, U.P. Besides these, inorder to equip the farmers with the right kind of know-how for post harvest management & value addition and marketing of the quality produce, CIH has taken a lot of new initiatives for the benefit of the farmers. Trainings on harvesting, post harvest operations and value addition during the season, organizing in exposure trips, exhibitions, etc. to provide suitable market linkages to the horticulture crops growers of the region and giving an opportunity to the farmers to showcase their produce and earn a premium for their high quality horticulture produce are some of the initiative undertaken during the reported year.

The Institute has also participated in the 7<sup>th</sup> Indian Horticulture Congress at New Delhi and has also organized one National conference on Advances in Indian Floriculture with focus on North East & Hill Region at CIH, Nagaland 13-15 January 2017. An initiative was taken for implementation of “Integrated Horticulture Development” project for the states of Manipur, Mizoram and Nagaland and is to be implemented over a period of two years.

CIH, though a small team, works together day in and day out for the upliftment of the Institute in particular and the horticulture sector development of the region in general. With the help of Dr. S K Malhotra, Agriculture & Horticulture commissioner and his officials at DAC & FW, Ministry of Agriculture Cooperation & FW, Govt. of India, the Institute has been able to achieve whatever it has during the year, and look forward to their full cooperation in future as well.



**Dr. Lallan Ram**  
Director

## 1

**ABOUT THE INSTITUTE**

**T**o provide Institutional support to tap the huge potential for horticulture development in the North-Eastern region, Government of India has set up the “Central Institute of Horticulture” at Medziphema, Nagaland in the year 2005-06 for holistic development of horticulture in NE Region of India. The Institute is spread over 43.5 ha area at Medziphema, Nagaland. The main thrust areas of the Institute are demonstrations of identified technologies pertaining to the region; production and supply of quality seed and planting material; training and capacity building of state govt. officials, field functionaries and farmers, accreditation and certification of nurseries in NER, monitoring of centrally sponsored programmes in the area of horticulture, promotion of organic farming, certificate and skill development course, post harvest management, processing, value addition, marketing and agribusiness promotion.

**VISION**

To emerge as the pioneering, innovative, farmer focused and self-supporting institute in the country.

**MISSION**

To provide excellent, innovative and relevant training to all the stakeholders so as to empower individuals and enable horticulture industry to bring about socio-economic development and sustainability in North East Region.

**OBJECTIVES**

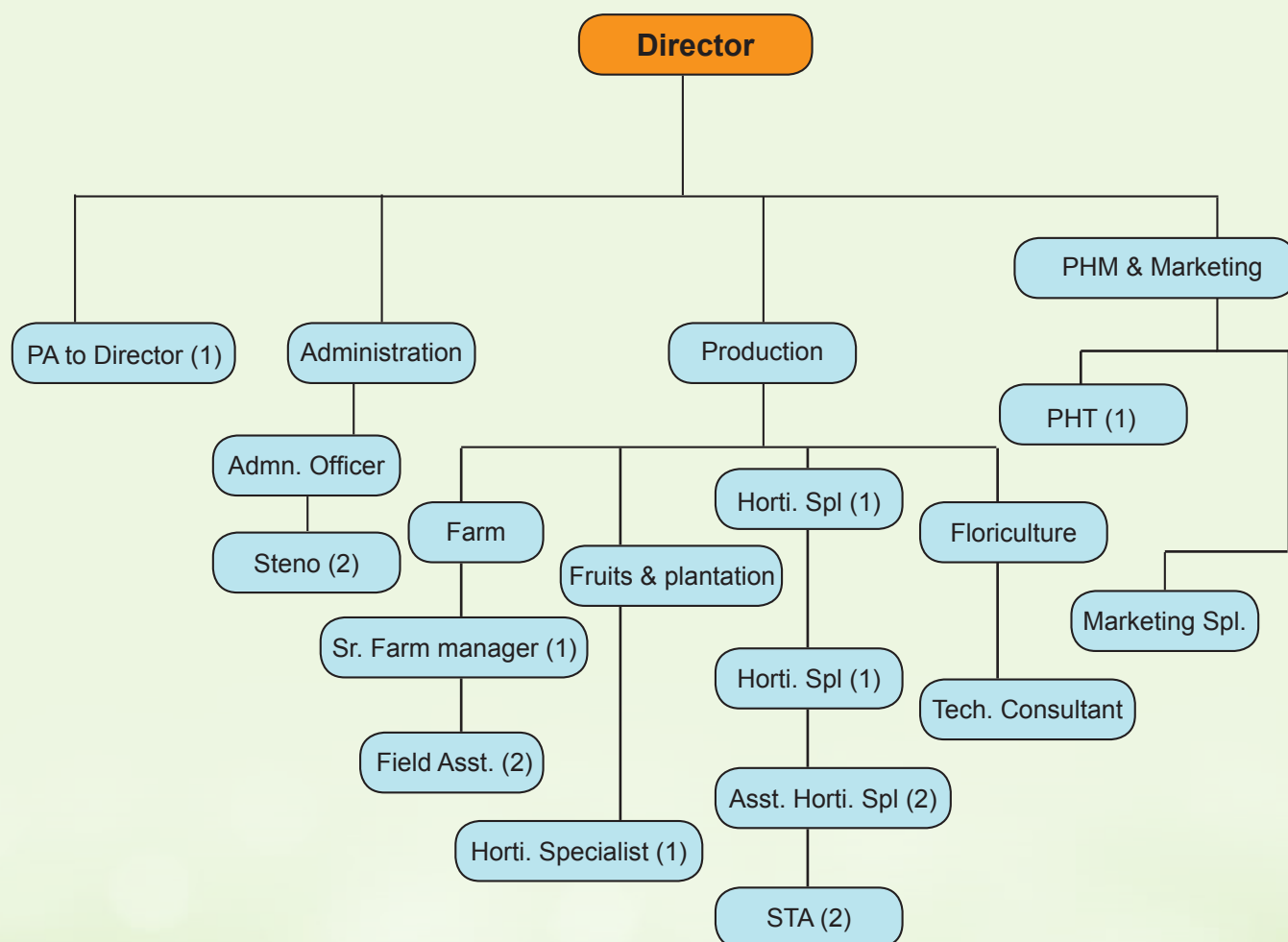
- ⊙ Capacity building by training of trainers and farmers.
- ⊙ Demonstration of improved production technologies.
- ⊙ Accreditation and certification of nurseries in NER
- ⊙ Follow-on extension support in the field of horticulture.
- ⊙ Promotion of organic cultivation of horticulture crops.
- ⊙ Establishing convergence and synergy among programmes in the field of horticulture.
- ⊙ Monitoring of centrally sponsored programmes in the area of horticulture.



## FOCUS AREAS

- ⦿ Training of State Govt. officials and farmers/beneficiaries of North Eastern Region.
- ⦿ Production and supply of quality planting material.
- ⦿ Accreditation and certification of nurseries in NER
- ⦿ Transfer of technology through method and result demonstration and publication of folders, manuals, leaflets etc
- ⦿ Promotion of organic farming.
- ⦿ Post harvest, marketing and agri-business promotion through exhibition, seminars, workshop, exposure trip, buyers' seller meet.
- ⦿ Coordination with state horticulture departments of NER and other National organizations.
- ⦿ Monitoring of centrally sponsored programmes in the area of horticulture
- ⦿ Three months certificate courses in horticulture.
- ⦿ One month skill development course on floriculturist- protected cultivation landscaping and gardener.

## ORGANIZATIONAL SETUP



## 2

**A GLANCE OF HORTICULTURE SCENARIO IN NORTH EAST REGION**

Horticulture in North East is known for its vast resources and its varied climate, altitude, edaphic condition offers immense scope to enrich biodiversity in the region and social diversification. Horticulture in North east is a significant and upcoming sector in India and has proved to be the best diversification option for agriculture land use, because of assured and remunerative returns to the farmers. Horticulture provides higher unit of productivity and offers great scope for value addition and this sector is taking inroads throughout the length and breadth of the region as this region has rich diversity of both indigenous and introduced horticultural crops. The diverse agroclimatic conditions, varied soil type and abundance of rainfall offer immense scope for cultivation of different types of horticultural crops, including fruits, vegetables, flowers, plantation crops, tuber and rhizomatous crops and crops of medicinal and other economic values. Apart from these, there are certain underutilized or lesser known horticultural crops which are grown at large scale in some or other parts of the region by tribals. In North east region, the production of fruits accounts to 4434.01MT, vegetables 5406.8MT, cut flowers 4962.98 MT, loose flowers 205.04MT, aromatic crops 109.89MT, spices 627.62MT, plantation 227.45MT.

In NEH region, farming being the main stay of the people, development of horticulture will markedly improve the economy of the people. It may be mentioned that in hill area particularly horticultural crop cultivation as an alternative to jhuming may prove to be a boon in the regional economy. Establishment of orchards and planting of plantation crops on hill slopes will prevent soil erosion which may solve the problem of shifting cultivation and out migration of people to towns. However, considering the excellent climatic conditions, abundant rainfall and fertile soil (high organic content) of the region the productivity of different horticultural crops is quite low as compared to national productivity but horticulture bears the bright future in the region and it has every opportunity to be developed as valuable processed food product and produce export quality fruits, vegetables, flowers and other horticultural products.

The state wise status of area, production of fruits, vegetables, flowers and spices in North east is indicated in Table 1-5.

**Table 1. Area (A) and production (P) of various horticulture crops in NER (2016-17)**  
*Area in ha ('000); Production in MT ('000)*

State	Fruits		Vegetables		Flowers			Aromatic & Medicinal		Spices		Plantation	
	A	P	A	P	A	P		A	P	A	P	A	P
						loose	cut						
Arunachal Pradesh	66.21	306.27	4.00	33.01	0.02	0.01	0.07	0.46	0.99	11.44	68.72	0.07	0.10
Assam	165.49	2412.79	315.77	3936.67	5.05	33.68	46.59	4.40	0.17	100.53	333.69	103.38	194.16
Manipur	49.48	342.13	43.59	323.70	0.22	0.10	0.16	0.00	0.00	10.47	24.14	0.90	0.32
Meghalaya	37.97	447.27	49.92	541.89	0.06	0.00	2.65	0.00	0.00	18.37	90.26	25.37	31.60
Mizoram	51.34	304.05	33.96	163.90	0.19	0.57	0.00	0.93	0.93	24.57	68.89	10.77	7.37
Nagaland	37.72	383.24	45.69	526.66	0.07	0.89	0.59	0.11	0.47	15.00	119.25	1.36	5.44
Sikkim	17.53	23.48	12.67	111.27	0.24	16.50	0.09	0.00	0.00	29.46	64.78	0.00	0.00
Tripura	75.74	854.05	46.48	793.24	0.00	0.00	0.00	0.00	0.00	5.69	18.04	16.15	33.47
<b>Total</b>	<b>501.48</b>	<b>5073.28</b>	<b>552.08</b>	<b>6430.34</b>	<b>5.85</b>	<b>51.75</b>	<b>50.15</b>	<b>5.9</b>	<b>2.56</b>	<b>215.53</b>	<b>787.77</b>	<b>158.00</b>	<b>272.46</b>

Source: DAC & FW 2016-17 (Third estimate)

**Table-2. State wise area and production of fruit crops in NE Region (2016-17)**

States	Area (000 ha)	Production (000 t)	Productivity (t/ha)
Arunachal Pradesh	66.21	306.27	4.62
Assam	165.49	2412.79	14.57
Manipur	49.48	342.13	6.91
Meghalaya	37.97	447.27	11.77
Mizoram	51.34	304.05	5.92
Nagaland	37.72	383.24	10.16
Sikkim	17.53	23.48	1.33
Tripura	75.74	854.05	11.27
<b>Total</b>	<b>501.49</b>	<b>5073.27</b>	<b>10.11</b>

Source: DAC & FW 2016-17 (Third estimate)

**Table-3. State wise area and production of Vegetable crops in NE Region (2016-17)**

States	Area (000 ha)	Production (000 t)	Productivity (t/ha)
Arunachal Pradesh	4.00	33.01	8.25
Assam	315.77	3936.67	12.46
Manipur	43.59	323.70	7.42
Meghalaya	49.92	541.89	10.85
Mizoram	33.96	163.90	4.82
Nagaland	45.69	526.66	11.52
Sikkim	12.67	111.27	8.78
Tripura	46.48	793.24	17.06
<b>Total</b>	<b>552.08</b>	<b>6430.34</b>	<b>11.64</b>

Source: DAC & FW 2016-17 (Third estimate)

**Table-4. State wise area and production of flower crops in NE Region (2016-17)**

States	Area (000 ha)	Production	
		Loose (000 t)	Cut (lakh nos.)
Arunachal Pradesh	0.02	0.01	0.07
Assam	5.05	33.68	46.59
Manipur	0.22	0.10	0.16
Meghalaya	0.06	0.00	2.65
Mizoram	0.19	0.57	0.00
Nagaland	0.07	0.89	0.59
Sikkim	0.24	16.50	0.09
Tripura	0.00	0.00	0.00
<b>Total</b>	<b>5.85</b>	<b>51.75</b>	<b>50.15</b>

Source: DAC & FW 2016-17 (Third estimate)



**Table-5. State wise area and production of Major spices crops in NE Region (2016-17)**

States	Area (000 ha)	Production (000 t)	Productivity (t/ha)
Arunachal Pradesh	11.44	68.72	6.00
Assam	100.53	333.69	3.31
Manipur	10.47	24.14	2.30
Meghalaya	18.37	90.26	4.91
Mizoram	24.57	68.89	2.80
Nagaland	15.00	119.25	7.95
Sikkim	29.46	64.78	2.19
Tripura	5.69	18.04	3.17
<b>Total</b>	<b>215.52</b>	<b>787.77</b>	<b>3.65</b>

Source: DAC & FW 2016-17 (Third estimate)

## 3

## SALIENT ACHIEVEMENTS OF THE INSTITUTE

## 3.1. Production &amp; distribution of quality planting material

## 3.1.1. Establishment of scion/mother block under field condition

Availability of good planting material being very important for horticulture development and one of the key mandates of CIH is production of quality planting material and the Institute have established about 14 ha area under different fruit blocks as mother plants for scion collection to be used in different propagation activities. The following fruit crops that were established in CIH are given below.

Table 6. Establishment of scion/mother block

Sl/No.	Crops	Varieties
1	Sweet orange	Early Gold, Rhod-e-Red, Trovita, Cara-cara Navel, Ruby Nucellar, Moro Blood, Olinda Valencia, Itaborai,
2	Tangerine/ Mandarin	Clemenule, Daisy Tangerine, W. Murcott, Sikkim Mandarin, Khasi Mandarin, STG, Nagpur Mandarin, Khasi Mandarin, Assam Lemon, Kinnow Mandarin
3	Lime	Bears lime, Mexican lime, Acid lime
4	Lemon	Eureka Lemon, Lisbon lemon, Kachai lemon
5	Cashew	VRI-3, Vengurla-4, BBSR -1, H-2/16, H-1608, Bhaskara, Dhana, V-7, Ullal-3, Ullal-4, Priyanka, VRI-3, Sel.-2
6	Guava	Sweta, Lalit, Allahabad safeda, Lucknow-49,
7	Mango	Langra, Bombay green, Pant Sinduri, Dashehari, Mallika
8	Litchi	Shahi, Seedless, Kalkatia, Red Rose Scented, China and Tezpur
9	Bael	B-2, NB-5, NB-6
10	Aonla	Kanchan, NA-6, NA-10, NA-7, Krishna, Laxmi -52
11	Peach	Shane-E-Punjab
12	Passion fruit	Purple local, Yellow
13.	Pomegranate	Bhagwa

During 2016-17, gap filling of existing mother blocks was done in fruit crops such as Guava var Lucknow-49 (100 nos), Allahabad Safeda (100 nos), Shweta (50 nos). Passion fruit var. Yellow and purple 150 nos, Cashew nut var. VRI-3 (50 nos.) and V-4 (50 nos.) and for citrus var. Khasi Mandarin 100 nos of plants were gap filled.

### 3.1.2. Raising of Rootstocks

#### 3.1.2.1. Containerized primary nursery

Under containerized primary nursery, plastic crates are used for sowing the seeds filled with media in the composition of two part soil, one part sand and one part coco peats/ FYM. Seeds were sown at a distance of 4 cm at a depth of 1-2 cm.

The supply of good planting material is very vital for the development of good nursery management practices which include methods of propagation. As such, the Institute has been raising rootstock for crops such as citrus, cashewnut, guava and rose for further multiplication. The numbers of rootstock raised at the Institute during the year 2016-17 are Rangpur lime (21525), Cashewnut (25824), Guava (4750) and Mango (5720).



Fig. 1. Rangpur lime seedling in plastic crate



Fig. 2. Rangpur lime rootstock seedling in polybags



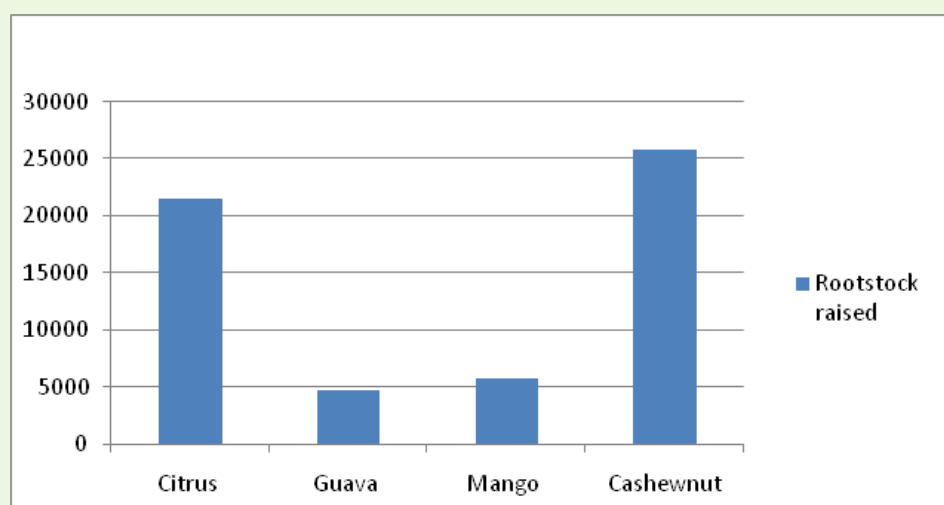
Fig. 3. Local Mango rootstock seedling in polybags



Fig. 4. Local Guava rootstock seedling in polybags

**Table 7. Details of rootstocks raised at Institute**

Sl. No.	Crops Name	Variety	No. of root-stock raised	Source	Remarks
1.	Citrus	Rangpur Lime	21,525	NRC Citrus, Nagpur,	Successful seedlings were used for budding and grafting purposes
2.	Guava	Local	4750	Local	
3.	Cashew Nut	Local	25824	Cashew Development Board, Orissa	
4.	Mango	Local	5720	Local	

**Fig. 5. Different Rootstock raised at CIH**

### 3.1.3. Propagation

The availability of quality planting material is one of the major constraints in improving the production of horticulture crops and considering the huge demand for quality planting material of improved varieties, the Institute is putting its effort in carrying out propagation activities in crops like citrus, cashew, mango and guava. During the period under report, the Institute has propagated 6025 nos of cashew nut in varieties V-4, VRI-3, H-1608, H-2/16 and BBSR-1, The propagation method followed in cashew nut is soft wood grafting. In guava var. L-49, Allahabad Safeda, Sweta and Lalit, 21200 nos of plants were propagated by wedge grafting method, 14639 nos of citrus var. Khasi Mandarin, Valencia, W. Murcot, Early Gold and Mosambi following T-Budding and Wedge grafting method. The successful propagated plants are used for gap filling in farm and distributed to the farmers for demonstration programmes at farmers field in NER. and sale to the various farmers.

The scion /bud stick has been produced from existing scion mother block at the Institute. During the year under report, the Institute has produced 6700 nos of scion stick of Cashewnut (V-4, VRI-3, H-1608, H-2/16, and BBSR-1), 23500 nos of scion stick of Guava (L-49, Allahabad Safeda, Sweta and Lalit), 4500 nos of bud stick of citrus (Khasi Mandarin, Valencia, W. Murcot, Early Gold and Mosambi) .



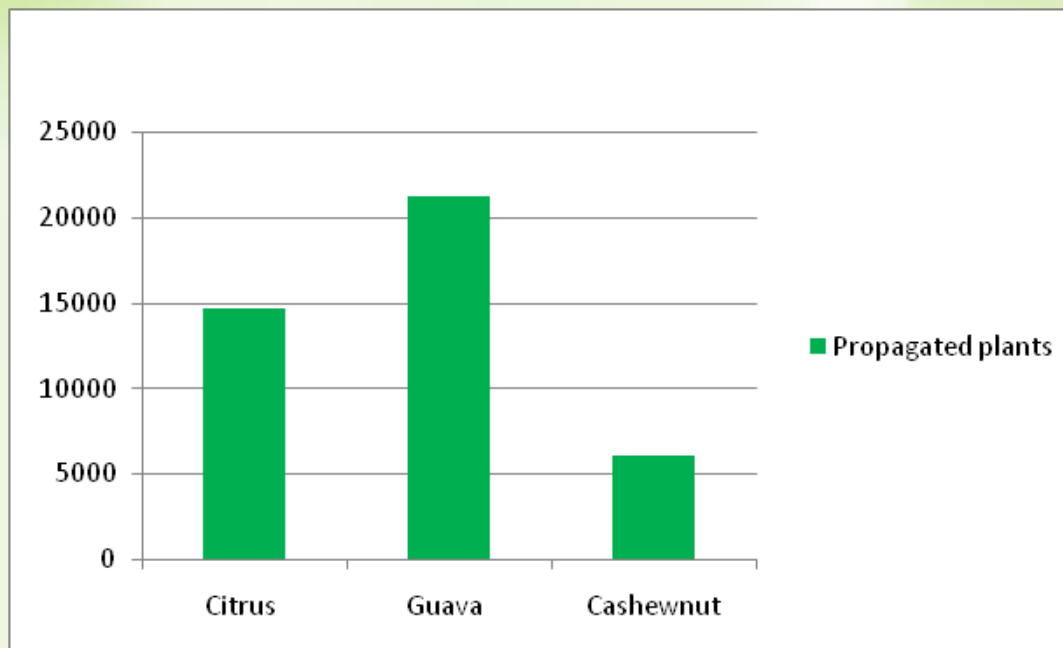


Fig. 6. Number of plants propagated at CIH



Fig. 7. Grafted Guava (L-49, Lalit, Shweta, Allahabad Safeda)



Fig. 8. Grafted Cashewnut (VRI-3, H-1608, H2/16, BBSR)



Fig. 9. Budlings of Khasi Mandarin

### 3.2. Technology demonstration

#### 3.2.1. At Institute

##### 3.2.1.1. Protected cultivation

#### 1. Dendrobium Orchid

Orchids account for a large share of global floriculture trade both as cut flowers and as potted plants and is estimated to comprise around 10% of international fresh cut flower trade. *Dendrobium* can create the foundation of orchid industry in our country like another Asian country. It may be easily grown in wider geographical area ranging from low altitude hills, foothills and plain areas with milder climate.



Fig. 10. Orchid plantation under shade net

Many parts of southern India, Maharashtra, Assam and other north eastern states are highly suitable for growing *Dendrobium* the potential for which is yet untapped. Very recently, some states of the country like West Bengal, Jharkhand, Assam, Tripura, Mizoram, Kerala, Karnataka and Maharashtra have taken some initiatives to grow *Dendrobium* mostly through Government supported programmes creating newer opportunities.

Therefore, keeping in view the above points, the Institute has undertaken cultivation of *Dendrobium* orchid variety White Singapore and Sonia Red during 2016-17 under shade net house in an area of 100 sq m with the objectives to study the varietal evolution of orchid at CIH Nagaland; Intensive crop cultivation farm by demonstrating latest technologies; to achieve potential productivity per unit area and lead the farmers with technology. The plants were transplanted during the month of Dec.2016 in coco husk blocks in the size 1x1 feet accommodating 12 plants per sqm. The parameters to be recorded are plant height (cm), number of leaves, number of flowers per clump, colour of flower, diameter of flower (cm), stalk length, number of petals per flower, number of days required to flowering after planting and vase life.

#### 2. Chrysanthemum

Chrysanthemum (*Dendranthema grandiflora* Tzeuleu) has earned tremendous popularity as an ornamental flower. Its present-day colorful varieties have risen through indiscriminate inter varietal hybridization, spontaneous and induced mutations and selection. Hence, the Institute has undertaken cultivation



Fig. 11. Cultivation of different cvs of chrysanthemum



of cut chrysanthemum cv. Red, Yellow, Orange and White under poly house in an area of 500 sq m with an objective to study the performance on growth and flower yield; to demonstrate latest technologies and to achieve potential productivity per unit area. The plants were transplanted during the month of Dec.2016 following recommended package of practices and parameters are to be recorded on plant height (cm), number of leaves, number of flowers per clump, colour of flower, diameter of flower (cm), stalk length, number of petals per flower, number of days required to flowering after planting and vase life.

### 3. Tomato

Tomato (*Lycopersicon esculentum* L) is one of the most popular and widely grown vegetables. However, most of the farmers in the region grows vegetables traditionally with little technological inputs. Therefore, new technologies have to be adopted to increase the production and productivity. During the reported year, the Institute has undertaken cultivation of tomato variety Himsona and Avinash under poly house in an area of 200 sq m with an objective to study the performance of different varieties under foot hill condition of Nagaland; intensive crop cultivation farm by demonstrating latest technologies and achieve potential productivity per unit area. The seedlings were transplanted after 4 weeks of sowing at a spacing of 60 x 45 cm. Manures were incorporated at the time of transplanting and observations on plant growth and physico-chemical parameters were also recorded as given in Table 8. The result indicates that the variety Avinash is suitable for growing under protected cultivation as it showed significant impact on growth, yield and other attributes.

Some of the outcomes from the above demonstration are successful varieties were recommended to the farmers; regular trainings conducted to the growers and extension workers; farmers and officials from the State departments of the region visited the Centre to see the technologies demonstrated in the whereby some of the farmers got confidence and started adoption of technologies at their farm; the produce were showcased in exhibitions and trade fair.



Fig. 12. Tomato cultivated under polyhouse

**Table 8. Physico-chemical characteristics of tomato varieties at different stage of development**

Qualitative characters	Himsona				Avinash			
	Colour break stage	1/4 <sup>th</sup> stage	1/2 <sup>nd</sup> stage	Ripen stage	Colour break stage	1/4 <sup>th</sup> stage	1/2 <sup>nd</sup> stage	Ripen stage
Fruit wt.(g)	20.00	25.00	30.00	35.00	10.00	15.00	20.00	25.00
Fruit diameter (mm)	33.35	31.21	30.59	28.52	31.35	30.12	29.60	26.34
T.S.S (Brix)	6.10	6.20	6.50	6.68	6.00	6.10	6.30	6.38
Acidity (%)	0.59	0.58	0.51	0.33	0.58	0.57	0.52	0.28
Fruit firmness (kg/ cm <sup>2</sup> )	8.96	7.43	7.17	5.1	8.87	7.31	7.14	5.0
Lycopene (mg/100g)	0.23	0.37	1.01	1.64	0.21	0.35	1.00	1.63
Total sugar (%)	1.89	2.50	2.50	3.04	1.85	2.20	2.30	3.02

DAT: Days after transplanting

**Table 9. Economics of tomato for 100 sq m**

Variety	Estimated expenditure	Total expenditure (Rs)	Production (kg)	Gross return (Rs)	Net return (Rs)	Cost benefit ratio
	Material & inputs					
Him Sona	10000	10000	1400	21000	11000	1.1
Avinash	10000	10000	700	10500	500	--

#### 4. Gerbera

Gerbera (*Gerbera jamesonii*) has occupied a proud fourth position among the top ten cut-flowers of world-trade by the attractive and very beautiful flowers and is grown throughout the world under a wide range of climate. It is valued for their brilliant colours, appearance and potentialities in the local as well as domestic and international.

A field demonstration was conducted at CIH during 2016-17, with an objective to study the performance of gerbera cultivars Imperial, Rosalin, Shimmer, Paradise, Zingaro and White house under protected condition. Improved production technologies, uniform cultural practices and fertilizers application was followed to ensure optimum good quality flowers as well as response of vegetative growth. The performance indicated strong adoptability and good association with foot hill agro climatic condition of Nagaland. Among the characters studied, days to flowering, plant height, number of leaves/clump, number of flowers/clump, flower colour, stalk length, number of petals/flower, flower bud size, flower diameter and vase life under room condition variety Zingaro showed significant differences among the other varieties. The data given in table 10 & 11 indicates that the cultivation and performance of



different cultivars of gerbera has been found more productive in variety Zingaro followed by Paradise. Popularizing the package of practices with emphasis of improved varieties, use of balanced nutrient management and proper use of plant protection which will subsequently increase the income as well as livelihood of the farming community.



Fig. 13. Different cultivars of Gerbera cultivated under polyhouse

**Table 10. Plant characteristics flowering traits and yield of gerbera**

Cultivars	Plant height (cm)	Number of leaves/ plant	Number of days taken for bud emergence after planting	Flower petal colour	No. of flowers/ plant
Imperial	34.80	18.36	117.50	Yellow	14-16
Rosalin	31.90	15.83	116.25	Pink	16-18
Shimmer	34.68	16.89	117.00	White	15-18
Paradise	41.44	17.53	116.50	Yellow	14-15
Zingaro	42.11	18.50	118.00	Red	15-16
White house	33.00	15.60	114.75	White	12-13

**Table 11. Flower characteristics of gerbera**

Cultivars	Number of flowers/ clump	Length of flower stalk (cm)	Diameter of flower bud (cm)	Diameter of flower (cm)	Disc diameter (cm)	Number of petals/ flower	Vase life of flowers in 2% sucrose solution (days)
Imperial	15.21	30.40	1.83	5.78	2.78	51.28	12.32
Rosalin	13.00	25.59	1.67	5.45	2.47	51.28	7.30
Shimmer	13.65	31.60	1.88	5.60	2.58	51.30	5.58
Paradise	15.31	32.90	2.02	6.10	2.88	56.90	8.90
Zingaro	15.35	33.00	2.04	6.21	2.98	57.00	12.57
White house	14.12	30.20	1.68	5.75	2.74	52.68	11.45

**Table 12. Economics of gerbera for 1000 sq m**

Variety	No. of plants	Estimated expenditure		Total expenditure (Rs)	Production (nos.)	Gross return (Rs)	Net return (Rs)	Cost benefit ratio
		Material	inputs					
Imperial	500	-	2000	3000	7500	37500	34500	11.5
Rosalin	500	-	2000	3000	8500	42500	39500	13.2
Shimmer	500	-	2000	3000	8000	40000	37000	12.3
Paradise	500	-	2000	3000	7000	35000	32500	10.8
Zingaro	1000	-	5000	6000	15000	75000	69000	11.5
White house	1000	-	5000	6000	12000	60000	54000	9.0

## 5. Anthurium

Anthurium is becoming a lucrative business in different parts of India particularly North east region of India. Anthurium are tropical plants of great beauty and grown either for the showy cut flowers or for their unusually attractive foliage. *Anthurium andreanum* species is grown for cut flowers purpose and *A. Scherzerianum* is grown for pots ornamental purpose. During the period under report, a field demonstration was undertaken with an objective to study the performance of Anthurium cultivars Tropical, Xavia, Momento and Pistachi under protected condition at CIH Farm, Medziphema. The main purpose is to ensure uniform cultural practices to ensure optimum good quality flowers as well as response of vegetative growth. The observations recorded indicate that the highest number of sprout per plant and plant height (cm) was recorded in variety Tropical. The maximum number of leaves/ plant, length of leaf lamina (mm) and width of leaf (mm) was recorded in Xavia and diameter of petiole (mm) was recorded highest in variety Pistachi.



Fig. 14. Director, CIH along with official from DDK, Kohima visiting the Anthurium cultivation at CIH



Fig. 15. Different cultivars of Anthurium cultivated under polyhouse

**Table 13. Plant characteristics flowering traits of Anthurium**

Variety	No. of sprout per plant	Plant height (cm)	No. of leaves/plant	Length of leaf lamina (mm)	Width of leaf (mm)	Diameter of petiole (mm)	Colour of leaf	Days to full bloom	Spathe size (cm) (length & width)	Colour of spathe	Colour of spadix (lower & upper)
Xavia	3	14.20	10.00	20.65	15.17	4.13	green	360	L=9.21B=6.48	pink	L=dark pink U=light pink
Tropical	4	16.30	7.00	19.12	14.13	4.21	green	360	L=7.18B=8.85	red	L=white U=yellowish
Momento	3	11.60	7.00	15.33	11.29	3.97	green	360	L=6.76B=7.90	white	L=light yellowish U=greenish
Pistachi	3	14.50	8.00	14.87	13.68	4.30	green	360	L=8.95B=9.77	green	L=light brown, U=brown

## 6. Rose

Rose (*Rosa* sp.) belongs to the family Rosaceae. It a long term crop with an average life of 6-7 years, requires more commitment of grower in day to day operations like proper management, right type of equipment installations and corrects technology etc. For successful production of roses, it is



Fig. 16. Rose cultivation under polyhouse

imperative to adopt well planned strategy including soil environment, choice of varieties, green house designs, marketing and all the related technologies. It has become very much essential to exploit hi-tech floriculture with standing inputs, cultural practices and others as India has a cost-effective agro climatic base. Hence, the Institute has undertaken cultivation of Rose cut flower variety Wham, Top-secret, Goldstrike and avalanche under poly house in an area of 1000 sq m with an aim to study the influence of different rose cultivars; produce high quality cut flower production systems and to enhance the productivity per unit area. All recommended cultural practices regular observations and datas are being recorded in different growth and yield parameters. During the reported period, the Institute has harvested around 7900 nos of rose



cut flowers. The data recorded indicates that the maximum plant height (51.10 cm), Number of braches per plant (3.00), Length of shoot after 2weeks of bud sprouting (60.28cm) was recorded in cv. Wham whereas the cv. Top secret recorded the maximum length of the sprouted bud (3.13cm), Length of shoot after 4weeksof bud sprouting (64.72cm). The cv. Wham also recorded maximum values in all yield attributing traits such as Length of flower bud (3.75cm), Diameter of flower bud (2.84 cm), Diameter of flower (8.11cm), Number of flower per plant (3.05) and Number of petals per flower (54.25).

**Table 14 : Performance of Dutch Roses cultivars of various growth parameters grown under Protected condition at CIH, Nagaland**

Cultivars	Plant ht. at first flower flush (cm)	Num-ber of braches per plant	Days taken to bud sprout-ing	Length of the sprouted bud (cm)	Length of shoot after 2 weeks of bud sprouting (cm)	Length of shoot after 4week-sof bud sprouting (cm)	Plant spread EW/NS directing (cm)	Leaf area (cm <sup>2</sup> )	Thorn density per inch
<b>Top-secret</b>	49.00	2.95	58.75	3.13	59.91	64.72	24.84	48.87	3.05
<b>Wham</b>	51.10	3.00	56.15	2.97	60.28	63.68	23.48	39.95	5.90
<b>Avalanche</b>	45.76	2.70	62.45	2.59	53.55	58.99	25.46	53.82	2.80
<b>Goldstrike</b>	40.15	2.35	71.10	3.13	48.97	52.61	20.45	43.92	2.35

**Table 15: Performance of Dutch Roses cultivars on yield and yield attributes grown under Protected condition at CIH, Nagaland**

Cultivars	Length of flower bud (cm)	Diameter of flower bud (cm)	Diameter of flower (cm)	Number of flower at first flower flush	Plant height at second flower flush (cm)	Number of flower per plant	Number of petals per flower
<b>Top-secret</b>	3.68	2.69	8.06	1.15	57.13	2.45	38.10
<b>Wham</b>	3.75	2.84	8.11	1.15	46.49	3.05	54.25
<b>Avalanche</b>	3.61	2.65	5.82	1.55	46.13	2.60	35.15
<b>Goldstrike</b>	3.37	2.64	7.58	1.40	29.14	2.40	35.60



### 3.2.1.2. Open field

#### 1. Naga king chilli

King chilli (*Capsicum Chinese* Jackquin) also called Naga Mircha, Naga Jolokia or Naga Hari is a short perennial crop but cultivated as annual. It is a potential crop for NE Region particularly in Nagaland. It similar to other solanaceous vegetables like tomato, brinjal, capsicum and chilli, requires substantial quantity of plant nutrients. In view of the above, a field demonstration was conducted to study the effect of organic manure on growth and yield of King chilli under field cultivation. A total of four treatments farmyard manure @ 6 tonnes/ha, pig manure @5 tonnes/ha, vermicompost @4 tonnes/ha and control were replicated three times and was incorporated at the time of planting. Plot size was measured 3x2 m. A pit size of 30x30 cm with spacing of 1x1 m was maintained. Local cultivar of king chilli was used and observations were recorded on plant height, number of branches /plant, number of leaves /plant, fruit length, fruit diameter, number of fruit/ plant, fresh weight of fruit, yield /plant as well as hectare. The data recorded from the demonstration were analyzed statistically as per procedure (Table 16 & 17).

The maximum plant height of 34.00, 48.33, 65.00, 76.20 and 89.00 cm were recorded with application of FYM at all the stages of observation. Similarly, number of branches per plant (13.20, 29.00, 51.00, and 69.20 ) were recorded maximum with application of FYM at all stages of observation. This was followed by Pig manure. The number of leaves like growth characters was also recorded maximum FYM. Application of FYM recorded maximum values in all yield attributing traits such as number of fruit/ plant (147.00), fresh weight of fruit (7.80), fruit length (7.06 cm) and fruit diameter (3.51cm). Hence, it can be suggested from the demonstration that FYM can play a vital role in sustaining the King chilli production under foothill conditions of Nagaland.



Fig. 17. Fruiting plant of Naga king chilli



Fig. 18. Harvested fruits of Naga king chilli

Table 16. Effect of organic manures on the growth parameters of King chilli

Treat- ments	Plant height (cm)				Number of branches/ plant						Number of leaves /plant				
	45 DAT	65 DAT	85 DAT	105 DAT	125 DAT	45 DAT	65 DAT	85 DAT	105 DAT	125 DAT	45 DAT	65 DAT	85 DAT	105 DAT	125 DAT
Control	21.03	29.31	38.00	47.00	55.17	6.00	13.43	19.00	26.34	44.00	20.22	47.35	68.57	87.47	138.30
FYM	34.00	48.33	65.00	76.20	89.00	13.20	29.00	51.00	69.20	80.43	30.00	65.00	145.00	228.00	350.00
Pig manure	33.00	47.67	64.20	75.77	85.00	12.00	24.00	40.00	60.67	79.33	27.00	60.00	140.67	226.67	210.67
Vermi- compost	30.28	45.67	62.33	73.67	83.60	11.00	22.67	38.00	60.00	78.67	24.00	51.00	139.33	220.00	195.00

DAT – Days after transplanting

Table 17. Effect of organic manures on the yield attributes of King chilli

Treatments	No. of fruits/ plant	Fruit weight of fruit (g)	Fruit length (cm)	Fruit diameter (cm)	Yield /plant (g)	Yield /Hectare (q)
Control	67.00	5.20	4.33	2.20	448.00	45.00
FYM	147.00	7.80	7.06	3.51	1150.00	110.73
Pig manure	145.90	7.65	6.39	3.20	1060.59	106.15
Vermicompost	140.73	6.58	6.22	2.78	939.64	103.00

## 2. Ginger

Spices are high value and export oriented crops, which play an important role in agricultural economy of the country. Among the spices, ginger (*Zingiber officinale* Rose.) is the main cash crop supporting the livelihood and improving the economic level of many ginger growers of North-Eastern Region. The soil, climate and other ecological factors of this region favour the growth and development of the crop and there is scope to increase the productivity of this crop in North-Eastern Region. Keeping this idea in view and considering the importance of the problems, an effort has been made to study the effect of organic manures of ginger var. Nadia. The field experiment was conducted during the year 2016-17. The rhizomes (20g) were planted in the fourth week March with a spacing of 20 cm x 25 cm in 3.6 x 3.0 m plots in an area of 0.25 ha. The observations on growth and yield were recorded randomly from five plants of each plot. The crop was harvested at 8 months after planting when the leaves turned yellow and start drying up. From the data presented in table 18, it is observed that application of pig manure recorded the maximum plant height (72.40 cm), Number of tillers /clump (8.87), Number of Leaves/plant (23.93), Finger Length (8.97 cm), Rhizome yield (18.14t/ ha) and Oleoresin (5.35%) followed by FYM and Vermicompost. Hence, it is suggested that application pig manure is a better source of nutrient input for obtaining higher yield as well as in sustaining soil fertility under the foothill agro-climate conditions.



Fig. 19. Ginger cultivation in field



Fig. 20. Harvested ginger rhizomes

**Table 18. Effect of organic manures on growth, yield and quality of ginger var. Nadia**

Treatments	Height of plants (cm)	Number of tillers / clump	Number of Leaves/ plant	Finger length (cm)	Rhizome yield (t/ ha)	Oleoresin (%)
Control	64.07	6.70	16.53	5.90	14.00	5.03
FYM	71.00	8.67	22.87	8.73	16.00	5.35
Pig manure	72.40	8.87	23.93	8.97	18.14	5.35
Vermicompost	70.60	7.89	21.53	7.27	15.00	5.20



**Table 19. Economic analysis of establishing, maintaining and returns from ginger cultivation**

Year	Estimated expenditure	Total expenditure (Rs)	Production (tonnes)	Gross return (Rs)	Net return (Rs)	Cost benefit ratio
	Material & inputs					
2017-18	20000	20000	15.0	45000	25000	1.25

### 3. Radish

Radish (*Raphanus sativus* L) is a popular vegetable in the temperate and tropical parts of the world. Extensive cultivation of this vegetable round the year is done for more remunerative returns and to make this vegetable more popular. Hence, a demonstration has been carried out to study the performance of radish cultivars Chinese Pink under Nagaland condition and to study the influence of organic manures on growth and yield of radish. A total of four treatments farmyard manure @ 10 tonnes/ha, pig manure@5 tonnes/ha, vermicompost @4 tonnes/ha, Azotobacter and control were replicated three times and was incorporated at the time of planting. All the recommended agronomic practices were followed to raise healthy roots. The seedlings were transplanted at a spacing of 60cm x 45cm in the plot size of 1m x 1m. Based on the results given in table 20, it is found that Plant height (27.92cm), No. of leaves/plant (10.19), Root length/plant (17.57cm), Root diameter/plant (2.57cm), Wt. of root / plant (171.31g), Yield/ha (30.38 t) was recorded in Pig manure followed by Vermicompost. The result indicates that application of pig manure followed by FYM was found more beneficial and significantly improved growth parameters, yield and yield components in radish cv. Chinese pink.



Fig. 21. Cultivation of radish in field



Fig. 22. Radish harvested in field



**Table 20: Influence of organic manures on growth and yield of radish cv. Chinese Pink**

Treatments	Plant height (cm)	No. of leaves/ plant	Root length/ plant (cm)	Root diameter/ plant (cm)	Wt. of root / plant (g)	Yield/ha (t)
FYM	22.90	10.13	17.29	2.40	165.44	29.61
Pig manure	27.92	10.19	17.57	2.57	171.31	30.38
Vermicompost	27.86	10.03	17.07	2.26	160.27	29.00
Azotobacter	25.33	9.11	16.74	2.12	158.25	28.49
Control	15.90	8.54	13.42	1.96	145.75	22.17

**Table 21. Economic analysis of establishing, maintaining and returns from knol khol cultivation**

Estimated expenditure	Total expenditure	Production	Gross return	Net re- turn	Cost benefit ratio
Material	(Rs)	(tonnes)	(Rs)	(Rs)	
50000	50000	15.0	300000	250000	5.00

#### 4. Marigold

Marigold belongs to the family Asteraceae (Compositae). The cultivated types of marigold are African marigold and French marigold. The eco-friendly nature of organic manures provide healthy environment as sustainability to horticulture. Profit from the cultivation of flowers by application of organic manures, the quality of flowers can be enhanced. Now a day's use of organic manures has played significant role in floriculture. Modern agriculture is based on the use of organic manures, which play a major role for producing the good quality and higher yield per unit area.



Fig. 23. Flowering plants of Marigold cv. Pusa Arpita



Fig. 24. Harvesting of Marigold flower for seed production

A field demonstration was conducted at CIH, Nagaland during 2016-2017 to evaluate the performance of marigold var. Pusa Arpita to various manures on growth and flower yield under Nagaland condition. Three treatments consisted of vermicompost@5t/ha, FYM@24 t/ha, poultry manure 10 t/ha were compared with control plot. Seeds were sown in the month of October and transplanted in main field after 60 days. Observations were recorded on growth and yield characters (table 22 & 23). The data recorded indicates that amongst the organic manures, the application of FYM gave the maximum flower growth and yield which was closely followed by pig manure and vermicompost.

**Table 22. Growth attributed of marigold as influenced by various treatments**

Treatments	Plant/height (cm)	Girth of stem (cm)	Length of branches/ plant	No. of branches/ plant
Control	55.00	1.24	48.70	13.87
Pig manure	61.75	1.37	50.22	16.50
FYM	65.17	1.39	51.35	17.00
Vermicompost	59.89	1.36	50.00	15.95

**Table 23. Yield attributed of marigold as influenced by various treatments**

Treatments	No. of flowers per plant	Circumference of flower (cm)	Fresh weight of flower (g)	Flower yield/ plant (g)
Control	17.85	19.25	9.29	198.25
Pig manure	21.78	23.02	10.85	236.66
FYM	23.00	23.50	11.00	263.54
Vermicompost	20.78	22.10	10.25	221.61

**Table 24. Economic analysis of establishing, maintaining and returns from marigold**

Estimated expenditure	Total expenditure (Rs)	Production (tonnes)	Gross return (Rs)	Net return (Rs)	Cost benefit ratio
Material & inputs					
9200	9200	2.0	20000	10800	1.17

## 5. Turmeric

Turmeric (*Curcuma longa*) is an erect, perennial herb grown as an annual crop. Turmeric being a value added crop may be cultivated by the farmers on commercial basis. During 2016-17, demonstration of organic model farm for cultivation of turmeric variety Megha Turmeric-1 and Lakadong was undertaken in an area of 0.5 ha. It was planted at a distance 30 x 25 cm during the month of May, 2016. Activities such as farmers meeting and field visit during cropping season, low yield and increased incidence of insect pest and diseases of turmeric were identified as major issues. In order to manage these problems, innovative and recommended practices were followed as new interventions during demonstrations programme. In case of

recommended practices, field drainage, seed treatment, plant protection measures and balanced cultural practices were followed.

Parameters on growth and yield data was collected from demonstration plots and analyzed as shown in Table 26 & 27. The result indicates that the yield of turmeric could be increased with the help of innovative technological intervention coupled with the proper management of disease. The demonstration has also motivated the farmers towards adoption of turmeric cultivation. The suitable technology for enhancing the productivity of turmeric crop, and need to conduct such demonstrations may lead to the improvement and empowerment of farmers.



Fig. 25. Organic turmeric cultivation in field



Fig. 26. Harvested rhizomes of turmeric

**Table 25 . Nutrients status of turmeric cultivation**

Sl. no.	Available Nutrient	Average (kg/ha)	Comment	Method
1	Organic carbon	0.81	high	Walkey and Black titration method
2	Organic matter	1.39	high	
3	Nitrogen	1028.60	high	Alkali potassium permanganate method
4	Potassium	1.39	high	Neutral Normal Ammonium Acetate method
5	Phosphorus	49.06	medium	Bray's and Olsen method

**Table 26. Growth, yield and quality characteristics of Turmeric var. Lakadong**

DAS	Pl. Height (cm)	No. of leaves	No. of clumps	Wt. Of rhizome/plant (kg)	Wt of whole plant		Yield (kg/ha)	Cucurmin content (%)
					Fresh. Wt (kg)	Dry Wt @ 7 week (kg)		
30 DAS	21.18	3.4	2.0	0.182	0.381	0.290	900	4.61
60 DAS	33.68	5.2				0.198		
90 DAS	65.6	6				0.102		
120 DAS	82.8	7.4						
180 DAS	112.4	7.6						
210 DAS	144.8	5.8						
240 DAS	121.4	6.6						

*DAS : Days after sowing*



**Table 27. Growth, yield and quality characteristics of Turmeric var. Megha Turmeric I**

DAS	Plant Height (cm)	No. of leaves	No. of clumps	Wt. of rhizome/plant (kg)	Wt. of whole plant		Yield (kg/ha)	Cucurmin content (%)
					Fresh. Wt (kg)	Dry Wt @ 7 week (kg)		
30 DAS	17.06	3.2	2.0	0.48	0.318		950	4.57
60 DAS	33.72	3.4				0.270		
90 DAS	56.6	4.4				0.180		
120 DAS	74.8	5.4						
180 DAS	113.2	7.4				0.109		
210 DAS	140.6	6.2						
240 DAS	137.2	5.6						

*DAS : Days after sowing*

**Table 28. Economic analysis of establishing, maintaining and returns of Turmeric var. Lakadong & Megha Turmeric I**

Estimated expenditure	Total expenditure (Rs)	Production (tonnes)	Gross return (Rs)	Net return (Rs)	Cost benefit ratio
Material & inputs					
20000	20000	1.85	55500	35500	1.7

## 6. Pineapple

Nagaland pineapples are best known for their unique taste and high qualitative parameters with almost fibreless pulp, high juice and high TSS content. The most commonly grown variety in Nagaland is “Giant Kew” and the season of fruit availability is July-August in summer and Oct-Jan in winter. It is one of the main crops supported by the government for commercialization in the state as pineapple cultivation has the potential to improve the livelihood of the rural people in the state. During the reported period, the demonstration plot for Pineapple variety Giant Kew was established in an area of 0.25 ha which was planted at double row system of 30 x 60 x 90 cm. Besides, area expansion of 1508 sqm was also done. The parameters recorded in different stage is given in Table 29 & 30.



Fig. 27. Cultivation & harvesting of pineapple in field



**Table 29. Physical parameters recorded in pineapple variety Giant Kew**

Parameters	Green stage	Matured stage	Slightly yellowish stage	Fully ripened stage
Fruit whole wt (kg)	1030.00	1.46	1.15	1.87
Fruit wt (kg)	0.87	1.17	0.87	1.65
Crown wt (kg)	0.25	0.35	0.31	0.32
Fruit length (cm)	12.76	11.78	12.39	15.87
fruit breadth (cm)	8.78	10.67	10.45	12.8
peel wt (g)	0.31	0.37	0.33	0.47
Pulp wt. with core (kg)	0.64	0.75	0.55	1.17
Pulp wt. without core (kg)	0.65	0.62	0.47	0.97
Core wt. (kg)	0.09	0.15	0.07	0.17
Juice content (ml)	245.00	303.00	276.00	661
wt. of extracted pulp waste (kg)	0.15	0.16	0.14	0.27

**Table 30. Qualitative parameters recorded in pineapple variety Giant Kew**

Parameters	Green stage	Matured stage	Slightly yellowish stage	Fully ripened stage
TSS ( <sup>o</sup> Brix)	12.95	13.00	16.20	14.26
Vit. C (mg/100g pulp/juice)	60.00	64.66	54.66	60.00
Acidity (%)	0.45	0.36	0.37	0.37
Total sugar (%)	6.61	6.47	6.05	4.15
Reducing sugar (%)	1.93	1.57	1.84	1.83
Non-reducing sugar (%)	4.47	4.63	3.96	2.17

**Table 31. Economic analysis of maintaining and returns from pineapple var. Gaint Kew under plastic mulch**

Estimated expenditure	Total expenditure (Rs)	Production (tonnes)	Gross return (Rs)	Net return (Rs)	Cost benefit ratio
Material & inputs					
50000	50000	6.00	120000	70000	1.4

## 7. Khasi Mandarin:

In the North east Khasi Mandarin (*Citrus reticulata* L. Blanco) is a well established commercial citrus variety. It is a crop adaptable to wide range of soil, terrain, planting and cultural arrangements. The rind of citrus fruits is rich in pectin and certain essential oils. Citrus fruit contain considerable amount of ascorbic acid, the vitamin C, polyembryonic, keeping quality good. During the reporting period, the Institute has planted Khasi Mandarin in an area of 0.5 ha. Farmyard manure was incorporated at the time of planting and the saplings were transplanted in the field at a distance 5 x 5 m in a pit size of 90 x 90 x 90 cm. The main objective is to make availability of disease free scion sticks to be used for the budding purpose.



Fig. 28. Khasi Mandarin block

## 8. Assam lemon:

This is a popular cultivar of north-eastern region of India. Fruits are medium to large, long, elliptic to oblong-obovate, nipple broad, m colour greenish- yellow, rind medium, tight, smooth, glossy, pulp white, juicy, acidic with strong aroma, normally seedless but occasionally with few seeds. During the period under report, Institute has planted Assam Lemon in an area of 0.5 ha. The plants are planted at the spacing of 2.5 x 2.5 m in pit size of 60 x 60 x 60 cm, FYM was incorporated in the pit during the planting. The plants will be used for multiplication of planting materials through stem cutting and leaf bud cutting methods.



Fig. 29. Assam lemon block

## 9. Kinnow Mandarin:

It is a popular cultivar of Punjab. Fruits are medium sized, globose to oblate, orange colour with flat base, rind medium to thin, leathery soft, with slight adherence but peelable, segments 9 to 10 and separable fairly easily, juice abundant, bright golden yellow in colour, rich flavor, acidic to sweet, seeds (15-25), polyembryonic. During the reporting period, the Institute has planted Kinnow Mandarin in an area of 0.5 ha. Farmyard manure was incorporated at the time of planting and the saplings were transplanted in the field at a distance 5 x 5 m in a pit size of 90 x 90 x 90 cm. The main purpose is to evaluate the suitability of the cultivar in the north east region and thereby popularize the cultivar in this region.



Fig. 30. Kinnow Mandarin block



## 10. Pomegranate:

Pomegranate (*Punica granatum*) is commercially grown for its sweet-acidic taste. The fruits are mainly used for dessert purposes. The ripe fruits are consumed fresh. Juice extracted from fruits makes an excellent drink. Seeds are dried and sold as anardana, which is used as acidulant for cooking. The variety Bhagawa matures in 180-190 days, bigger fruit size, sweet and glossy red rind with bold red arils, thick skin makes it suitable for distant market. During the reported period, the Institute has planted Pomegranate var. Bhagawa in an area of 0.5 ha. Plants were planted at the spacing of 4.5 x 3.0 M in pit size 90 x 90 x 90 cm. The FYM was incorporated in the pit during planting. The main purpose is to evaluate the suitability of the cultivar in the north east region and thereby popularize the cultivar in this region.



Fig. 31. Pomegranate block

## 11. Strawberry

The modern cultivated strawberry (*Fragaria x ananassa* Duch.) is a hybrid of two largely dioecious octoploid species, *Fragaria chelonensis* Duch and *Fragaria virginiana* Duch. Basically, it is herbaceous perennial and short day plant grows in humid or dry regions, widely grown under protected and open condition in temperate and subtropical countries with maximum temperature of 22° -25° C in the day and 7° -13° C at night. Its fruits are rich source of vitamin and minerals. Strawberry is known for its pleasant aroma. During the year 2016-17, CIH, Nagaland has established a demonstration plot for strawberry varieties Sabrina, Winter Dawn, Barak, Gili and Hada in an area of 1 acre with an objective to study the performance of different varieties under Nagaland condition. The plantation was carried out following the right package of practices and the plants were regularly observed and recorded. The results revealed the growth, yield and yield attributing characters significantly differed within the varieties (table 32). On the basis of performance of varieties related to growth and other yield attributing characters Winter Dawn proved to be the best suited with a yield of 6.25 t/ha followed Sabrina (4.26 t/ha) and Hada (4.21 t/ha).



Fig. 32. Different cultivars of strawberry cultivation in field

**Table 32. Physical and qualitative characters of strawberry cultivars**

Varieties	Plant spread (cmxcm)	Crowns /plant	Berry length x breadth (mm)	Fruit weight (g)	TSS ( $^{\circ}$ B)	Acidity (%)	Yield / plants	Yield (t/ha)
Sabrina	25.4 x 25	3.2	39.4 x 27.16	15.42	8.4	1.09	385.85	4.26
Barak	27 x 24.2	4.4	34.74 x 21.22	14.85	7.8	0.95	465.12	3.95
Winter Dawn	31.3x 30.8	6.2	42.85 x 32.73	22.26	10.3	0.64	546.26	6.25
Gili	22.4 x 22.7	4.6	27.77 x 27.10	15.26	9.2	1.15	365.56	3.45
Hada	21.1 x 18.75	5.2	18.23 x 17.52	16.35	8.6	0.73	295.85	4.21

**Table 33. Economics of strawberry per ha**

Cultivar	Estimated expenditure	Total expenditure (Rs)	Production (tonnes)	Gross return (Rs)	Net return (Rs)	Cost benefit ratio
	Material & inputs					
Sabrina	350500	350500	4.26	639000	288500	0.82
Barak			3.95	592500	242000	0.69
Winter Dawn			6.25	937500	587000	1.67
Gili			3.45	517500	167000	0.47
Hada			4.21	631500	281000	0.80

### 3.2.1.3. Maintenance of existing plantation of various horticulture crops

#### 1. Ultra high density plantation of guava

Guava (*Psidium guajava*) is an important fruit crop in tropical and subtropical regions of the country due to the hardy nature of its tree and prolific bearing even in marginal lands. Its cultivation requires little care and inputs. Hence, a need arose to improve the existing production system, besides increasing its productivity through higher density or meadow orcharding to control tree size and maintain desired



Fig. 33. Ultra HDP of guava in field

architecture for better light interception and ease in operations such as pruning, pest control and harvesting. The high density or meadow orcharding facilitates enhance production and quality of fruits. Ultra high density plantation of guava variety Lucknow 49, Shweta, Lalit and Allahabad safeda was established in an area of 1 ha at CIH farm during May 2010. In case of recommended practices, field drainage, plant protection measures and balanced cultural practices were followed. Visits of the farmers and extension functionaries were organized at demonstration plots to show the significance of large scale cultivation of guava. Yield data was collected from demonstration plots and cost of cultivation, net income and Benefit: Cost ratio were calculated and analyzed as shown in Table 34 & 35. The highest yield was recorded in Shweta (11.18 t/ha)



**Table 34. Fruit growth characteristics of different guava varieties**

Parameters	L-49	Allahabad Safeda	Lalit	Shweta
Fruit weight (kg)	0.15	0.13	0.16	0.12
Fruit length (cm)	2.10	2.22	2.11	2.12
Fruit breadth (cm)	2.21	2.25	2.21	2.23
Yield/ plant (kg)	9.93	10.82	9.12	10.75
Yield/ ha (t/ha)	10.16	11.27	9.65	11.18

**Table 35. Performance of different guava varieties on fruit quality**

Parameters	L-49	Allahabad Safeda	Lalit	Shweta
TSS ( <sup>0</sup> Brix)	9.80	6.80	5.40	9.00
Vit. C (mg/100g pulp/juice)	108.00	98.00	52.00	96.00
Reducing sugar (%)	3.30	3.70	6.60	3.70
Non-reducing sugar (%)	0.13	0.43	0.11	0.10
Total sugar (%)	3.44	4.16	3.27	3.12
Acidity (%)	0.89	0.96	0.64	0.57

**Table 36. Economic analysis of establishing, maintaining and returns from meadow orchard**

Cultivar	Estimated expenditure	Total expenditure (Rs)	Production (tonnes)	Gross return (Rs)	Net return (Rs)	Cost benefit ratio
	Material & inputs					
L-49	172050	172050	10.16	304800	132750	0.77
Allahabad Safeda			11.27	338100	166050	0.96
Lalit			9.65	289500	117450	0.68
Sweta			11.18	335400	163350	0.94

## 2. Mango

The Institute has established mango block of varieties Langra, Bombay green, Pant Sinduri, Dashehari, Mallika in the farm to evaluate the performance of different varieties. The plantation was done during the year 2010-12 in an area of 0.5 ha. The planting materials were procured from CISH Lucknow and BAU, Sabour. Highest yield (2.45t/ha) was observed in Mallika variety. Dashehari recorded the highest Juice content/ fruit, T.S.S.

**Fig. 34. Plantation of mango in field**

**Table 37. Performance of different mango varieties on growth and yield attributes**

Variety	Plant ht. (cm)	Trunk diameter (cm)	Canopy spread (cm)		No. of terminal Shoots/ tree	No. of Fruits/tree
			East west	North south		
Amrapalli	185.31	31.00	172.10	174.22	25.60	29.60
Langra	211.18	23.17	165.17	135.24	69.00	0.00
Gulabkhas	216.26	34.05	201.27	211.19	70.60	0.00
Pant Sindhuri	365.83	31.19	354.63	365.28	182.25	35.00
Mallika	225.04	31.48	301.10	235.34	123.60	41.25
Dashehari	213.21	29.00	174.18	189.14	104.80	25.00
Bombay green	195.27	28.42	203.22	216.35	74.80	0.00

**Table 38. Performance of different Mango varieties on quality attributes**

Parameters	Amrapalli	Pant Sindhuri	Dashehari	Mallika
Fruit wt (kg)	0.17	0.20	0.18	0.17
Fruit length (cm)	8.16	8.20	8.14	8.12
Fruit breadth (cm)	5.45	5.75	5.43	5.37
Juice content/ fruit (ml)	27.00	36.33	41.66	36.00
T.S.S (Brix <sup>0</sup> )	16.00	15.20	17.60	12.80
Acidity (%)	0.12	0.26	0.36	0.21
Vit C (Mg/100g of pulp/juice)	53.33	356.66	280.00	200.00
Reducing sugar (%)	2.43	3.83	4.09	2.56
Total sugar (%)	4.42	5.12	6.34	5.71
Non-reducing sugar (%)	1.92	1.22	2.13	4.32
Yield/ ha (t)	1.95	2.41	1.48	2.45

**Table 39. Economic analysis of mango per ha**

Cultivar	Estimated expenditure	Total expenditure (Rs)	Production (tonnes)	Gross return (Rs)	Net return (Rs)	Cost benefit ratio
	Material & inputs					
Amrapalli	50000	50000	1.95	97500	47500	0.95
Pant Sindhuri			2.41	120500	70500	1.41
Dashehari			1.48	74000	24000	0.48
Mallika			2.45	122500	72500	1.45

### 3. Peach

Peach is a cold season crop and is cultivated in all the North east states. It is consumed as fresh fruit or processed one. The Institute has established peach block in an area of 0.25 ha during the year 2009-10 to study the performance of peach variety Shane-E-Punjab. The planting materials were procured from ICAR Research Centre for NER, Barapani.



Fig. 35. Peach Plantation in field

**Table 40. Performance of peach variety Shane-E-Punjab on growth, yield and quality attributes**

Variety	Plant height (cm)	Trunk diameters (cm)	Fruit length (cm)	TSS (°Brix)	Acidity (%)	Total sugar (%)	Vit. C (mg/100g of pulp/juice)	Fruit wt. (g)	Fruit breadth (cm)	Yield per plant (kg)
Shane-e Punjab	265.20	41.02	46.20	11.00	0.91	3.41	103.00	61.23	85.54	13.65

#### 3.2.2. Farmers field

The demonstrations in farmer's field are conducted under the close supervision of technical staff of the Institute. There are multiple objectives of undertaking such demonstration trials at farmers field viz., updating the end users, the farmers; getting the farmers realised about the possible changes in productivity through technology intervention; building the confidence of farmers about scientific know-how; expanding the livelihood opportunities; building up the horticulture- based trained man power as an aid to small scale entrepreneurship; and lastly transforming tribal agriculture into sustainable horticulture to be realized with glaring success at national level.

With the intervention of CIH, Nagaland in establishing demonstration plots in different parts of northeast region, the total area under different horticulture crops has increased conspicuously. The Institute has established about more than 30 ha of demonstration plots, comprising the crops like fruits, vegetable, spices alongside citrus rejuvenation programme. The Institute supplied all inputs and technical guidance for establishing the demonstration plots. Details of demonstration trials implemented and planting material distributed to the farmers by CIH during the reported year is given in Table 41.

**Table 41. Details of demonstration sites at farmers field covering entire northeastern region**

Sl.no	Name of farmer	Place	Crop/ demonstration	Area (ha/ / No/unit)
		<b>2016-2017</b>		
1	Ms. Dziizienuo Meyase	Zubza, Kohima, Nagaland	Mango	1 ha
2	Mr. Neivilhou Kuotsu	Zubza, Kohima, Nagaland	Litchi	1 ha
3	Mr. Longbir Ingti	KarbiAnglong, Assam	Mango &KhasiMandrin	2 ha
4	Mr. Subhachandra	Thoubal, Manipur	Mango & Litchi	2 ha
5	Mr.Chozukhwu Nyekha	Bade Area Agri-allied Cooperation Society Ltd., Dimapur, Nagaland	Turmeric	1 ha
6	Mr. Tassaso Yun	Lohit district , Arunachal Pradesh	Citrus rejuvenation	1 ha
7	Mr. Akangmar	Mokokchung, Nagaland	Citrus rejuvenation	1 ha

### 3.2.2.1. Details of the impact of different technologies

#### 1. Organic cultivation of Turmeric

Turmeric is considered not only as one of the spices, but at an equally important a value added crop extensively cultivated by the farmers on commercial basis in entire northeastern region. The flavour also attains quite attractive in this region. Demonstration of organic cultivation of turmeric, variety Megha Turmeric-1 was undertaken in an area of 1 ha at Bade village by FPO (Farmer's Producer Organisation). FPO was formed under Bade Area Agri. & Allied Co-operative Society Ltd., Dimapur. Before the intervention of CIH, Nagaland, they were blindly engaged in traditional farming using primitive forms of agricultural practices. These famers were first trained at CIH, and after attending awareness and training programme on improved production technology of vegetables & spices organized by CIH, Nagaland. These efforts as a consequence of impact made them ultimately interested in implementing the demonstration to see the performance in their own field.

Activities such as Farmers Meeting and Field Visit during cropping season, low yield and incidence of insect pest and diseases of turmeric were identified as major issues at farmers level. In order to manage these problems, innovative and recommended practices were followed as new interventions during demonstrations programme. In case of recommended practices, crop rotation, field drainage, seed treatment, plant protection measures and proper cultural practices were followed.



## Constraints

- Lack of proper roads, as major handicap to reach to distant places of turmeric growing sites
- Total absence of knowledge on proper package of practices to be followed for value added response of turmeric production
- Lack of marketing and processing facilities make the objectivity of turmeric cultivation further cost- as well as labor- intensive

## Impact and Outcome

The demonstrations undertaken by the Institute have benefitted not only to the beneficiary, but also several other farmers as a trickle down impact on spontaneous term.

- In the first year, the total production under turmeric cultivation more 20 t/ha, which is surely higher than average productivity of turmeric.
- Many farmers who were initially reluctant to go for turmeric cultivation due to marketing problems have now started turmeric cultivation on a thumbing scale.
- With hands on training on production, post harvest management and value addition, keeping in mind, the demand by different markets, the farmers have now a good understanding on quality management of turmeric and in tune with latest development.

## 2. Rejuvenation of declining orchard of Khasi Mandarin

Though citrus is considered as native to northeast, but citrus faces multiple problems in its own home. Khasi Mandarin is one of the major fruit crop in Nagaland, and considered as the major mandarin producing state but the production has dropped down in the last 10-15 years due to aging of orchard, multiple soil fertility constraints and build up of many of the undiagnosed pest and diseases, besides the fact that entire citrus industry is raised on zero input, with the result, decline in productivity sets in, for which, growers remain always unprepared. Therefore, a great majority of orchards need to be subjected to intensive rejuvenation. Therefore, to revive the declining orchards, a rejuvenation programme was undertaken by the Central Institute of Horticulture during the year 2015-16. The programme was undertaken in Wokha districts of Nagaland and Karbi Anglong district of Assam, covering an area of 2 hectare. The calendar of operation recommended by ICAR-CCRI, Nagpur was adopted monthwise, with required adjustments to suit local conditions. Farmers of those areas were supported with training, plant protection chemicals, manual equipments, water retaining granules and water soluble fertilizers so that orchard recuperated from any ailment.

**Constraints:**

- Lack of convenient assessability via proper approach road to orchards, sometimes located at farm places from the actual place of sale.
- Majority of orchards are rendered old and unproductive orchards, their seedling origin nature also adding to the cause.
- Cultivation is predominantly confined on steep slopes, more vulnerable to soil erosion and eventually loss of top fertile soil.
- Application of manures, fertilizers and other cultural practices in orchards established on so steep slopes is almost like impossibility. Establishing orchards on half moon contours, or on broad terraces is so cost intensive, farmers are simply unwilling to invest so heavily on this account.
- Most of the orchards have exposed sub- surface since top fertile soil from these orchards is already eroded, setting huge set back to orchards productivity on a sustained basis.
- Absolute lack of proper marketing channels from sites of production to site of production to site of sale, value chain management is a bigger issue.
- Lack of postharvest management and processing of the fruits are almost irrelevant, but such we need intervention of secondary agricultural practices

**Impact and outcome**

The result proved fruitful as the rejuvenated trees started bearing normal fruits and shown sign of improvement in the last two years.

The rejuvenated garden gives excellent results and is stated below.

<b>Existing garden (Before)</b>	<b>Rejuvenated garden (After)</b>
Problem of trunk and shoot borer	Minimize the problem below ETL
Immature fruit drop	Successfully minimized
Lack of Technical know-how	Trained with latest technology
Poor plant growth	Plant growth improves sizably
Suffer drought like situation resulting poor return	Application of water holding granule and water soluble fertilizer shows excellent results
Nos. of fruits per plant – 300 (approx)	Nos. of fruit per plant – 800 (approx)
Cost per hectare – Rs. 15000/-	Cost per hectare – Rs. 60000/-
Price per fruit – Rs. 1.00	Price per fruit – Rs. 1.50 to 2.00
Net return – Rs. 90000/-	Net return – Rs. 300000/-

Taking baseline data of 2004-05, comparing them with data of 2015-16 as year of assessment, the average citrus productivity has increased significantly in all the northeastern states. The average citrus productivity has witnessed a significant increase from 1.6 to 4.7 tons/ha in Arunachal Pradesh, 8.2 to 10.6tons/ha in Assam, 4.1 to 8.4 tons/ha in Manipur and from 3.5 to 4.9 tons/ha in Tripura, suggesting further relevance of technology adoption and, thereby, the impact of the CIH.

**Table 42 :** Changes in area, production and productivity of khasi mandarin during 2008- 09 (Baseline information) versus 2015-16 (Year of Impact assessment) in the northeastern region.

States	Area (000ha)		Production(000 tons)		Productivity (tons/ha)	
	2004 - 05	2015-16	2004- 05	2015- 16	2004 - 05	2015- 16
Arunachal Pradesh	5.5	40.0	9.0	190.0	1.6	4.7
Assam	13.3	28.9	109.1	308.7	8.2	10.6
Manipur	2.2	11.3	9.0	96.0	4.1	8.4
Meghalaya	7.1	12.0	48.2	52.9	6.8	4.3
Mizoram	9.6	26.0	34.9	78.8	3.6	3.0
Nagaland	1.4	7.9	5.3	69.2	3.8	8.7
Sikkim	6.3	0.01	16.6	0.02	2.6	2.0
Tripura	12.7	13.4	44.5	66.1	3.5	4.9

*Based on National Horticulture Board Database*

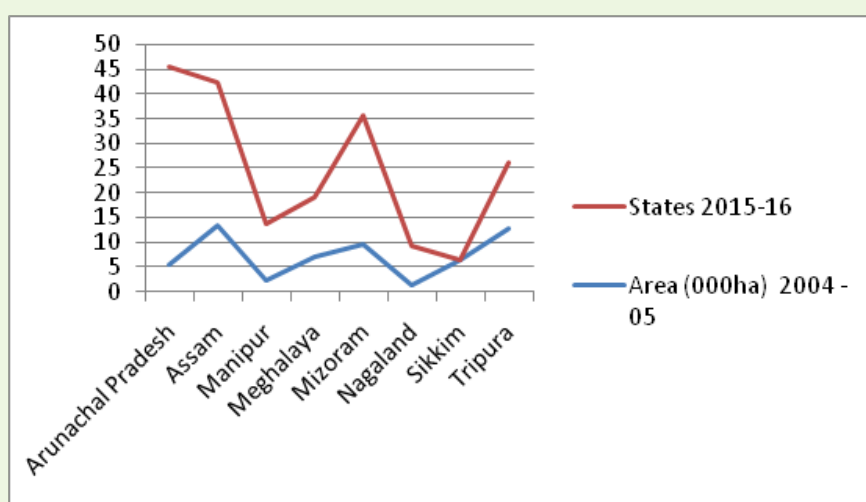


Fig. 36.. Changes in area under Khasi Mandarins during 2004-05 (Baseline data) versus 2015-16(Year of impact assessment)

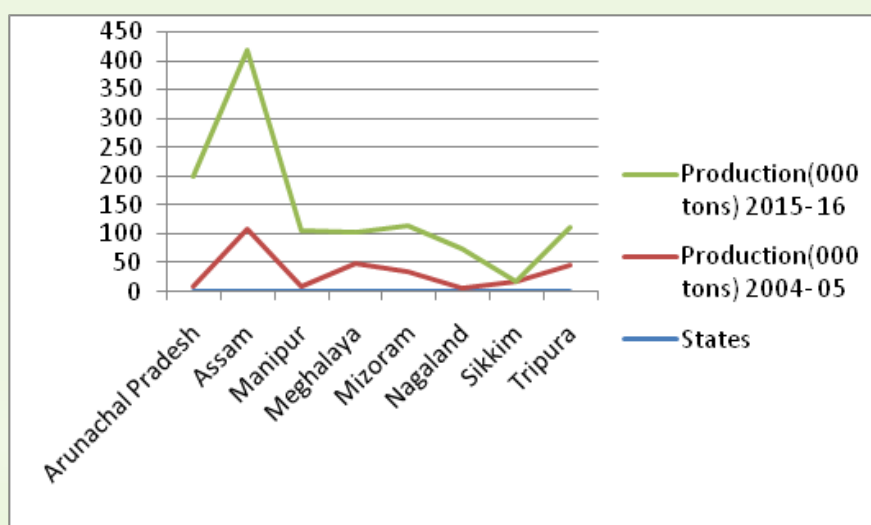


Fig. 37. Changes in production under Khasi Mandarins during 2004-05 (Baseline data) versus 2015-16(Year of impact assessment)



### 3.2.2.2. Socio economic status of farmers in North east region

The plain and valley land of Assam, Tripura, Manipur are suitable for most of the tropical and subtropical fruit crops like banana, pineapple, citrus, coconut, mango, jackfruit, papaya, litchi, guava etc. However, banana, pineapple, citrus, papaya, peas, plum, peach apple, etc are also widely grown in hills of Meghalaya, Mizoram, Manipur, Nagaland and Arunachal Pradesh. Arecanut, betelvine and several spice crops are grown throughout the region. Enormous variations of crops as well as practice of growing vegetables both in kharif and rabi are seen in the region. As per estimates of North Eastern Council, the region produces 23.44 lakh tonnes of fruits in 4.87 lakh ha area and 1.22 lakh tonnes of spices like turmeric, ginger, onion and chillies. In addition, about 25.36 lakh tonnes of vegetables are grown in about 2.0 lakh ha area. Among the fruit crops, banana is the most popular crop and grown in all N.E. states producing 714.3 thousand tonnes in 60.24 thousand ha area. In Arunachal Pradesh, wild and seedy banana are found in forest areas. The cultivation of pineapple is concentrated in Assam, Meghalaya and Manipur covering 37.87 thousand ha producing a total of 307.68 thousand tonnes.

Among the citrus crops, mandarin orange and lemon are of commercial types grown in all N.E. states, which cover an area of 71.88 thousand ha. But the area under mandarin orange is declining due to the problem of dieback and poor management. Regular and commercial cultivation of temperate fruits like plum, peach and peas are found in the higher elevation of Arunachal Pradesh, Mizoram, Manipur, Nagaland and Assam (N.C. Hills). Arunachal Pradesh has 5.1 thousand ha under apple cultivation mainly in the Kameng District where rainfall is around 900 mm. Other promising temperate fruits like walnut, almond, cashewnut is grown in Arunachal Pradesh and Tripura. Coconut and arecanut are the crops with high commercial value and these are grown mainly in Assam, Meghalaya and Tripura in an area of 1.10 lakh ha. There is enough scope for increasing farm returns through value-addition by use of efficient post-harvest management practices. The horticultural crops generate substantial marketable surplus for which adequate processing facility is necessary for value-addition and commercial trading. There is also need for storage, processing and marketing facilities, which are largely absent in the whole region.

#### 1. Technological Constraints

- Lack of suitable high-yielding varieties for diverse upland situations, flood affected areas, moisture stress conditions, and hill areas
- Improvement and standardization of production techniques of fruits and vegetable crops
- Use of improved post harvest management including pest and disease management and processing techniques for the major cash crops and horticultural crops
- Land and water management technique specifically for acid soils

- Economic packages for integrated farming systems combining crop cultivation with livestock, fishery, etc.
- The facilities of storage, processing and marketing are particularly deficient for perishable commodities.

## 2. Socio-economic Constraints

The N.E. India has diverse ethnic groups and social systems bound with customs and traditions. These factors clearly differentiate the type of economic activities and the economic status of the population, which inhibit the adoption of modern methods. Carefully prioritized strategies for

## 3. State-wise Farm Household Income

The table below provides the state-wise farm household incomes and their composition.

**Table 43. Income of Farm Households across different states**

States	Income from farming (Rs)	Income from livestock (Rs)	Income from non-farm business (Rs)	Income from wages/ salary (Rs)	Total annual income (Rs)
Arunachal Pradesh	77,785(64)	8,466(7)	10,919(9)	24,916(20)	1,22,086
Assam	50,521(63)	9,553(12)	3,078(4)	17,176(21)	80,328
Manipur	35,089(33)	18,470(17)	6,835(6)	45,743(43)	1,06,107
Meghalaya	77,354(54)	9,808(7)	10,888(8)	45,308(32)	1,43,358
Mizoram	54,729(50)	10,499(10)	314(0)	43,858(40)	1,09,400
Nagaland	38,545(35)	10,398(9)	740(1)	64,718(57)	1,14,401
Sikkim	20,350(24)	13,536(16)	11,986(14)	37,361(45)	83,233
Tripura	33,270(51)	3,684(6)	1,976(3)	26,187(40)	65,117

Source: NSSO, 2013

Note: Figures in brackets indicate the share of income component in total income

Among the states, farm households in Meghalaya, Arunachal Pradesh and Nagaland have the highest incomes while farm households in Tripura, Assam and Sikkim have the lowest total income. A farm household in Meghalaya earns INR 1,43,358 in a year or approximately INR 11,946.5 per month while a farm household in Tripura earn INR 65117 in a year or approximately INR 5,426 a month.

The rich resource base in the region such as mega bio-diversity, fertile soil, varied agro-ecological situations of plains as well as valleys, hills, immense water resources, human resources of ethnic diversity and cultural groups, could be potential sources of agricultural as well as economic development of the N.E. India. However, due to lack of appropriate strategies for development of natural resources, absence of coordination in programme implementation, weak geographical links and poor infrastructure facilities, the region is handicapped in catching up with the agricultural developmental pathways in tune with the national ethos. In this circumstance, agricultural sector needs prioritization of development perspectives for enhancing the adoption of recommended technologies through extension programmes, input supply, support of financial institutions and marketing functionaries. More crucially, the research and development programmes must address the problem of generation of need-based location-specific technologies for the specific agro-ecological situations .

### **3.3. Human resource development**

Training plays an important role in the advancement of human performance in a given situation. Training provides a systematic improvement of knowledge and skills which in turn helps the trainees to function effectively and efficiently in their given task on completion of the training. It is an essential component for successful dissemination and adoption process of any agricultural technologies. The training programmes are idealistically designed and conducted for inducing changes in the durable aspects of persons, changes in relationships and changes in action. The training strategies depend on the learning outcome the trainer seeks to achieve among their trainees. The training may be for improving the proficiency in the task performed or learning a process. The training modalities also need to be differentiated based on the requirement and type of organization which is imparting the training. Any training programme starts with identification of the training needs, followed by translation of training needs into objectives. Based upon the objectives, the contents of the programme are developed, taking into consideration the knowledge, skill and attitude elements needed to achieve each objective. Once the training contents or topics are decided, appropriate training methods suitable for each topic should be selected. Then, the topics have to be put in a particular sequence and complete course schedule with time and duration is to be decided.

The CIH imparts trainings to state govt. officials of horticulture department and farmers of all North East states as per the need of the state. The trainings are conducted in respective states by inviting renowned experts from different parts of the country along with the faculty of CIH.



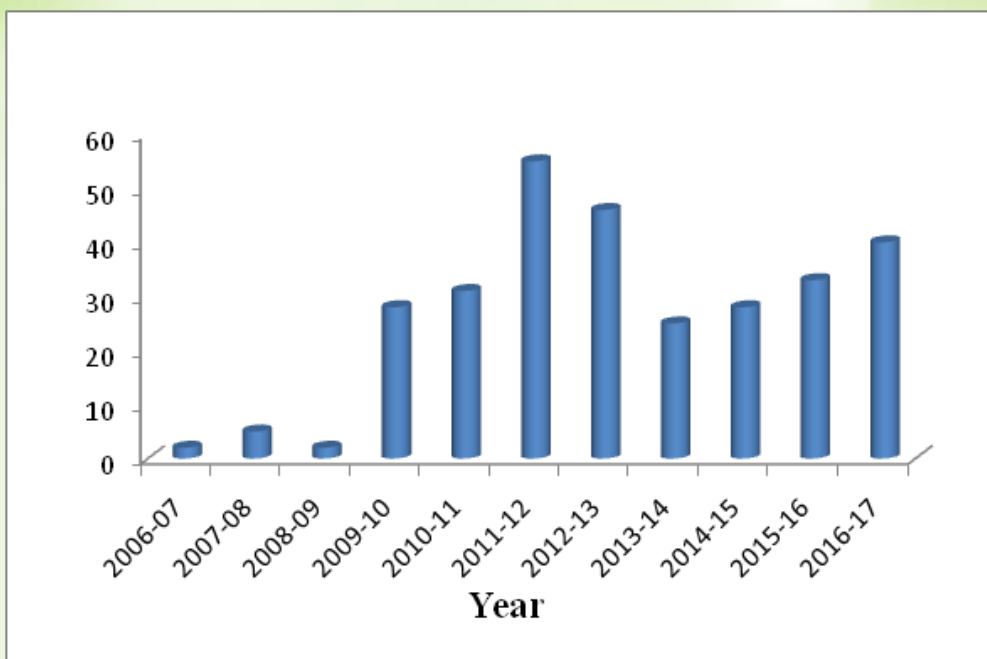
The institute has so far conducted **358** trainings out of which **295** trainings for farmers and **63** trainings for state government officials and extension functionaries in different states of North East, where about **19671** farmers and **2445** state government officials and extension functionaries have been trained in identified areas of horticulture for NER from 2006-2017 as shown in Table 44, Table 45 and Table 46 and Figure 38, Figure 39, Figure 40 and Figure 41.

**Table 44: Focus areas of trainings provided by CIH in NER**

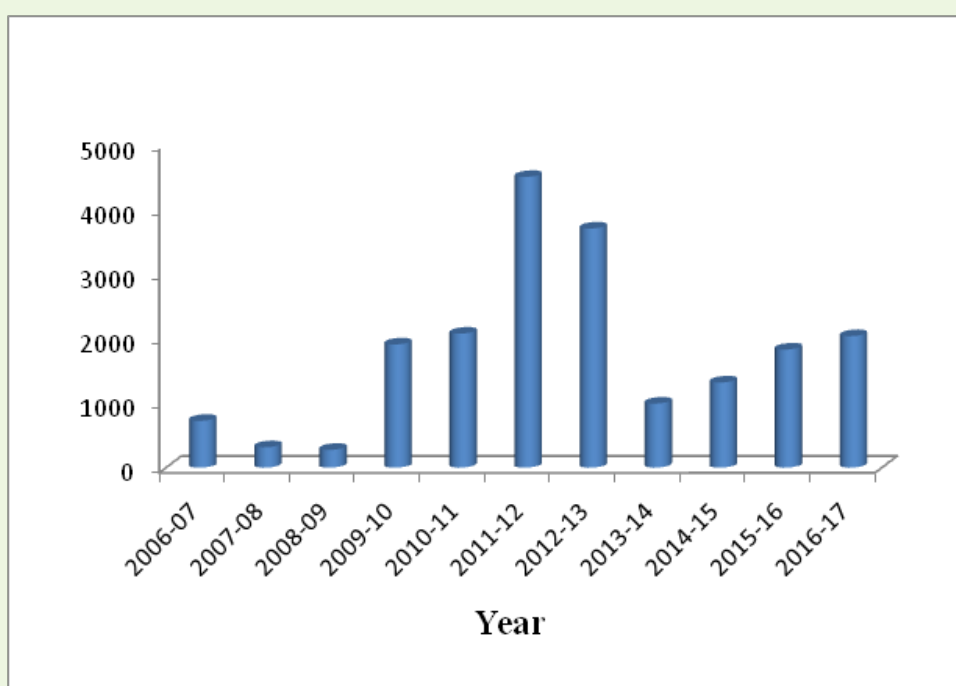
Sl. No.	Training Topics
1	Improved production technology of horticultural crops
2	Nursery management and quality planting materials production
3	High density planting and canopy management in fruit crops
4	Organic farming and certification of horticulture crops
5	Post-harvest management of horticultural crops
6	Protected cultivation and precision farming of horticulture crops
7	Value addition in horticulture crops
8	Supply chain and marketing linkages of Agri./Horti. Crops
9	Production technology of underutilized/underexploited horticulture crops
10	Integrated pest and disease management of horticulture crops

**Table 45: No. of farmers trainings, participants and states covered during 2006-17**

Year	No. of farmers Training	No. of participants	States where trainings conducted
2006-07	2	725	Nagaland
2007-08	5	315	Assam, Meghalaya, Arunachal Pradesh, Nagaland
2008-09	2	275	Nagaland & Mizoram
2009-10	28	1907	Nagaland, Meghalaya, Arunachal Pradesh, Tripura
2010-11	31	2074	Nagaland, Tripura, Meghalaya, Arunachal Pradesh, Sikkim, Mizoram
2011-12	55	4500	All NE states
2012-13	46	3702	All NE states
2013-14	25	991	Nagaland, Manipur
2014-15	28	1318	Nagaland, Tripura, Manipur
2015-16	33	1828	Meghalaya, Mizoram, Tripura, Sikkim, Manipur, Arunachal Pradesh, Nagaland
2016-17	40	2036	Meghalaya, Mizoram, Manipur, Arunachal Pradesh, Nagaland, Assam
<b>Total</b>	<b>295</b>	<b>19671</b>	



**Fig. 38. No of farmers training conducted (2006-17)**

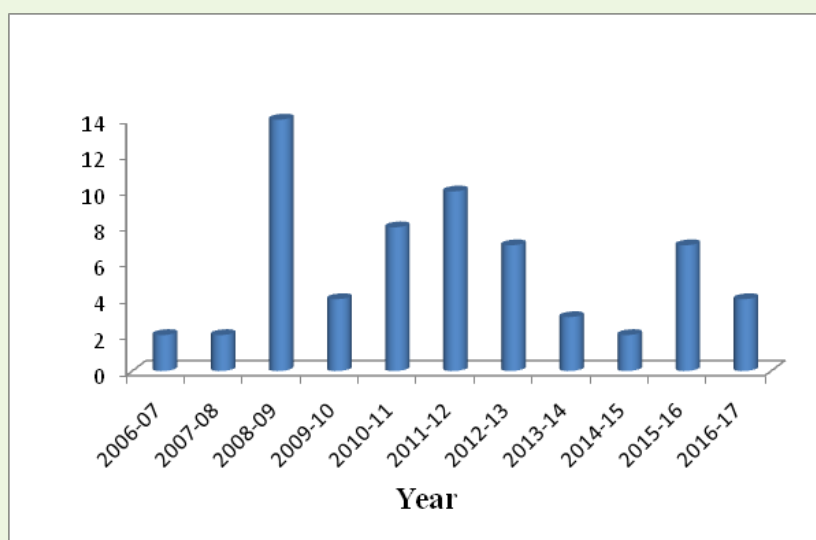


**Fig. 39. No of participants during farmers training (2006-17)**

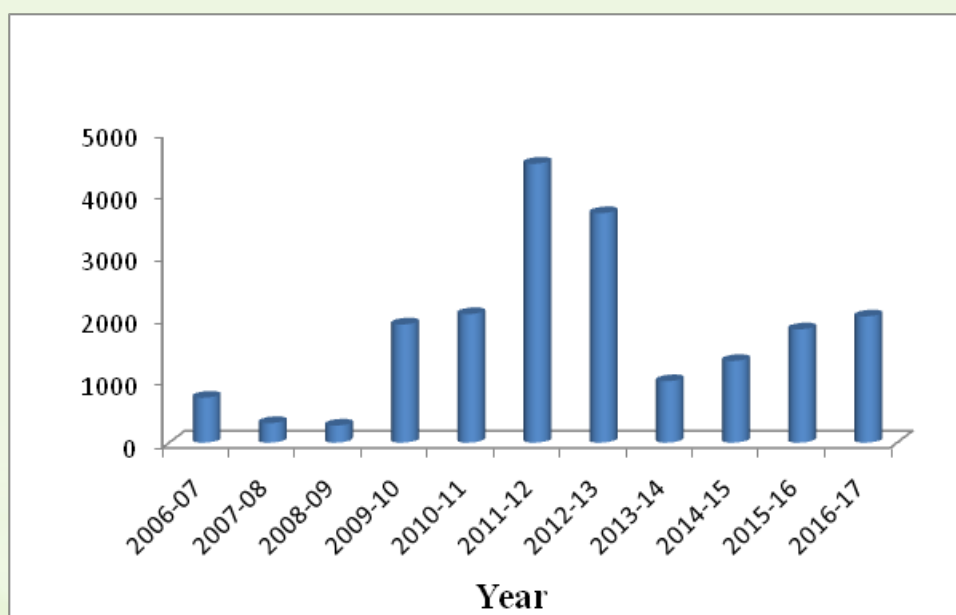
**Table 46: No. of trainers trainings, participants and states covered during 2006-17**

Year	Nos. of Training	Nos. of participants	States where trainings conducted
2006-07	2	102	Nagaland
2007-08	2	120	Assam
2008-09	14	551	All NE states

<b>2009-10</b>	4	139	Nagaland, Assam
<b>2010-11</b>	8	341	Nagaland, Assam, Tripura, Sikkim, Mizoram
<b>2011-12</b>	10	415	All NE states
<b>2012-13</b>	7	295	Nagaland, Assam, Tripura, Arunachal Pradesh, Meghalaya, Manipur, Mizoram
<b>2013-14</b>	3	51	Bangalore, Nagaland
<b>2014-15</b>	2	69	Nagaland, Assam
<b>2015-16</b>	7	201	Nagaland
<b>2016-17</b>	4	161	Nagaland, Tripura, Sikkim, Meghalaya
<b>Total</b>	<b>63</b>	<b>2445</b>	



**Fig. 40. No of Trainers training conducted (2006-17) in NER**



**Fig. 41. No of participants during trainers training (2006-17) in all NER states**



## 2. IMPACT EVALUATION

Impact evaluation refers to assessing the programme impact on the job performance of the participants. The response of the participants (Farmers/Trainers) were collected in 3-point continuum scale such as Very high utility (I), High utility (II) and Average utility (III) by assigning scores 3, 2 and 1 respectively.

Option (Response Category)	Score
Very high utility (I),	3
High utility (II)	2
Average utility (III)	1

The results were calculated as weighted score for each of the thrust area identified for the training

$$1. \text{ Training participation Index (TPI)} = \frac{x (\text{No. of actual participants})}{Y (\text{No. of target participants})} \times 100$$

$$2. \text{ Training utility index (TUI)} = \frac{X}{Y} \times 100$$

For this index we have to prepare questionnaire according to the number of questions we would like to have, where X = the marks score or the weighted mean score

$$Y = \text{No. of participants or the maximum possible score}$$

Eg. Question can be in terms of (Very High utility(3), High utility(2) and Average utility(1), so out of 100 participants if 40 ticked Very high utility, 50 ticked High utility & 10 ticked on Average utility than the weighted mean score will be =  $(40 \times 3) + (50 \times 2) + (10 \times 1) / 100$  (No. of participants)

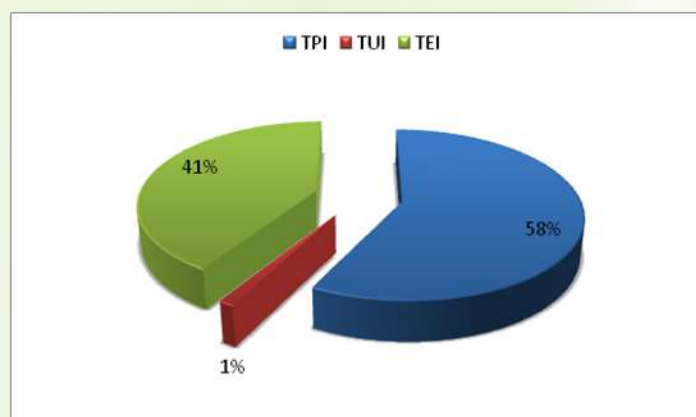
where utility index =  $1.2/3 \times 100 = 77\%$

$$3. \text{ Training effectiveness index (TEI)} = \text{TPI} \times \text{TUI}$$

Weighted score in the range of 3, 2 and 1 were ranked in each topic and the highest score was observed in High utility (2) followed by Very high utility (3) and the least was observed in Average utility (1) and the result of the analysis is presented in Table 47 and Table 48 and Figure 42 and Figure 43 which shows the impact of different topics of the training in farmers and trainers training in terms of Training participation index (TPI %), Training utility index (TUI %) and training effectiveness index (TEI %).

**Table 47 : Impact factor of farmers training programmes on different topics**

Sl. No.	Farmers Training	TPI (%)	TUI (%)	TEI (%)
1	Nursery management & propagation techniques in fruits & IPM in horti crops	185.60	2.05	126.53
2	Nursery Management & propagation techniques of fruit crops	101.00	2.19	73.67
3	Training on Mandarin in orange - cultivation and maintenance in Mizoram	100.00	2.07	68.89
4	Bee keeping for enhancing horticulture crop production	48.00	2.19	35.00
5	Advances in production technologies of focus horti. Crops	104.00	2.25	78.00
6	IPM of horti. Crops	100.00	2.10	70.00
7	Improved production technologies of organic farming	100.00	2.13	71.00
8	Hands on Demonstration Oyster Mushroom & cultivation & value addition of Horti. Crops	190.00	2.05	130.00
9	Winter crops cultivation	102.00	2.18	74.00
10	Advance in improved production technology in Apple	100.00	2.16	72.00
11	Training & Pruning in Kiwi	100.00	2.26	75.33
12	Nursery management & propagation techniques in Kiwi	100.00	2.32	77.33
13	Advances in production technology of major spice crops (Ginger, Turmeric & King chilli)	46.00	2.09	32.00
14	Post harvest handling of mandarin orange	110.00	2.09	76.67
15	Technological advancement in HDP & Canopy management for enhanced production in horti. Crops	112.00	2.16	80.67
16	Value addition of hort. Crops for livelihood	106.00	2.11	74.67
17	Advances in Integrated pests & diseases management in horticulture crops	108.00	2.11	76.00
18	Protection cultivation technology in vegetables/ flowers	108.00	2.11	76.00
19	Rejuvenation of declining orchard for quality fruit production	100.00	2.20	73.33

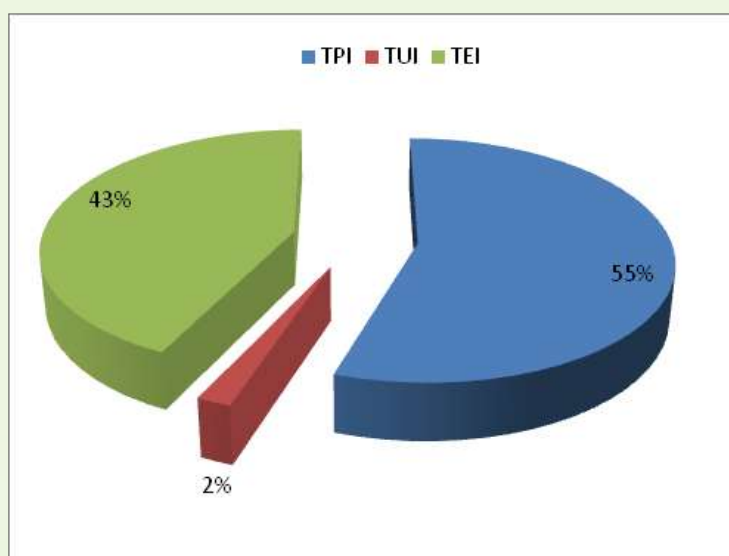


**Fig. 42. Percent Impact factor of farmers training programmes on different topics**

Where, **TPI**= Training Participation Index, **TUI**= Training Utility Index & **TEI**= Training Effectiveness Index.

**Table 48: IMPACT FACTOR OF TRAINERS TRAINING PROGRAMMES ON DIFFERENT TOPICS**

Sl. No.	Trainers Training	TPI (%)	TUI (%)	TEI (%)
1	Supply chain management & marketing of Horti. Crops	105.00	2.57	90.00
2	Advances in production technology of focus fruit crops	50.00	4.20	70.00
3	Production of quality planting material & accreditation of nursery of focus horti. Crops	105.00	1.00	35.00
4	“Production of quality planting material & accreditation of nursery of temperate fruit crops	100.00	2.25	75.00
5	Technological advancement in HDP & Canopy management for enhanced production in horti. Crops	87.50	2.14	62.50
6	Short term training in horticulture	25.00	4.20	35.00



**Fig. 43. Percent Impact factor of trainers training programmes on different topics**

Where, **TPI**= Training Participation Index, **TUI**= Training Utility Index & **TEI**= Training Effectiveness Index.



### 3. Improvement in socio-economic status of the farmers after the technical intervention imparted by CIH, Nagaland

#### 3.1 Impact of Technology Transfer

One of the important objectives of this evaluation is to assess how implementation of the new technologies benefited the farmers implementing the transferred technologies. The result indicated a number of positive impacts which is shown in Table 49 and Figure 44.

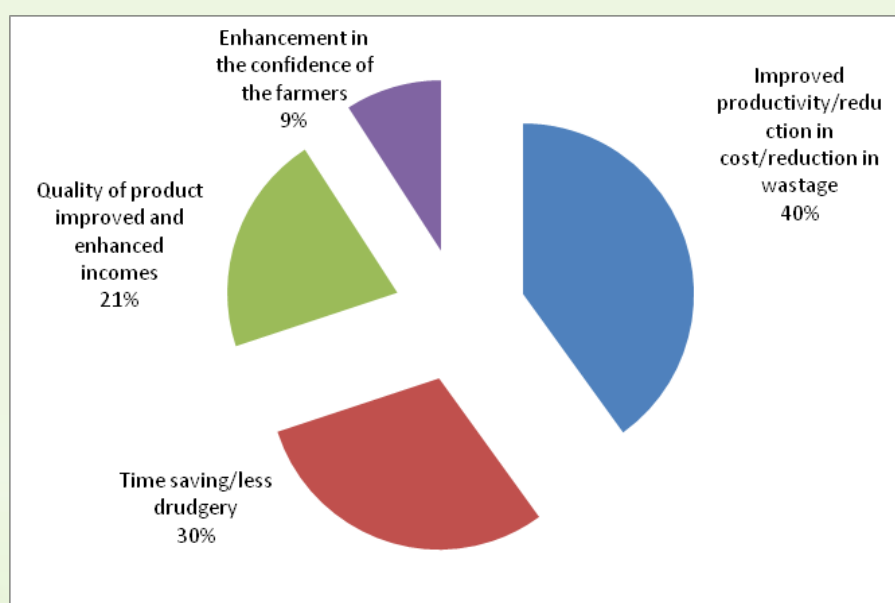
##### 3.1.1 Benefits from technologies transferred

Table 48: Presents the percentage distribution of technologies by types of outcomes of adoption of new technologies.

**Table 49. Impact of farmers adopting the technologies**

Type of impact	% of trainings imparted by CIH to have resulted in the impact	
	State govt. officials	NGO
Improved productivity/reduction in cost/reduction in wastage	40	52.8
Time saving/less drudgery	29.9	7.4
Quality of product improved and enhanced incomes	20.9	35.8
Enhancement in the confidence of the farmers	9.15	4
	100	100

According to the information provided by extension officers, 40 % of the technologies adopted resulted in higher productivity and reduction in cost and wastage. About 21% of the technologies led to quality improvement and enhanced income. 30% of the technology proves to be time saving and less labour intensive and therefore led to drudgery reduction. The remaining 9 % boost confidence among the farmers.



**Fig. 44. Major impact report on technologies disseminated (Total)**

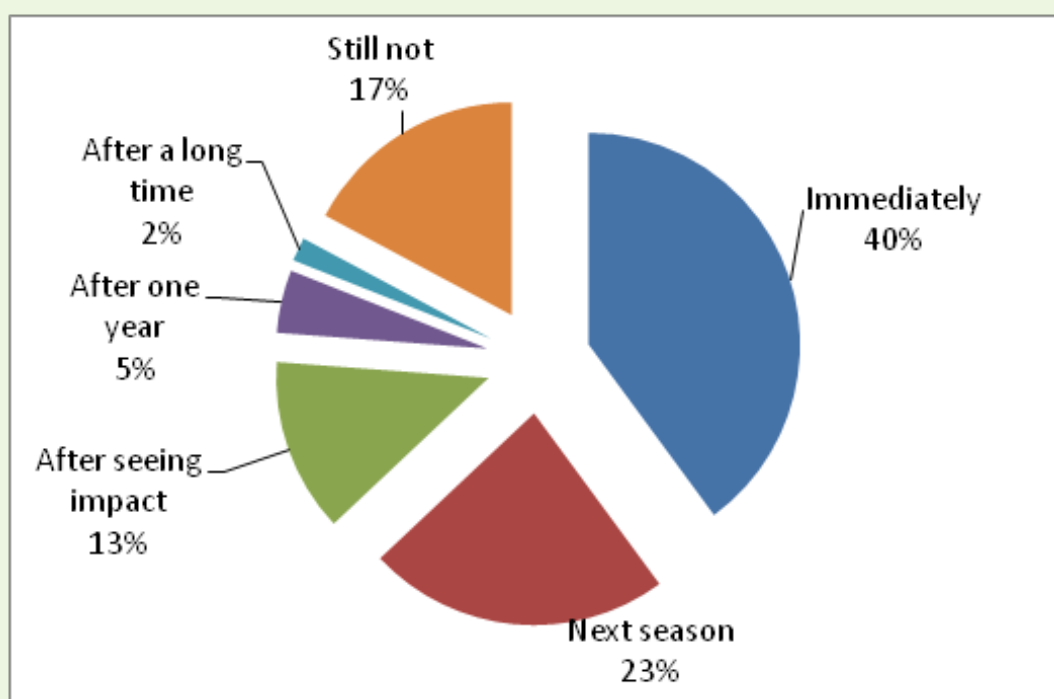
### 3.1.2. Adoption of technologies by farmers

To what extent did the farmers adopt the new technological knowledge acquired by them and how long it had taken to do so?

Table 50 and Fig. 45 seeks the answer to these questions.

**Table 50: Time taken by farmers with different sizes of land holding to adopt the new technologies**

Size of land holdings (ha)	Percentage of farmers with different size of land holding to adopt the new technologies						Total
	Immediately	Next season	After seeing impact	After one year	After a long time	Still not	
0.5 to 2.5	40.8	22.7	14.4	5.3	2.3	14.6	100
3 to 4.5	43.9	24	12.8	4.5	1.5	13.4	100
5 to 6.5	45.1	22.3	8.7	4.3	1.1	18.5	100
7 to 8.5	33.3	25.5	15.7	3.9	2	19.6	100
More than 10	34.9	22.9	10.1	3.7	0.9	27.5	100
All	39.9	23.1	13.2	4.8	1.8	17.2	100



**Fig. 45. Distribution of farmers by source of knowledge on new technology**

About 40 per cent of the farmers reported that they had implemented the technology soon after they learned it and about 23 per cent did so from next agricultural season. About 17 per cent had not yet implemented. Surprisingly, the proportion of those implementing immediately was higher among farmers with a holding upto 8 hectares than among farmers with large holdings. So was the proportion of those yet to be implemented.

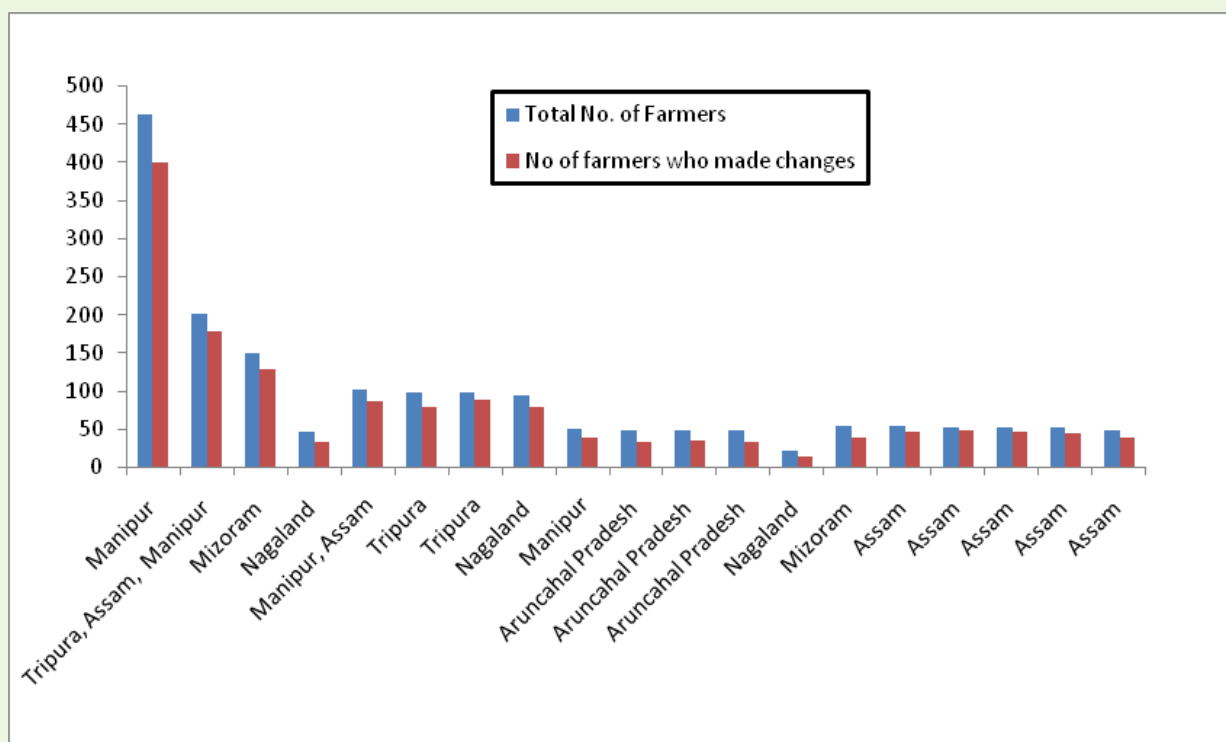
### 3.1.3 Changes in farming practices

In response to the question on whether there has been any changes in their farm practices during the year (2015-17), 75 per cent of the farmers stated that they had made some changes or the other. The most commonly reported changes were diversification of crops and changes in cropping pattern, and use of bio inputs like bio pesticide and bio insecticides. Some farmers reported changes in machinery used and water use pattern. It is represented in Table 51 and Figure 46.

**Table 51: Farmers who made changes in farming practices after attending the training programmes (2015-17)**

Sl. No.	Farmers Training (2015-17)	States	Total No. of farmers	No of farmers who made changes
1	Nursery management & propagation techniques in fruits & IPM in horti crops	Manipur	464	400
2	Nursery Management & propagation techniques of fruit crops	Tripura, Assam, Manipur	202	180
3	Training on Mandarin in orange - cultivation and maintenance in Mizoram	Mizoram	150	130
4	Bee keeping for enhancing horticulture crop production	Nagaland	48	35
5	Advances in production technologies of focus horti. Crops	Manipur, Assam	104	87
6	IPM of horti. Crops	Tripura	100	80
7	Improved production technologies of organic farming	Tripura	100	89
8	Hands on Demonstration Oyster Mushroom & cultivation & value addition of Horti. crops	Nagaland	95	80
9	Winter crops cultivation	Manipur	51	40
10	Advance in improved production technology in Apple	Aruncahal Pradesh	50	35
11	Training & Pruning in Kiwi	Aruncahal Pradesh	50	37
12	Nursery management & propagation techniques in Kiwi	Aruncahal Pradesh	50	35
13	Advances in production technology of major spice crops (ginger, turmeric & naga king chilli)	Nagaland	23	15

14	Post harvest handling of mandarin orange	Mizoram	55	40
15	Technological advancement in HDP & Canopy management for enhanced production in horti. crops	Assam	56	47
16	Value addition of hort. crops for livelihood	Assam	53	49
17	Advances in Integrated pests & diseases management in horticulture crops	Assam	54	48
18	Protection cultivation technology in vegetables/ flowers	Assam	54	45
19	Rejuvenation of declining orchard for quality fruit production	Assam	50	40
	<b>Total</b>		<b>1850</b>	<b>1383</b>



**Fig. 46. Total no. of farmers, No. of farmers who made changes in farming practices after attending the training programmes (2015-17) in all NE States**

### 3.1.4. Benefits accrued due to CIH interventions

Out of 1850 farmers covered by the survey, 1383 reported beneficial impact of interventions by CIH. The types of benefits included increase in production and income, better quality of produce, reduction in cost of inputs and other cost, access to self-employment and others. These are summarized State-wise in Table 52.



**Table 52: Distribution of farmers who have impact and type of impact after the intervention of CIH**

Types of Impact	States							
	Assam	Arunachal Pradesh	Mizoram	Nagaland	Sikkim	Tripura	Meghalaya	Manipur
Increase in production	28.93	37.74	31.46	27.56	30.11	28.87	30.6	33.6
Improvement in Quality	17.36	28.3	13.04	16.62	15.38	14.4	24.4	18.7
Reduction in cost	37.13	15.09	39.73	38.31	38.26	40.86	31.6	28.6
Increased income	11.51	7.55	11.16	13.42	12.03	13.07	5.4	10.4
Started self-employment	4.2	7.55	3.98	2.31	3.07	1.4	5.6	6.8
Others	0.89	3.77	0.62	1.78	1.15	1.4	2.4	2.6
Total	100	100	100	100	100	100	100	100

### 3.2 Impact on income and production

The farmers interviewed were asked to indicate if the training rendered by CIH ultimately led to increased production and incomes. Over one-third of farmers did not choose to respond to this question. However, among those who responded, a large proportion reported increase of over 10 per cent both in production and income as mentioned in Table 53.

**Table 53: Distribution of farmers who are reporting about changes in production and income**

State	Increase in	No of farmers reporting increase by				
		upto 5 %	5 to 10 %	10 to 20 %	More than 20 %	Total reporting
Assam	Production	23	43	102	114	282
	Income	27	47	95	127	296
Arunachal Pradesh	Production	8	37	75	135	255
	Income	15	31	59	104	209
Mizoram	Production	22	35	112	100	269
	Income	22	41	95	121	279
Nagaland	Production	13	37	97	154	301

	Income	16	31	85	106	238
Sikkim	Production	17	50	98	111	276
	Income	19	45	83	121	268
Tripura	Production	0	4	8	17	29
	Income	0	6	8	19	33
Meghalaya	Production	11	40	101	105	257
	Income	14	35	98	123	270
Manipur	Production	9	38	105	134	286
	Income	11	31	95	107	244

## FEEDBACK BY THE FARMERS AND OFFICIALS

The overall feedbacks from the trainees have been very positive. Some of the suggestion which has been suggested by the trainees during the various trainings are:

- Training duration to be increased especially for Trainers' Training.
- Inclusion of more practical based training and Field Visits.
- Training Manuals to be distributed.
- Conduct of more training at Village level as per the need of the locality.
- To include local as resource persons due to language barrier in farmers training

## ISSUES AND CHALLENGES

### ➤ **Poor women participation in training.**

Despite the fact that the participation of women has been encouraged, it has been encountered that very few women attend or participate in the training as compared to men.

### ➤ **Poor participation of progressive farmers.**

It has been found that only few progressive farmers attend the training/s. Due to reasons unknown, the farmers, either send their sons or daughters or even the laborers to attend the training.

### ➤ **Inaccessible/far away demonstration plots/ fields for field visits.**

Very often, during the course of the training, it has been encountered that the demonstration plot/field lies very far away from the site of the training thus wasting precious training/practical hour.

### ➤ **Lack of proper guest house and farmer's hostels.**

As trainings are conducted year round, the absence/lack of proper/permanent guest house and farmers hostel hinder proper conduction of training. Much of the efforts of the training seem to be spent on finding proper Guest Houses for resource persons or accommodation for the trainees.

➤ **Transportation**

Lack of proper transportation facilities for transportation of resource persons and trainees creates problem during trainings. The institute very often has to resort to hiring of private vehicles/buses. This problem is acutely felt especially during “on campus” training.

➤ **Irregular electricity.**

Erratic and irregular supply of electricity has been affecting the smooth conduction of trainings. Due to this problem the use of audio visual aids and training equipments are hindered.

➤ **Absence of a common language/dialect and local experts for effective conduction of training.**

The NER is a region of hundreds of languages and dialects. This rich lingual diversity sometimes creates problem especially during conduction of trainings as the trainer has to conduct the training with the help of a local interpreter. Very often, in a situation like this, the message gets lost in translation/interpretation.

➤ **Translation of study materials in local dialects.**

For easy understanding and grasping of knowledge, the study materials need to be translated into local dialects. Although efforts have started in this area, more study materials in many dialects needs to be translated so as to reach more farmers and cover more regions.

### 3.3.1. Farmers training

During 2016-17, the institute has organized 40 farmers training which were attended by 2036 farmers. The trainings were conducted in different areas of horticulture in different states of the region and as mentioned in brief below.

**Table 54. Farmers' training**

Sl/ no.	Topic	Date	Venue	No. of participants	Organized/ sponsored
1	Production technology of kiwi fruits and its management	18-19 <sup>th</sup> May, 2016	Ziro, Arunachal Pradesh	15	Organized
2	Value addition of horti. Livelihood	12 <sup>th</sup> July 2016	EEO Auditorium hall, Landing Thoubaldist. Manipur	50	in coll. with RAPA

3	Rejuvenation of declining orchard for quality fruit production	12 <sup>th</sup> July 2016	PheijaLeitong Community hall, Imphal East	50	in coll. with RAPA
4	Protected cultivation tech. of vegetables/ flowers	14 <sup>th</sup> July 2016	PheijaLeitong Community hall, Imphal East	50	in coll. with RAPA
5	Advance in Integrated pest disease management in horti.	5 <sup>th</sup> July 2016	BB Hall, Mayang, Imphal west	50	in coll. with RAPA
6	Advance in IPT of focus horti crops	16 <sup>th</sup> July 2016	BB Hall, Mayang, Imphal west	50	in coll. with RAPA
7	Approaches for Organic production in horti. Crops	2 <sup>nd</sup> Aug. 2016	Pabhoi, BiswanathChariali, Assam	50	in coll. with Pabhoi Greens,
8	Nursery management & propagation techniques of fruit crops	3 <sup>rd</sup> Aug. 2016	Pabhoi, BiswanathChariali, Assam	50	in coll. with Pabhoi Greens,
9	Vermicopmposting& use of biofertilizers	4 <sup>th</sup> Aug. 2016	Pabhoi, BiswanathChariali, Assam	50	in coll. with Pabhoi Greens,
10	Protected cultivation technology of vegetables/ flowers	5 <sup>th</sup> Aug. 2016	Pabhoi, BiswanathChariali, Assam	50	in coll. with Pabhoi Greens,
11	Value addition of horti. Livelihood	6th Aug. 2016	Pabhoi, BiswanathChariali, Assam	50	in coll. with Pabhoi Greens,
12	Value addition of horti. Livelihood	4 <sup>th</sup> Oct. 2016	RiBhoi, Meghalaya	50	in coll. with MBDA



13	Approaches for Organic production in horti. Crops	5 <sup>th</sup> Oct. 2016	West Jantia Hills, Meghalaya	50	in coll. with MBDA
14	Promotion of farmers producers organisation	6 <sup>th</sup> Oct. 2016	West Jantia Hills, Meghalaya	50	in coll. with MBDA
15	Protected cultivation tech. of vegetables/ flowers	7 <sup>th</sup> Oct. 2016	East Jantia Hills, Meghalaya	50	in coll. with MBDA
16	Technological interventions for reduction in post harvest losses	8 <sup>th</sup> Oct. 2016	East Jantia Hills, Meghalaya	50	in coll. with MBDA
17	Production & processing of Alovera for Value Addition	8 <sup>th</sup> – 9 <sup>th</sup> Nov. 2016	Chekeyie village, Nagaland	40	Organized
18	Approaches in organic production of horticulture crops	21 <sup>st</sup> Nov. 2016	Ziro-I, Arunachal Pradesh	50	Organized in coll. with DHO, Ziro, Arunachal Pradesh
19	Nursery management and propagation techniques of fruit crops	22 <sup>nd</sup> Nov. 2016	Ziro-II, Arunachal Pradesh	50	Organized in coll. with DHO, Ziro, Arunachal Pradesh
20	Vermicopmposting& use of biofertilizers	23 <sup>rd</sup> Nov. 2016	Raga, Arunachal Pradesh	50	Organized in coll. with DHO, Ziro, Arunachal Pradesh
21	Protected cultivation tech. of vegetables/ flowers	24 <sup>th</sup> Nov. 2016	Raga, Arunachal Pradesh	50	Organized in coll. with DHO, Ziro, Arunachal Pradesh
22	Value addition of horticulture crops for livelihood	26 <sup>th</sup> Nov. 2016	Raga, Arunachal Pradesh	50	Organized in coll. with DHO, Ziro, Arunachal Pradesh

23	Integrated pest and disease management of horticulture crops	12 <sup>th</sup> Dec. 2016	Tanghavill., Longleng, Nagaland	50	Organized in coll. with Agri. & Allied Cooperative Society, Dimapur
24	Improved production technology of vegetables	13 <sup>th</sup> Dec. 2016	Yonhsheivill., Longleng, Nagaland	50	Organized in coll. with Agri. & Allied Cooperative Society, Dimapur
25	Nursery management and propagation techniques	14 <sup>th</sup> Dec. 2016	Yongnyahvill., Longleng, Nagaland	50	Organized in coll. with Agri. & Allied Cooperative Society, Dimapur
26	Value addition of horticulture crops for livelihood	15 <sup>th</sup> Dec. 2016	Bhumnyuvill., Longleng, Nagaland	50	Organized in coll. with Agri. & Allied Cooperative Society, Dimapur
27	Technological interventions for reduction of post harvest losses in horticulture crops	16 <sup>th</sup> Dec. 2016	Orangkongvill., Longleng, Nagaland	50	Organized in coll. with Agri. & Allied Cooperative Society, Dimapur
28	Value addition of horticulture crops for livelihood	31 <sup>st</sup> Jan. 2017	Aizawl, Mizoram	50	Organized in coll. with AMFU
29	Approaches in organic production of horticulture crops	7 <sup>th</sup> Feb. 2017	Kolasib, Mizoram	50	Organized in coll. with AMFU
30	Promotion of farmers producers organisation	14th Feb. 2017	Champhai, Mizoram	50	Organized in coll. with AMFU
31	Protected cultivation technology of vegetables/ flowers	17 <sup>th</sup> Feb. 2017	Serchhip, Mizoram	50	Organized in coll. with AMFU

32	Technological interventions for reduction of post harvest losses in horticulture crops	23 <sup>rd</sup> Feb. 2017	Aizawl, Mizor-ma	50	Organized in coll. with AMFU
33	Oyster Mushroom, Kiwi, king chilli	6 <sup>th</sup> March 2017	Heningkunglwa, Peren	50	Organized in coll. with Dept. of Hort., Peren
34	Oyster Mushroom, Kiwi, king chilli	7 <sup>th</sup> March 2017	Orphanage Home, Peren	50	Organized in coll. with Dept. of Hort., Peren
35	Oyster Mushroom, Kiwi, king chilli	8 <sup>th</sup> March 2017	Old TesenVill., Peren	50	Organized in coll. with Dept. of Hort., Peren
36	Oyster Mushroom, Kiwi, king chilli	9 <sup>th</sup> March 2017	New TesenVill., Peren	50	Organized in coll. with Dept. of Hort., Peren
37	Oyster Mushroom, Kiwi, king chilli	10 <sup>th</sup> March 2017	Jalukie, Peren	50	Organized in coll. with Dept. of Hort., Peren
38	Scientific cultivation of Kiwi Fruits and its management practices	16 <sup>th</sup> March 2017	DRDA Conference Hall, Senapati	98	organized in coll. with Senapati District Agril. Society
39	Scientific cultivation of Kiwi Fruits and its management practices	17 <sup>th</sup> March 2017	DRDA Conference Hall, Senapati	81	organized in coll. with Senapati District Agril. Society
40	Scientific cultivation of Kiwi Fruits and its management practices	18 <sup>th</sup> March 2017	DRDA Conference Hall, Senapati	52	organized in coll. with Senapati District Agril. Society



## Glimpses of Farmers training



Fig. 47. Dr. Lallan Ram, Director, CIH along with the participants at Chekiye Village, Dimapur,



Fig. 48. Dr. Lallan Ram, Director, CIH delivering an address during a training at Biswanath Chariali, Assam



Fig. 49. Participants during a training programme at Thoubal district, Manipur



Fig. 50. Ms. Shisarenla Aier, Training i/c, CIH during a training programme at Ri Bhoi, Meghalaya



Fig. 51. Participants of training conducted at New Tesen Village, Peren District, Nagaland



Fig. 52. Training on promotion of farmers producers organization at Champhai, Mizoram



### 3.3.2 Trainers training

During 2016-17, the institute has organized 4 training for trainers which were attended by 161 officials. The trainings conducted are mentioned in brief below.

#### 1. Production technology of underexploited/underutilized horticulture crops at Medziphema, Nagaland

Three days trainer's training on "Production technology of underexploited horticulture crops" under the theme "Crops for the Future" was organized by Central Institute of Horticulture, DAC& FW, Ministry of Agriculture, GOI, Medziphema, Nagaland at Training centre, CIH, Medziphema from 29<sup>th</sup>-31<sup>st</sup> August, 2016.

The inaugural programme commenced with welcome address & a brief remark about the training which was delivered by Dr. Lallan Ram, Director, CIH. The resource persons were Dr. K.K. Jindal, UGC Emeritus Fellow, Retd. ADG Horticulture ICAR & Ex-Director of Research, UHF Solan, Himachal Pradesh & CAU, Imphal, Manipur, Dr. V.K. Verma & Dr. H. Rymbai, Scientist, ICAR Research Complex for Northeast Region, Umiam, Meghalaya. They delivered various topics on their field of expertise like Prospects and Strategies for production of higher quality Underexploited Temperate Fruits, Diversification of Underutilized Temperate Fruits in Sub-Temperate & Sub-Tropical Zones of NEHR, Underutilized Crops, Trends, Challenges & Opportunities in the 21<sup>st</sup> Century, Constraints & Strategies for the development of underexploited Horticulture Crops, Underutilized Vegetable & Spice Crops, Root & Tuber Crops & Underexploited Flowers of NER. Feedback forms were evaluated. Certificates along with reading materials were distributed to all the participants. Altogether 27 participants from 10 districts attended the training programme



Fig. 53. Dr. Lallan Ram, Director, CIH, Dr. K.K. Jindal, Resource person along with the participants of the trainers training at Medziphema, Nagaland

#### 2. Organic Farming & Certification of Horticultural Crops at Shillong, Meghalaya

Three days trainer's training on 'Organic Farming & Certification of Horticultural Crops' was organized by Central Institute of Horticulture, DAC, Ministry of Agriculture, GOI, Medziphema, Nagaland in collaboration with Directorate of Horticulture, Meghalaya at the conference hall of Directorate of Agriculture, Shillong, Meghalaya from 25<sup>th</sup> -27<sup>th</sup> October 2016, for the state Govt. officials of horticulture department, Govt. of Meghalaya.

The inaugural programme was chaired by Shri. L.K. Dkhar, Assistant Director & Training Coordinator, Directorate of Horticulture, Shillong, Meghalaya. Dr. N.K. Mohan, Chief

Consultant, CIH who was also the guest of honour deliberated that Meghalaya being a treasure groove of many horticulture crops including indigenous fruits and vegetables and varied agro climatic condition has a huge scope for organic production in a large scale. The resource persons were Dr. H.J. Barooah, Ex Director of Horticulture, Govt. of Assam, Ms M.S. Madhusmita Katoky, SMS, KVK, Kamrup, Assam, Mr. Kuntal Saha, Manager, One Cert-Asia, Kolkata and Dr. Chandan Hazarika, Director of post graduate studies, AAU, Jorhat. The topics imparted were Organic Farming: Opportunities & Challenges, Scope and Scenario in North Eastern Region along with practical case studies on On-Farm organic manure production, Botanical pesticides & Biocontrol of pest and diseases of Horticulture crops, Quality control standards and certification, Programme grantee system (PGS), Organic Certification Standards: NSOP, EU, Codes & IFOAM, Smaller Holder Group and ICS, Establishment of ICS, Importance and Benefits of ICS and preparation of Tracenet for data entry, Organic Marketing, Emerging opportunities in Organic Agribusiness of Horticulture crops in NER and Potential markets for Organic products. Certificates along with reading materials were distributed to all the participants. Altogether 51 participants attended the training programme.



Fig. 54. Dr. N. K. Mohan, Chief Consultant, CIH along with resource persons and participants of trainers training on at Shillong, Meghalaya.

### 3. Organic Farming & Certification of Horticultural Crops at Tripura,

Three days trainer's training on 'Organic Farming & Certification of Horticultural Crops' was organized by Central Institute of Horticulture, DAC, Ministry of Agriculture, GOI, Medziphema, Nagaland in collaboration with Directorate of Horticulture & Soil Conservation, Agartala Tripura and Horticulture research complex, Nagicherra, Agartala at the conference hall of Horticulture research complex, Nagicherra, Agartala from 19<sup>th</sup> -21<sup>st</sup> January 2017, for the state Govt. officials of horticulture dept. Govt. of Tripura.



Fig. 55. Participants along with resource person during trainers training at Tripura

The inaugural programme was chaired by Shri. Sudhriti Das, Assistant Director, Horticulture research complex, Nagicherra, Agartala, Tripura. The welcome address was delivered by Shisarenla Aier, Training Coordinator, CIH, Medziphema. The resource persons



were Mr. Kuntal Saha, Manager, One Cert-Asia, Kolkata, Mr. Anjan Sen Gupta, P.O & Head, Directorate of biotechnology, Deptt. of Science, Technology & Environment, Govt. of Tripura and Dr. Pranab Dutta, Scientist, Deptt. of Plant Pathology, AAU, Jorhat. Topics such as Quality control standards and certification, Programme grantee system (PGS), Organic Certification Standards: NSOP, EU, Codes & IFOAM, Smaller Holder Group and ICS, Establishment of ICS, Importance and Benefits of ICS and preparation of Tracenet for data entry, Emerging trends and advances in the field of biocontrol agents for control of disease and pest in organic farming, On-farm organic production of biocontrol agents & organic inputs were imparted to the participants during the training. Altogether 40 participants attended the training programme.

#### 4. Organic Farming & Certification of Horticultural Crops at Sikkim

Three days trainer's training on 'Organic Farming & Certification of Horticultural Crops' was organized by Central Institute of Horticulture, DAC, Ministry of Agriculture, GOI, Medziphema, Nagaland in collaboration with the Horticulture & Cash Crop Development Department, Govt. of Sikkim, at the SAMETI conference hall, Tadong, Gangtok, Sikkim from 15<sup>th</sup> -17<sup>th</sup> of March 2017, for the state Govt. officials of horticulture dept. Govt. of Sikkim.



Fig. 56. Participants along with resource person during trainers training at Sikkim

The programme was chaired by Shri. D. L Dahal, Joint Director, Horticulture & Cash Crop Development Department, Govt. of Sikkim, who also delivered the welcome address. The inaugural speech was addressed by Shri. D.K. Bandari, Mission Director, Horticulture & Cash Crop Development Department, Govt. of Sikkim. The resource persons were Mr. Kuntal Saha, Manager, One Cert-Asia, Kolkata, Dr. Sunil Kumar, Head, Deptt. of Horticulture, NEHU, Tura Campus, Meghalaya and Dr. Pranab Dutta, Scientist, Deptt. of Plant Pathology, AAU, Jorhat. The resource person imparted training on various topics covering organic Certification, Programme grantee system (PGS), Organic Certification Standards: NSOP, EU, Codes & IFOAM, Establishment of ICS, Importance and Benefits of ICS and preparation of Tracenet for data entry, biocontrol agents for control of disease and pest in organic etc. The participants also expressed their gratitude to the institute for conducting such intensive and practical oriented training programme and requested CIH to conduct similar training programme in the near future. Certificates along with reading materials were distributed to all the participants. Altogether 43 participants attended the training programme.

**Table 55. Trainers' training**

Sl/ No.	Topic	Date	Venue	No. of participants	Organized/ sponsored
1	Production Technology of Underexploited Horticulture Crops	29-31 <sup>st</sup> Aug. 2016	CIH, Medziphema	25	organized
2	Organic farming & certification of Horticultural crops	25-27 <sup>th</sup> Oct. 2016	State horti., Meghalaya	51	organized
3	Organic farming & certification of Horticultural crops	19-21 <sup>st</sup> Jan 2017	HRC, Nagicherra, Agartala, Tripura	40	organized
4	Organic farming & certification of Horticultural crops	21-23 <sup>rd</sup> March 2017	Gangtok, Sikkim	45	organized
	<b>Total</b>	<b>4</b>		<b>161</b>	

### 3.3.3. Capacity building

#### 3.3.3.1 Training programme on MS-Word (using –Office-2016) at ISTM, DOPT, New Delhi

Ms. Imtinaro Jamir, PA to Director underwent a training programme on MS-Word (using –Office-2016) from 14<sup>th</sup> -16<sup>th</sup> Dec., 2016 organised by Institute of Secretariat Training & Management (ISTM), DOPT, New Delhi.

#### 3.3.3.2 Skill development programme at NIRD, Guwahati

Mr Prabin Das, Marketing Specialist and Mr. Arvind Singh, Technical Consultant, CIH participated in 3 days Skill development programme at NIRD, Guwahati w.e.f. 10-12 November 2016. The programme was organised by Agriculture Skill Council of India, Gurgaon. The participants were given through knowledge on how to run and manage Skill Development courses in their respective institute/organizations.

#### 3.3.3.3 Skill development programme at NIRD, Guwahati

Mr. Arvind Singh, Technical Consultant, CIH attended one day training on RTI online portal development at CSOI, Vinay marg, New Delhi on 18<sup>th</sup> Feb. 2017.

### 3.3.4. Exposure trip

CIH conducts exposure trips cum trainings for the officials, farmers and SHGs of North East Region at regular intervals to various reputed Institutions and Research centres in the country. The main objective is to build and strengthen their capacities and help them to sharpen their skills and ability. During the year 2016-17, the Institute has conducted **4 nos** of exposure trips cum trainings for the farmers of NER in different high tech horticulture programmes.



### 3.3.4.1 Exposure trip cum training of Phek farmers of Nagaland to Ziro, Arunachal Pradesh

Two days exposure visit cum training on “Production technology of Kiwi fruits & its Management practices” was conducted for Phek District farmers by Central Institute of Horticulture (CIH), DAC & FW, Ministry of Agriculture & Farmers Welfare, Medziphema, Nagaland on 18<sup>th</sup> & 19<sup>th</sup> May 2016 at Ziro, Arunachal Pradesh. The programme was organized to equip the farmers with the advanced production technologies and post harvest management practices of Kiwi fruit for better income generation. Altogether 15 Kiwi growers attended the programme. The programme was coordinated by Ms. Shisarenla Aier, Asst. Horticulture Specialist & Training i/c, CIH, Medziphema.



Fig. 57. Nagaland farmers during the 2 days Training cum Exposure visit to Ziro, Arunachal Pradesh on Production technology of Kiwi fruits & its management practices.

### 3.3.4.2. Exposure trip cum training of Meghalaya farmers to CIH, Medziphema, Nagaland

5 Days Exposure cum farmers' training on “Technological Interventions for Reduction in Post-harvest losses in Horticulture Crops & Protected Cultivation Technology in Flowers” was organized by Central Institute of Horticulture, DAC, Ministry of Agriculture, GOI, Medziphema, Nagaland in collaboration with the Office of District Horticulture Officer, East Khasi Hills, Shillong, Meghalaya at the CIH, training hall from 1<sup>st</sup> -5<sup>th</sup> November 2016, for the farmers of East Khasi Hills, Shillong, Meghalaya. The trainees were imparted training on the Basics of Greenhouse, Site selection & Greenhouse construction, Irrigation System & Fertigation in ornamentals, Cultivation practices of Flowers, Harvesting, Packing & Marketing of Flowers and Field visit to flower units was conducted. Field visit to Organic Pineapple Farm at Molvom Village under Medziphema, Block, Nagaland Bamboo Mission Board, 4<sup>th</sup> Mile Dimapur, Nagaland Beekeeping & Honey Mission, 4<sup>th</sup> Mile Dimapur and Aloe vera Farm at Chekiye Village, Dimapur were visited to appraise entrepreneurial skills in farmers and on the 5<sup>th</sup> day visit to Kisama, The Heritage Village under Kohima District and Kohima War Cemetery were conducted. Altogether 29 participants attended the training programme along with 3 Horticulture Development Officers from East Khasi Hills, Meghalaya.



Fig. 58. Five days Training cum exposure visit to CIH, Medziphema, Nagaland by Meghalaya farmers

### 3.3.4.3. Exposure trip cum training of Sikkim farmers to Jaipur, Rajasthan

Central Institute of Horticulture under the Department of Agriculture Cooperation & FW, Ministry of Agriculture and FW, Govt. of India as a part of its vision to promote transfer of technology for better production and productivity organized a subject oriented exposure trip for 20 farmers and entrepreneur of Sikkim state to enhance skills for income generation so as to improve livelihood at Manesh Agro Engineering & Technology, Kotpuli, Jaipur, Rajasthan from 12<sup>th</sup> to 15<sup>th</sup> February, 2017 on ‘Advances in Production & processing of Aloe Vera with hands on demonstration on preparation of soap making, shampoo, juice and various value added products from Aloe vera and Amla were also shown. Field visits were also conducted. Exposure tour to Jaipur city was also conducted where various historical sites like Amer fort, Hawa Mahal, Jal Mahal and Albert Hall was visited by the participants.



Fig. 59. Sikkim farmers during the 4 days Training cum Exposure visit to Jaipur, Rajasthan on Advances in production and processing of Alovera.

### 3.3.4.3. Exposure trip cum training of Nagaland and Meghalaya farmers to Odisha, Bhubhaneswar

Two days Training cum Exposure Trip on “Advances in Production and Processing of Cashewnut” was organised by CIH, DAC & FW, Medziphema, Nagaland for the farmers of Nagaland and Meghalaya state at Odisha State Corporation Development Ltd., Odisha, Bhubaneshwar w.e.f 24<sup>th</sup> – 25<sup>th</sup> March 2017. The resource persons during the technical session were Dr. P.C. Lenka, Professor, Horticulture (Retd.), O.U.A.T, Bhubaneswar, Mrs. Kabita Sethy, Horticulturist, AICRP on Cashew, O.U.A.T, Dr. P.K. Panda, Horticulturist, AICRP on cashew, O.U.A.T and Dr. S. Mukharjee, Associate Professor & Head, AICRP on cashew, O.U.A. The farmers were also taken to an exposure visit to Processing units, Nursery units and Solar high-



density plantations areas. Certificates along with reading materials were distributed to the all the participants. Altogether 20 participants attended the training programme accompanied by one CIH official Mr. Eliyamo Humtsoe, FA.



Fig. 60. Nagaland and Meghalaya farmers during the 2 days training cum exposure visit to Odisha, Bhubaneswar on Advances in production and processing of Cashewnut.

### 3.4. Agri-business promotion

#### 3.4.1 Participation in exhibitions, trade fairs, meets.

##### A. Participated in International Agriculture & Horti Expo at New Delhi

Central Institute of Horticulture, Nagaland participated in International Agriculture & Horti Expo which was held in Pragati Maidan, New Delhi w.e.f. 22-24 July, 2016. The event was organized by NNS Media Group. The activities and programmes of the Institute were highlighted through display materials and print media. The focus horticulture crops of the North East region were being showcased in CIH stall. A number of farmers enquired on issues related to quality planting material, production, post-harvest management, protected cultivation & marketing and the technical staffs provided the required information.



Fig. 61. CIH stall in International Agriculture & Horti Expo

##### B. Participation in Agriculture & Horticulture Entrepreneurship Development in North East Region at Guwahati, Assam

The Institute participated as an exhibitor in Agriculture & Horticulture Conclave which was held at NEDFI House, Guwahati, Assam on 19<sup>th</sup> & 20<sup>th</sup> October, 2016. The event was organized by Ministry of Agriculture & Farmers Welfare. A host of exhibitors and participants under the agriculture ministry and other stakeholders participated in the exhibition and seminar. The exhibition was inaugurated by Shri. S.K. Pattanayak, Secretary, DAC&FW on 20<sup>th</sup> October 2017. The 2 days seminar deliberated on several issues related to planting material availability, production, organic farming, supply chain management and marketing and recommendations were made to streamline and uplift the horticulture sector in North East.



Fig. 62. Shri. S K Pattanayak, Secretary, DAC&FW visiting CIH stall



Fig. 63. Plenary session of the seminar

### C. Participation in Field Day cum Farmers-Scientist Interaction at ICAR, Nagaland

A one day Field Day cum Farmers-Scientist Interaction was organized by ICAR-NEH, Nagaland centre on 27<sup>th</sup> October 2016 where the Institute participated as an exhibitor. The programme was inaugurated by Dr. Benjongliba Aier, Hon'ble Parliamentary Secretary, Agriculture, Govt. of Nagaland.



Fig. 64. Dr. Benjongliba Aier, Parliamentary Secy., GoN, interacting with Director, CIH



Fig. 65. Dr. Lallan Ram, Director, CIH during the Inaugural programme

The activities and programmes of CIH, Nagaland were highlighted during the event. The exhibits for display included planting material produced in the Institute, horticulture crops (fruits, vegetables & flowers) cultivated in CIH demonstration plots, various publication materials including folders on improved production technologies of horticulture crops. The farmers interacted with the technical staffs and enquired on several crops related issues during the event.

### D. Participation in Horti India at Noida, Uttar Pradesh

Central Institute of Horticulture, Nagaland participated in Horti India from 9<sup>th</sup> – 10<sup>th</sup> February, 2017 at Horticulture Technology Park, Greater Noida, UP. The event was organized by Institute of Horticulture Technology, Greater Noida and co-organized by Ministry of Agriculture & Farmers Welfare. The Workshop cum Exhibition event focused on “Conventional and Alternative Horticultural Production Systems”. A variety of exhibits were displayed by the Institute and information on advanced technologies in horticulture were given to the farmers during the event.



Fig. 66. CIH stall in Horti India at Horticulture Technology Park, Greater Noida, UP



Fig. 67. Farmers interacting with resource persons during the workshop



### 3.5. Post harvest management

The North east region cultivates a number of fruits and vegetables crops that gives the huge quantity of the produce. Even though the region produces enormous amount of horticultural commodities but, due to lack of suitable post harvest management practices it leads to severe post harvest loss. To create awareness on post harvest management practices, the Institute carried out several activities on shelf life extension, product development and post harvest operation in the farm and polyhouses during 2016-17. The details of the activities are mentioned below.

#### 3.5.1. Guava:

**Extending storage life:** The ripened fruits of guava cvs. Allahabad Safeda, L-49, Lalit and Shweta were harvested from the Institute's farm and were stored under ambient temperature ( $28\pm4^{\circ}\text{C}$ ) and cold storage ( $8^{\circ}\text{C}$ ). Among the cultivars stored in ambient condition, Allahabad Safeda showed maximum shelf life of 4.5 days, whereas, the cultivar L-49 could be stored up to 11.6 days without affecting the quality in significant amount in the cold storage.

#### 3.5.2. Gerbera:

**1. Extending storage life:** Gerbera flowers cv. Shaina was kept in five different treatment viz., tap water, distilled water, 2% sucrose solution, 20 ppm silver nitrate and 2% sucrose solution+20 ppm silver nitrate and stored under ambient condition. It was observed that flowers kept in 2% sucrose solution+20 ppm silver nitrate, obtained maximum vase life of 12.5 days.



Fig. 68. Gerbera flower kept in different treatments

#### 2. Gerbera flower under ambient storage

Gerbera flowers c.v. Shaina was kept in five different treatment viz., tap water, distilled water, 2% sucrose solution, 20 ppm silver nitrate and 2% sucrose solution+20 ppm silver nitrate under cold storage. The result suggested that flowers kept in 2% sucrose solution+20 ppm silver nitrate solution showed maximum vase life (21.5 days).



Fig. 69. Gerbera flower in under cold storage

### 3. Gerbera flower in tap water under ambient storage

An experiment was conducted to study the vase life of eight different cultivars of gerbera flowers using tap water under ambient storage condition. The experiment was performed at CIH laboratory. The cultivars used in the trial were Ice queen, White house, Pre Intezz, Diakan, Paradise, Jaffna, Lieke and Zingaro. It was found that among the different cultivars, Paradise obtained maximum vase life of 12.33 days.



Fig. 70. Different cultivars of Gerbera kept under tap water

#### 3.5.3. Anthurium:

**Extending storage life:** To study the vase life of Anthurium, four cultivars Xavia, Tropical, Moment and Pistachi were harvested from the polyhouse. After harvesting, the flowers were kept in conical flask containing tap water under ambient condition. The maximum vase life of 25 days was observed in cv. Pistachi among the four cultivars.



Fig. 71. Anthurium flower under ambient storage

#### 3.5.4. Strawberry

**1. Jam:** Strawberry jam was prepared by using the pulp of five cultivars namely, Winter Dawn, Sabrina, Barak, Hadar and Gili. The fruits were collected from Institute's farm. The stem and calyx was removed, de-stemmed fruit was washed and chopped. Sugar, citric acid and gelatin was added and cooked in heat by frequent stirring. Thereafter, sodium benzoate was added and mixed thoroughly when the mass of strawberry reached at TSS level 68 °B, cooking was stopped. The hot mass was filled in pre-sterilized glass jar and covered with lid. The filled glass jar was pasteurized at 85 °C for 30 min and stored in the refrigerator.



Fig. 72. Strawberry jam



**2. Wine:** Ripened strawberry was harvested from the CIH farm. After harvesting, the fruits were de-stemmed and washed by using tap water. The fruits were crushed and sugar was added to increase the TSS of crushed must up to 20° B, then 5 gm baker yeast (granular form) were inoculated and mixed. The inoculated must was filled in a glass bottle of volume up to  $\frac{3}{4}$ , covered with muslin cloth and tied with rubber band and kept for fermentation for 7 days at ambient temperature ( $25\pm 3^{\circ}\text{C}$ ) then siphoned and kept for maturation. The matured wine was filtered by using muslin and pasteurized at  $62^{\circ}\text{C}$  for 20 minutes and bottled. The crushed must was 2.56 kg and obtained strawberry wine was 850 ml and recovery percentage was nearly 33 %.

### Steps in strawberry wine preparation



Fig. 73. Harvested strawberry



Fig. 74. washed strawberry fruit



Fig. 75. De-stemmed strawberry



Fig. 76. Crushed strawberry must with incubated yeast



Fig. 77. Strawberry must filled in glass bottle and covered with muslin cloth



Fig. 78. Siphoned and kept for maturation



Fig. 79. Filtered wine



Fig. 80. Pasteurization of strawberry wine



Fig. 81. Strawberry wine

### 3.5.5. Post harvest activities in farm and polyhouse

**1. Banana:** Banana cv. Grand naine is harvested after 8-10 months of planting. The angularity of the fingers is taken as the index for maturity and the bunches are harvested when the

angularity disappear in the upper two rows of fingers. The weight of a single whole bunch is around 12.77 kg. The banana bunches are harvested with the help of Naga dao and then packed in corrugated fibre box.



Fig. 82. Accessing maturity of banana fruits



Fig. 83. Harvested banana bunch



Fig. 84. Banana bunch packed in CFB with paper cushion

**2. Guava:** The budded, grafted and layered plant usually bears the fruits at the age of 2-3 years. The plants may bloom all round the year in mild climates. Winter fruit has more flavour and sweet compared to summer and rainy season fruit. The fruit matures in between 90-150 days after the flowers bloom. The fruits are harvested when it changes its colour from deep green to light yellowish green and harvested fruits are collected in plastic crates. The TSS of the harvested fruits lies in between 8-10° B.



Fig. 85. Harvesting and collection of guava



Fig. 85. Harvesting and collection of guava

**3. Mango:** The mango trees starts bearing fruits at age of 3 years onward. The fruit setting is observed in the month of February and fruit reaches the shoulder stage at the end of June. The fruits are harvested with the help of secateurs in the month of June. Harvested fruits were collected in plastic crates and kept for latex removal. The analyzed soluble solid of the fruit is 15.20 °B.

**4. Pineapple:** Pineapple fruit matures in 140-150 days after flowering. The fruits are harvested when the peel colour turns from green to yellow at the base of the fruit. Harvesting of the fruits is done by using sharp knife (Naga Dao) leaving 2-3 cm stem intact in the fruit. After harvesting, fruits are stored in the plastic crates and loaded in the wooden cart to deliver the fruits in the packhouse. The fruit weighs around 1.80 kg with TSS of 16.7 °B.



Fig. 87. Mango fruits collected in plastic crates



Fig. 88. Harvesting of pineapple



Fig. 89. Pineapple harvested & collected in plastic crates



**5. Strawberry:** Strawberry vine bears fruits after 150-170 days after transplanting. Harvesting is done when the colour of the fruit changes from white to red. The weight of the fruit and TSS is 9-20 g and 5-8 °B respectively. The ripened fruits can be kept fresh up to 5 days in the cold storage at a temperature of 32° F.



Fig. 90. Strawberries harvested & collected in Plastic baskets

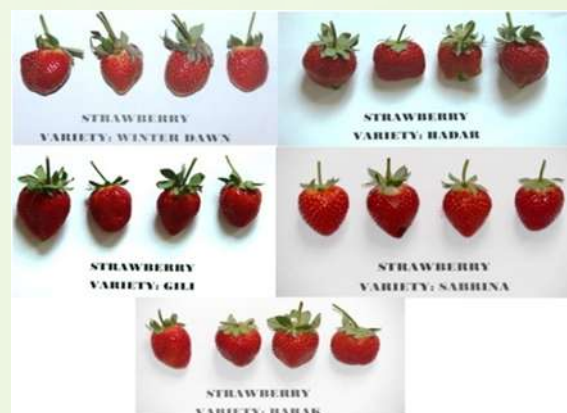


Fig. 91. Different cultivars of strawberry grown in CIH

## 6. Capsicum:

Harvesting of capsicum fruits is done after 60 to 75 days after transplanting. Harvested capsicums are collected in plastic crates after which cleaning, sorting and grading were done. The weight of a single capsicum fruit is around 25-30 g.



Fig. 92. Harvesting of capsicum leaving 2 cm stem attached in fruit

## 7. Tomato:

Tomato fruits are harvested at 60-65 days after transplanting. The harvested tomatoes were collected in plastic crates thereafter sorting and grading was done based on visual appearance. The weight and total soluble solids is 36 g and 3.2 °B respectively.



Fig. 93. Harvesting of tomato

## 8. King chilli:

King chilli is harvested when it obtains the optimum size and when the colour of the fruit turns from green to red or yellowish.



Fig. 94. King chilli harvested & collected in baskets

## 9. Anthurium:

In Anthurium, flowering starts at 6 months after planting. The flowers are harvested when colour changes is observed and is harvested from the base to the tip of the spadix by using secateurs leaving 3 cm stem on the mother plant. After harvesting flowers were conditioned, trimmed and packed in CFB boxes and delivered in the market.



Fig. 95. Harvesting of anthurium flower

**10. Chrysanthemum:** Chrysanthemum starts flowering after 3 months of the planting. The chrysanthemum flowers were harvested when 2 - 3 rows of rays florets were perpendicular to the flower stalk. Harvested flowers are carried to the packhouse by wooden cart. Thereafter, conditioning were done and packed in CFB boxes.



Fig. 96. Harvesting of cut chrysanthemum

**10. Gerbera:** Harvesting of Gerbera flower is done after 4 months of planting. Harvesting is done when the outer 2-3 rows of disc florets were perpendicular to the stalk. The heel for the stalk were cut about 2-3 cm above the base and kept in fresh water for conditioning. Thereafter, flowers are graded and sorted out in uniform batches. Flowers are packed individually in poly pouches and then kept in CFB boxes in two layers.



Fig. 97. Sorting and grading of gerbera flowers

**11. Gladiolus:** Gladiolus starts flowering at 3-4 months after planting. Flowers are harvested when colour development takes place at the bottom two or three florets on the spike. Harvesting is done by using secateurs followed by conditioning and after which the flowers are sorted, graded and packed in CFB boxes.



Fig. 98. Conditioning of gladiolus flowers



Fig. 99. Sorting of gladiolus flowers

**12. Rose:** In rose, flowering starts when the plant is 4 months old. Harvesting is done with a clean and sharp secateur at tight bud stage when the colour is fully developed and the petals have not yet started unfolding. The harvested flowers are then placed in a bucket of water inside the polyhouse immediately after harvesting. The flowers are de-leaved and graded according to the length of the stalk. The flowers are then wrapped and packed in perforated CFB boxes.



Fig. 100. Deleafing in rose stem



Fig. 101. Rose flowers wrapped in corrugated paper



### 3.6. Accreditation and certification of nurseries in NER

Quality planting being crucial for success of commercial horticulture, Central institute of Horticulture was authorized by Ministry of Agriculture during the year 2014 for the accreditation of Horticulture Nurseries in NEH region. Since then, the Accreditation and Certification of horticulture nurseries has been one of the major activities of the institute. During the period of 2016-2017, a total of 23 nurseries were assessed/monitored which includes both fresh application and renewal applications, out of which 19 nurseries were accredited and certification were done with a rating **2 Star** to four nurseries and with a **1 Star** rating to remaining 15 nurseries. The details of the nurseries are provided in the table below.

**Table 56. Total no. of horticulture nurseries accredited by CIH in NEH (2016-2017)**

Sl/No.	State	Accredited Nurseries
		2016-2017
1	Arunachal Pradesh	1
2	Assam	6
3	Meghalaya	10
4	Nagaland	2
	<b>Total</b>	<b>19</b>

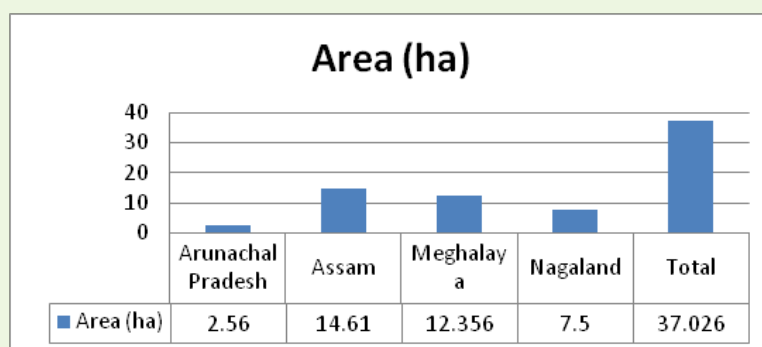


Fig. 102 . Area of Nursery Accredited State wise (ha)

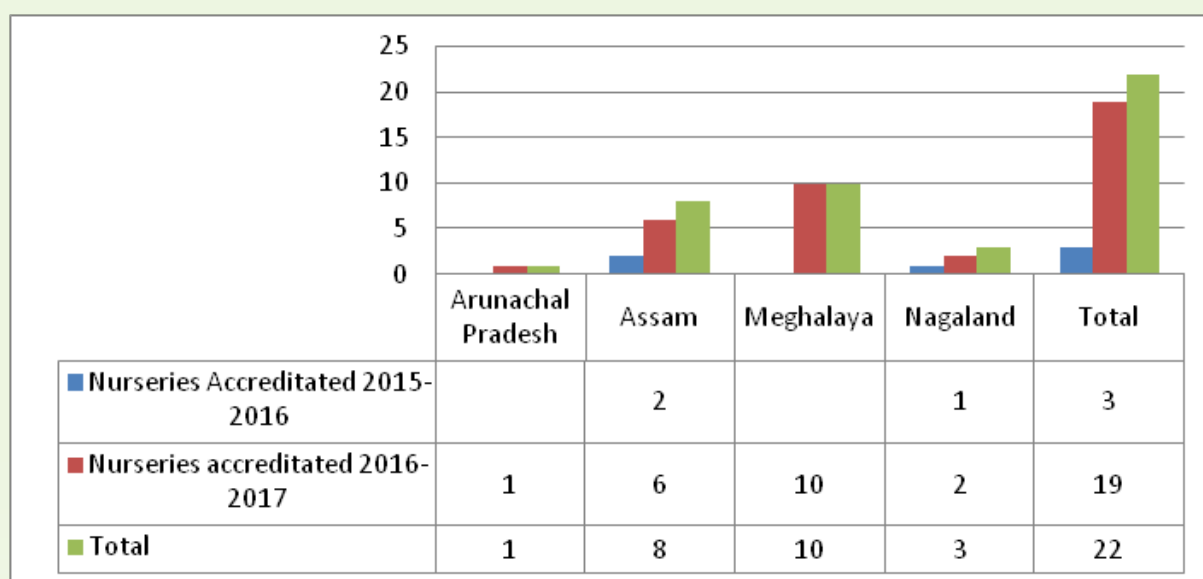


Fig. 103 . Nos. of Horticulture Nurseries Accredited by CIH



**Table 57. Details of the horticulture nurseries accredited by CIH in NEH (2016-2017)**

Sl. No	Name of the Nursery	Address	Contact	State	Name of the Horticulture Crop	Rating
1.	Daffodil Nursery (Old)	P.O, Bherakuchi, Dhopguri, Kamrup (M), Assam, 782403	Mrs. Rekha Sharma <b>Mobile no.</b> 9854323400 9854051202	Assam	1. Litchi 2. Citrus 3. Guava 4. Mango	“ 2 Star”
2.	Model Horticulture Nursery	16 Mile Byrnihat, Guwahati, Assam, 781002	Dept. Of Horticulture and Food Processing, Assam, Khanapara, Guwahati <b>Mobile no.</b> 9435331624 9859426821 directorhortiassam@gmail.com directorhortassam@yahoo.com gmail.com	Assam	1. Litchi 2. Citrus a). Assam Lemon b). Round Lemon c). Mosambi d). Mandarin 3. Guava 4. Mango	
3.	Sania Nursery	Dhupdhara, Goalpara-783123, Assam	Sajjad Gani Ph. 9854777447	Assam	1. Litchi, 2. Assam Lemon, 3. Guava	
4.	Medicinal and Fruit crop Nursery	Dhupdhara, Goalpara-783123, Assam	Baseruddin Sarkar Ph. 9854777838	Assam	1. Litchi, 2. Assam Lemon	
5.	Sundarban Nursery	Dhupdhara, Goalpara-783123, Assam	Jallaluddin Ahmed Ph. 9859540784 Email; sbn.nhb@gmail.com	Assam	1. Litchi, 2. Assam Lemon, 3. Guava, 4. Mango	“ 2 Star”
6.	Palash Nursery	Chamarkuchi, Nalbari-781350, Assam	Dhiraj Kumar Deka Ph. 9435310350 Email; ddeka493@gmail.com	Assam	1. Assam Lemon	
7.	Namthung Agri- Horti Multipurpose Nursery	Namthung, Dirang, West Kameng-790101 Arunachal Pradesh.	Dorjee Leto Ph. 8794491149, 9436225150 letojantsenpa11@gmail.com	Arunachal Pradesh	1. Apple 2. Kiwi	
8.	Ato Nursery	Khuzama village, Kohima-797001	Zakieleto, Khuzama village, Kohima -797001, Ph.9436604837	Nagaland	1. Plum 2. Peach	
9.	Rhakho Kiwi Nursery	Forest colony, Pfu-tero, Phek-797107	Zachirayi Rhakho, Forest colony, Pfu-tero, Phek-797107, Ph. 9612054230	Nagaland	1. Kiwi	“1 Star”

10.	Phodkylia Govt. Farm	Phodkylia, South West Khasi Hills, Meghalaya	Director, Directorate of Horticulture, Meghalaya; Shillong-793003, Ph.0364-2227434	Meghalaya	1.Citrus	“ 1 Star”
11.	M/s. B. Kharchandi Nursery	Kyiem-Mawphlang, East Khasi Hills, Meghalaya	Kyiem-Mawphlang, East Khasi Hills, Meghalaya- 793121, ph. 8575013446	Meghalaya	1.Peach 2. Plum	“ 1 Star”
12.	Horticulture Nursery	Nongstoin, West Khasi Hills, Meghalaya	Director, Directorate of Horticulture, Meghalaya; Shillong-793003, Ph.0364-2227434	Meghalaya	1. Pear	“ 1 Star”
13.	Horticulture Nursery	Thadlaskein, West Jaintia Hills, Meghalaya	Director, Directorate of Horticulture, Meghalaya; Shillong-793003, Ph.0364-2227434	Meghalaya	1.Peach 2. Pear	“ 1 Star”
14.	Horticulture Orchard Cum Nursery	Pomshutia, East Khasi Hills, Meghalaya	Director, Directorate of Horticulture, Meghalaya; Shillong-793003, Ph.0364-2227434	Meghalaya	1.Citrus	“ 1 Star”
15.	Horticulture Nursery	Muktapur, West Jaintia Hills, Meghalaya	Director, Directorate of Horticulture, Meghalaya; Shillong-793003, Ph.0364-2227434	Meghalaya	1. Citrus	“ 1 Star”
16.	Umlakro Farm	Umlakro, Ri-Bhoi, Meghalaya	Director, Directorate of Horticulture, Meghalaya; Shillong-793003, Ph.0364-2227434	Meghalaya	1.Citrus	“ 1 Star”
17.	Dewlieh Horti- Hub	Dewlieh, Ri-Bhoi, Meghalaya	Director, Directorate of Horticulture, Meghalaya; Shillong-793003, Ph.0364-2227434	Meghalaya	1.Strawberry	“ 1 Star”
18.	Horti-Hub-Samgong	Williamnagar, East Garo Hills, Meghalaya	Director, Directorate of Horticulture, Meghalaya; Shillong-793003, Ph.0364-2227434	Meghalaya	1.Citrus	“ 1 Star”
19.	Citrus Model Nursery cum orchard	Waribokgre, Rongram, West Garo Hills, Meghalaya	DHO, PH.03651-220849 Email. disthortiwith@gmail.com	Meghalaya	1.Citrus	“ 2 Star”



Fig. 104. Visit of nursery by the committee members of Nursery accreditation



Fig. 105. Issue of certificates to nurserymen by Hon,ble Governor of Nagaland, Shri. P.B. Archarya



Fig. 106. Issue of certificates to nurserymen by Dr. Lallan Ram, Director, CIH

### 3.7. Certificate course

#### 3.7.1. Protected cultivation of horticulture crops.

The three months certificate course on protected cultivation of horticulture crops commenced on 29<sup>th</sup> February 2016 and ended on 29<sup>th</sup> May 2016. Fourteen persons from four states of North East (Arunachal Pradesh-2, Manipur-5, Nagaland-6 & Sikkim-1) were trained on production technologies of vegetables & flowers under protected structure. The trainees were sent on a 15 days internship cum exposure visit to NRC orchid and other established protected structures in Meghalaya & Assam.



Fig. 107. CIH staff alongwith trainees during the certificate distribution programme

#### 3.7.2. Organic farming and certification of horticulture crops

The course on organic farming & certification started on 7<sup>th</sup> June 2016 and ended on 7<sup>th</sup> September 2016. A total of fifteen persons from Manipur & Nagaland received the training. As a part of the course, the trainees underwent a 15 days internship programme at Lakshmi Agriculture Multipurpose Project, Pabhoi Greens, Biswanath Chariali, Assam where they were trained on organic cultivation practices of focus horticulture crops of North East.





Fig. 108. Director CIH & staff alongwith trainees during the certificate distribution programme



Fig. 109. Practical on production of organic inputs

### 1.1.1. Modern nursery management practices of horticulture crops

A total of 19 trainees from 5 different states of North East (Arunachal Pradesh-1, Assam-1, Manipur-3, Meghalaya-6 & Nagaland-8) completed the three months certificate course on modern nursery management practices of horticulture crops. The course began on 14<sup>th</sup> September 2016 and ended on 14<sup>th</sup> December 2016. A 15 days internship programme was also organized at Daffodil Nursery, Assam where hands on training on all aspects of nursery management were given to the trainees.



Fig. 110. Class room sessions



Fig. 111. Practical on bed preparation

### 3.8. Skill development course

Central Institute of Horticulture, Nagaland has been assigned to conduct skill development courses in horticulture. The Institute is a Training Partner (TP) under Agriculture Skill Council of India (ASCI). The skill development course in CIH was formally launched by Shri. P B Acharya, Hon'ble Governor of Nagaland in the presence of Dr. S K Malhotra, Agriculture & Horticulture Commissioner, DAC&FW on 13<sup>th</sup> January 2017. Courses allotted

to the Institute during the year were “Floriculturist-Protected Cultivation” and “Gardener”.



Fig. 112. R-L. Dr. S K Malhotra, Agriculture & Horticulture Commissioner, Shri. P B Acharya, Hon'ble, Governor of Nagaland and Dr. Lallan Ram, Director CIH launching the skill development course

### 3.8.1. Floriculturist-Protected Cultivation.

The course commenced from 16<sup>th</sup> January 2017 and final assessment was completed on 28<sup>th</sup> February 2017. A total of 20 trainees from Manipur & Nagaland registered for the batch out of which 18 trainees have qualified the final assessment conducted by ASCI. The course provided indepth understanding on all activities related to production of flowers under protected structures. Practical trainings were given more focus so as to equip the trainees with the skills required for the job.



Fig. 113. Practical being conducted on bed preparation



Fig. 114. Trainees being trained on post harvest handling & packing of flowers



Fig. 115. Personal interview of trainees conducted by ASCI certified assessor



Fig. 116. Written exam of trainees by ASCI certified assessor



### 3.8.1. Gardener

The course on Gardening commenced from 31<sup>st</sup> March 2017 and 18 trainees registered for the batch. The course is of 260 hours duration and would conclude in the month of May 2017. The trainees are from different districts of Nagaland.



Fig. 117. Class room session on gardener

### 3.8. Infrastructure development

- Construction of polyhouse for Nursery Unit
- Construction of disinfectant chamber in polyhouse (double door)
- Setting up of laboratory for basic analysis
- Renovation of existing boundary wall (1km)
- Construction of deep bore well (8000ltr/hr capacity)
- Construction of 2.5 km of farm road (in process)



Fig. 118. Practical session in floriculture unit



Fig. 119. newly constructed polyhouse for nursery unit



Fig. 120. Construction of disinfectant chamber



Fig. 121. New laboratory inaugurated by Dr. S K Malhotra, Horticulture & Agriculture commissioner



Fig. 122. Renovation of existing boundary wall



Fig. 123. Construction of farm road (2.5 km)



Fig. 124. Construction of bore well



### 3. PUBLICATION

#### 4.1. Technical/ popular articles

- ☞ Aier Shisarenla, Borthakur P K, Boro R C and Ram Lallan (2017). Nanotechnology- a next generation dynamic approach for post harvest improvement of cut flowers in India and NER. In: National Conference on “*Advances in Indian Floriculture with Focus on North East & Hill Region*” held on 13<sup>th</sup> -15<sup>th</sup> Jan., 2017 at CIH, Medziphema, Nagaland.
- ☞ Aier Shisarenla, and Ram Lallan (2017). Floriculture in North East India: Scope and scenario. In: National Conference on “*Advances in Indian Floriculture with Focus on North East & Hill Region*” held on 13<sup>th</sup> -15<sup>th</sup> Jan., 2017 at CIH, Medziphema, Nagaland.
- ☞ Aier Shisarenla, Borthakur P K, Boro R C, Goswami G and Ram Lallan (2017). Isolation and characterization of bacteria from cut flowers during storage. In: National Conference on “*Advances in Indian Floriculture with Focus on North East & Hill Region*” held on 13<sup>th</sup> -15<sup>th</sup> Jan., 2017 at CIH, Medziphema, Nagaland.
- ☞ Shitiri Meribeni, Singh Arvind and Ram Lallan (2016). Effect of organic manures on growth, yield and quality of capsicum (cv. Indra) under protected cultivation in foot hill condition of Medziphema, Nagaland. In: *Indian Horticulture Congress* at IARI, New Delhi held from 15<sup>th</sup> -18<sup>th</sup> November, 2016.
- ☞ Singh Arvind, Shitiri Meribeni, P.S. Ngupani and Ram Lallan (2016). Varietal performance of gerbera cultivars under protected condition. In: *Indian Horticulture Congress* at IARI, New Delhi held from 15<sup>th</sup> -18<sup>th</sup> November, 2016.
- ☞ Singh Arvind, Maiti C S, Shitiri Meribeni and Ram Lallan (2017). Performance of different dutch rose cultivars under the foot hill condition of Nagaland. In: National Conference on “*Advances in Indian Floriculture with Focus on North East & Hill Region*” held on 13<sup>th</sup> -15<sup>th</sup> Jan., 2017 at CIH, Medziphema, Nagaland.
- ☞ Singh AK (2016). Role of Central Institute of Horticulture for linking prospective food entrepreneurs with Government schemes & market. In: conference on

*Linking prospective food entrepreneurs with Government schemes & market* organized by ASSOCHAM's held on 12<sup>th</sup> Aug., 2016 at SASRD, Nagaland university, Medziphema.

#### 4.2. Presentations in conference/seminar/workshop/others

- ☞ Aier Shisarenla, Borthakur P K, Boro R C and Ram Lallan (2017). Nanotechnology- a next generation dynamic approach for post harvest improvement of cut flowers in India and NER. In: National Conference on “*Advances in Indian Floriculture with Focus on North East & Hill Region*” held on 13<sup>th</sup> -15<sup>th</sup> Jan., 2017 at CIH, Medziphema, Nagaland.
- ☞ Ram Lallan (2016). Status & scope of value addition in Citrus in NE Region. In: *eight days Model Training Course on Sustainable Crop Production, Protection and Value Addition of Citrus in NEH Region* held on 18<sup>th</sup> to 25<sup>th</sup> Oct., 2016 at ICAR Research Complex for NEH Region, Jharnapani.
- ☞ Ram Lallan (2016). Organic Horticulture in NER-Recent Development and Progress. In: *Indian Horticulture Congress* at IARI, New Delhi held from 15<sup>th</sup> -18<sup>th</sup> November, 2016.
- ☞ Ram Lallan (2017). Floriculture in North East India: Scope & scenario. In: National Conference on “*Advances in Indian Floriculture with Focus on North East & Hill Region*” held on 13<sup>th</sup> -15<sup>th</sup> Jan., 2017 at CIH, Medziphema, Nagaland.
- ☞ Singh AK (2016). Role of Central Institute of Horticulture for linking prospective food entrepreneurs with Government schemes & market. In: conference on *Linking prospective food entrepreneurs with Government schemes & market* organized by ASSOCHAM's held on 12<sup>th</sup> Aug., 2016 at SASRD, Nagaland university, Medziphema.
- ☞ Singh A K (2016). Role of Central Institute of Horticulture for Sustainable Development of Horticulture in North East Region of India. In: *winter school on role of agri business and market intelligence for sustainable agriculture development* held on 26<sup>th</sup> Sept., 2016 at SASRD, Nagaland university, Medziphema.

- ☞ Singh A K (2016). Delivered lecture on plant propagation techniques in B.voc. programme on advance diploma in plant propagation and nursery management technology at Department of horticulture, SASRD, Nagaland university, Medziphema
- ☞ Singh Arvind (2016). Delivered lecture on plant propagation structures in B.voc. programme on advance diploma in plant propagation and nursery management technology at Department of horticulture, SASRD, Nagaland university, Medziphema
- ☞ Das Prabin (2016). Delivered lecture on Entrepreneurship and marketing in B.voc. programme on advance diploma in plant propagation and nursery management technology at Department of horticulture, SASRD, Nagaland university, Medziphema
- ☞ Singh Arvind, Maiti C S, Shitiri Meribeni and Ram Lallan (2017). Performance of different dutch rose cultivars under the foot hill condition of Nagaland. In: National Conference on “*Advances in Indian Floriculture with Focus on North East & Hill Region*” held on 13<sup>th</sup> -15<sup>th</sup> Jan., 2017 at CIH, Medziphema, Nagaland.

#### 4.3. CIH publications

- ☞ Lallan Ram and Meribeni Shitiri. 2016. ***Annual report (2015-16)***. Central Institute of Horticulture, DAC&FW, Ministry of Agriculture cooperation & FW, Govt. of India, Medziphema, Nagaland.
- ☞ Lallan Ram , Md. Manzar Hossain and Meribeni Shitiri (2016). ***Post harvest handling and processing of horticultural crops***. CIH/ Manual.2 / Pub. No. 2 / pp 1-
- ☞ Lallan Ram. 2016. Prospectus of three months Certificate Course & Skill development course. Central Institute of Horticulture, DAC&FW, Ministry of Agriculture cooperation & FW, Govt. of India, Medziphema, Nagaland.
- ☞ Lallan Ram. 2017. Brochure - About Nagaland. Central Institute of Horticulture, DAC&FW, Ministry of Agriculture cooperation & FW, Govt. of India, Medziphema, Nagaland.



- ☞ Lallan Ram and Meribeni Shitiri. 2017. *A decade of CIH*. Central Institute of Horticulture, DAC&FW, Ministry of Agriculture cooperation & FW, Govt. of India, Medziphema, Nagaland.
- ☞ Suresh K Malhotra and Lallan Ram. 2017. Book on *Advances in floriculture and landscape gardening*. Central Institute of Horticulture, DAC&FW, Ministry of Agriculture cooperation & FW, Govt. of India, Medziphema, Nagaland.
- ☞ Lallan Ram and Meribeni Shitiri. 2017. *Abstract*. National Conference on “*Advances in Indian Floriculture with Focus on North East & Hill Region*”. Central Institute of Horticulture, DAC&FW, Ministry of Agriculture cooperation & FW, Govt. of India, Medziphema, Nagaland.
- ☞ Arvind Singh, Meribeni Shitiri and Lallan Ram. 2017. *Production technology of rose*. CIH/ Tech./ Pub. No.6 / pp 1-26.
- ☞ Meribeni Shitiri and Lallan Ram. 2017. *Package of practices of Marigold*. CIH/ Tech. Folder 44/ pp 1-6.
- ☞ Lichamo Yanthan, Meribeni Shitiri and Lallan Ram. 2017. *Package of practices of Papaya*. CIH/ Tech. Folder 45/ pp 1-6.
- ☞ Shisarenla Aier, Meribeni Shitiri and Lallan Ram. 2017. *Package of practices of Lilium*. CIH/ Tech. Folder 46/ pp 1-6.
- ☞ Shisarenla Aier, Meribeni Shitiri and Lallan Ram. 2017. *Dryflower arrangement*. CIH/ Tech. Folder 47/ pp 1-6.
- ☞ A K Singh, Meribeni Shitiri and Lallan Ram. 2017. *Package of practices of Khasi Mandarin*. CIH/ Tech. Folder 48/ pp 1-6.

## 5. SEMINARS, CONFERENCES, WORKSHOPS, MEETINGS ETC

### 5.1. 7<sup>th</sup> Indian Horticulture Congress at New Delhi

The 7<sup>th</sup> Indian Horticulture Congress was organized by Horticultural Society of India at B P Pal Auditorium, IARI, Pusa Campus, New Delhi from 15<sup>th</sup> – 18<sup>th</sup> November, 2016. Director CIH, Dr. Lallan Ram participated in the congress and was the convenor of session on *“Developing Horticulture in North East India”*. The congress had deliberation on key issues in the horticulture sector and specific sessions were organized taking into consideration the important problems and challenges of the sector in the region.



Fig. 125. Inaugural programme of 7th Indian Horticulture Congress



Fig. 126. Dr. Lallan Ram, receiving Fellowship award conferred by the HSI, New Delhi During the 7th Indian Horticulture Congress

### 5.2. National conference on Advances in Indian Floriculture with focus on North East & Hill Region at Nagaland.

A 3 days National conference on Advances in Indian Floriculture with focus on North East & Hill Region was organized by Central Institute of Horticulture, Nagaland in collaboration with Dept. of Horticulture, Govt. of Nagaland & Indian Society of Organic Horticulture at CIH campus, Medziphema, Nagaland w.e.f. 13-15 January 2017. The programme was formally inaugurated by Chief Guest Shri. P B Acharya, Hon'ble Governor of Nagaland. Dr. S K Malhotra, Agriculture & Horticulture Commissioner, DAC&FW graced the occasion as Guest of Honor. Eminent resource persons in floriculture from all over the country participated in the event and deliberated on various issues, challenges and way forward for development of floriculture industry in North East during the technical sessions. Poster presentation was also organized during the event. A one day field visit was also arranged for the participants in floriculture farms in the state. A total of 153 participants were a part of the conference.





Fig. 127. Inauguration of conference by Hon'ble Governor of Nagaland, Shri. P B Acharya



Fig. 128. Release of publications by Chief Guest, Guest of Honor & other dignitaries



Fig. 129. Chief Guest, Shri. P B Acharya, Hon'ble Governor of Nagaland



Fig. 130. Guest of Honor, Dr. S K Malhotra, Agriculture & Horticulture Commissioner, DAC&FW



Fig. 131. Delegates posing with Chief Guest & Guest of Honor



Fig. 132. Dr. S K Malhotra reviewing the poster presentations



As a part of the event an exhibition was also organized on floriculture which was inaugurated by Shri. P B Acharya, Hon'ble Governor of Nagaland. Several govt. & private stakeholders participated in the event.



Fig. 133. Hon'ble Governor of Nagaland inaugurating the exhibition



Fig. 134. Chief Guest & Guest of Honor visiting the exhibition stalls

### 5.3. Meetings

- 5.3.1. Departmental co-ordination meeting at office of the Additional Deputy Commissioner, Govt. of Nagaland at Medziphema on 15<sup>th</sup> June, 2016.
- 5.3.2. Departmental co-ordination meeting at office of the Additional Deputy Commissioner, Govt. of Nagaland at Medziphema on 27<sup>th</sup> July, 2016.
- 5.3.3. Meeting at Chief Secretary's office, Govt. of Nagaland, Kohima on 28<sup>th</sup> November 2016 to give status report on activities and programmes of CIH, Nagaland.
- 5.3.4. Attended meeting on skill development with National level training Institute held on 28<sup>th</sup> November, 2016 in Krishi Bhawan, New Delhi under the chairmanship of additional secretary (Extension).
- 5.3.5. Departmental co-ordination meeting at office of the Additional Deputy Commissioner, Govt. of Nagaland at Medziphema on 15<sup>th</sup> December, 2016
- 5.3.6. Attended State level Stakeholders Consultation meet at Directorate of Horticulture, Govt. of Nagaland on 18<sup>th</sup> Jan., 2017
- 5.3.7. Technical Advisory Meeting (TAC) held on 14<sup>th</sup> January 2017 at CIH, Nagaland under the chairmanship of Dr. K.K.Jindal, Retd. ADG Horti., ICAR with 09 members and 15 invited members
- 5.3.8. Meeting of Nursery Accreditation Committee was conducted on 15<sup>th</sup> January 2017 at CIH, Nagaland.

- 5.3.9.** Meeting of the High Powered Committee for evaluation of Central Institute of Horticulture, Nagaland was held on 24<sup>th</sup> January 2017 in room no. 142, 1<sup>st</sup> Floor, Krishi Bhawan, New Delhi under the chairmanship of Additional Secretary (Horticulture).
- 5.3.10.** Board of Management meeting (BOM) held on 28<sup>th</sup> February 2017 in room no. 142, 1<sup>st</sup> Floor, Krishi Bhawan, New Delhi under the chairmanship of Dr. S K Malhotra, Agriculture & Horticulture Commissioner, Govt. of India.



Fig. 135. 9th Technical Advisory Committee meeting



Fig. 136. Dr. S K Malhotra, Agriculture & Horticulture Commissioner discussing with members of Nursery Accreditation Committee



## 6. IMPORTANT EVENTS CELEBRATED

### 6.1. Independence Day Celebration

Central Institute of Horticulture celebrated 69<sup>th</sup> Indian Independence Day along with the whole country on 15<sup>th</sup> August, 2016. Flag hoisting was done by Director CIH, Dr. Lallan Ram. All the staffs and field workers were a part of the programme.



Fig. 137. Flag hoisting by Dr. Lallan Ram, Director, CIH



Fig. 138. Dr. Lallan Ram, Director, CIH along with staff and farm workers

### 6.2. Republic Day Celebration

The Institute, with the rest of the country, celebrated the 68<sup>th</sup> Republic Day on 26<sup>th</sup> January 2017. Flag hoisting was done by Director CIH, Dr. Lallan Ram. A brief programme was being organized where all the staffs and field workers participated.



Fig. 139. CIH staff & farm workers with Dr. Lallan Ram, Director, CIH

### 6.2. Foundation Day Celebration

Central Institute of Horticulture, Nagaland celebrated its 12<sup>th</sup> Foundation Day on 27<sup>th</sup> March, 2017 at its campus. Prof. R C Gupta, Dean, SASRD, Nagaland University inaugurated the programme who graced the occasion as Chief Guest. Welcome address and brief remark was delivered by Dr. Lallan Ram, Director, CIH. Vote of thanks was delivered by Ms. Shisarenla Aier, AHS, CIH. The programme was attended by officials and members from Doordharshan Kendra, Kohima and all the staff as well as field workers of CIH. To commemorate the event recreational activities for staffs was organized simultaneously.



Fig. 140. Chief Guest Dr. R C Gupta, Dean, SASRD delivering speech during Foundation Day



Fig. 141. Chief Guest Dr. R C Gupta along with Director and staff of CIH



## 7. AWARDS AND RECOGNITION

### 7.1. Awards

- ☞ The Horticulture Society of India, New Delhi conferred fellowship for “Significant contribution in Fruit Science for the year 2016” to **Dr. Lallan Ram**, Director, CIH, Nagaland during the Indian Horticulture Congress held at IARI, New Delhi held from 15<sup>th</sup> -18<sup>th</sup> November, 2016, for his outstanding contribution in the field of Fruit science.
- ☞ The Indian Society of Ornamental Horticulture (ISOH), New Delhi conferred fellowship for “Significant contribution in Floriculture (Protected cultivation) for the year 2016” to **Dr. Lallan Ram**, Director, CIH, Nagaland during the National Conference on “*Advances in Indian Floriculture with Focus on North East & Hill Region*” held on 13<sup>th</sup> -15<sup>th</sup> Jan., 2017 at CIH, Medziphema, Nagaland.
- ☞ Best oral paper presentation was awarded to Ms. Shisarenla Aier, Asst. Horticulture Specialist, CIH for the deliberation on “Nanotechnology- a next generation dynamic approach for post harvest improvement of cut flowers in India and NER”. In: National Conference on “*Advances in Indian Floriculture with Focus on North East & Hill Region*” held on 13<sup>th</sup> -15<sup>th</sup> Jan., 2017 at CIH, Medziphema, Nagaland.

### 7.2. Recognitions

- ☞ Trendsetters Skill Assessors Pvt. Ltd empanelled **Dr. Lallan Ram**, Director, CIH, Nagaland as Assessor for conducting assessments in Horticulture Sector.
- ☞ Organizing Secretary of National Conference on “*Advances in Indian Floriculture with Focus on North East & Hill Region*” from 13<sup>th</sup> -15<sup>th</sup> Jan., 2017 at CIH, Medziphema, Nagaland.
- ☞ Member Secretary of Board of Management & Technical Advisory Committee of CIH
- ☞ Member of Nursery Accreditation Assessment committee of CIH.
- ☞ Member of NSLIC(MIDH) of Govt. of Nagaland

## 8. PERSONNEL

The Government of India has sanctioned 17 posts which include: Director (1), Horticulture Specialist (2), Marketing specialist (1), Post harvest technologist (1), Asst. Horticulture specialist (3), Farm Manager (1), Senior technical assistant (2), Administrative Officer (1), PA to Director (1), Stenographer (2), Field Assistant (2). All development, trainings and transfer of technology activities are being carried out at the institute under the administrative control of the Director, Central Institute of Horticulture supported by total staff strength of 16 comprising of technical, administrative staffs and 54 outsourced labours.

### 1.1. PRESENT STAFF POSITION AT CIH

1. Director	: Dr. Lallan Ram
2. Technical consultant	: Mr. Arvind Singh
3. Horticulture Specialist	: Mrs. Meribeni Shitiri
	: Mr. Anjani Kumar Singh
4. Post Harvest Technologist	: Mr. Manzar hossain
5. Marketing Specialist	: Mr. Prabin Das
6. Assistant Horticulturist	: Mr. Lichamo Yanthan
	: Ms. Shisarenla Aier
7. Senior Farm Manager	: Mr. Diganta Gohain
8. Senior Technical Assistant	: Mr. Ngupani P.S
	: Mr. Tokivi Zhimomi
9. Administrative officer	: Mr. Babu Singh
10. P A to Director	: Ms. Imtinaro Jamir
11. Stenographer	: Mrs. Sharda Devi
	: Mrs. Achibeni Yanthan
12. Field Assistant	: Mr. Eliyamo Humtsoe
	: Mr. Anukul Roy

## 9. BUDGET

Table 58. FINANCIAL STATEMENT OF CIH, FOR THE YEAR 2016-17

(Rs. in Lakh)

HEAD OF ACCOUNT 248-Crop Husbandry 119-Horti & Veg. crop	B.E. 2016-2017	R.E. 2016-2017	Total Expenditure
<b>02-Estt. of CIH</b>			
420001- Salary	30.00	22.64	29.70
420002- Wages	50.00	50.00	53.79
420006- Medical Treatment	10.00	7.00	9.71
420011- D T Expenses	20.00	7.00	6.95
420013- Office Expenses	50.00	35.00	34.92
420014- Rent rate & taxes	2.00	1.00	0.21
420016- Publication	10.00	10.00	10.00
420020- Other Admni. Expn.	80.00	60.00	52.77
420026- Advt. & publicity	5.00	3.00	0.90
420027- Minor works	60.00	50.00	15.34
420028- Prof. services	10.00	3.00	0.37
420050- Other charges	248.00	201.36	200.40
<b>Total (2401Crop Husbandry)</b>	<b>575.0</b>	<b>450.00</b>	<b>415.06</b>
4401 CO on Crop Husbandry 119-Horti. & Veg. Crop 14-Estt. of CIH			
160151-Motor Vehicle	10.00	-	-
160152-Machinery & Equip.	10.00	10.00	-
160153- Major Works	480.00	480.00	89.18
<b>Total – Major Head 4401-</b>	<b>500.00</b>	<b>490.00</b>	<b>89.18</b>
<b>Grand total</b>	<b>1075.00</b>	<b>940.00</b>	<b>504.24</b>



## 10. LIST OF BOARD OF MANAGEMENT AND TECHNICAL ADVISORY COMMITTEE MEMBERS

### 10.1. Members of Board of Management (BOM)

- |     |   |            |
|-----|---|------------|
| 1.  | Dr. S K Malhotra,<br>Horticulture Commissioner, Department of Agriculture Cooperation<br>& Farmers Welfare, Govt. of India, Khrishi Bhawan, New Delhi | - Chairman |
| 2.  | Secretary/Director (Horticulture),<br>Govt. of Arunachal Pradesh, Itanagar, Arunachal Pradesh   | - Member   |
| 3.  | Secretary/Director(Agriculture),<br>Govt. of Assam, Guwahati, Assam   | - Member   |
| 4.  | Secretary/Director (Horti. & Soil Cons.),<br>Govt. of Manipur, Imphal, Manipur  | - Member   |
| 5.  | Secretary/Director (Horticulture),<br>Govt. of Meghalaya, Shillong, Meghalaya   | - Member   |
| 6.  | Secretary/Director (Horticulture),<br>Govt. of Mizoram, Aizwal, Mizoram   | - Member   |
| 7.  | Secretary/Director (Horticulture),<br>Govt. of Nagaland, Kohima, Nagaland   | - Member   |
| 8.  | Secretary/Director (Horticulture),<br>Govt. of Sikkim, Gangtok, Sikkim  | -Member    |
| 9.  | Secretary/Director (Horticulture),<br>Govt. of Tripura, Agartala  | - Member   |
| 10. | Vice Chancellor/Director(Research),<br>Assam Agriculture University, Jorhat, Assam  | - Member   |
| 11. | Vice Chancellor/Director (Research),<br>Central Agriculture University, Imphal, Manipur   | - Member   |
| 12. | Prof.D.P.Ray,<br>Ex-Vice Chancellor of OUAT, Bhubaneshwar, Orissa   | - Member   |
| 13. | Dr.Kirti Singh,<br>Former Chairman ASRB and Vice Chancellor   | - Member   |

- |     |   |                       |
|-----|---|-----------------------|
| 14. | Joint Secretary/Representative of Ministry of Food Processing Industries (MOFPI), New Delhi                   | - Member              |
| 15. | Representative of Ministry of DONER, Vigyan Bhavan Annexe, Mulana, Azad Road, New Delhi                       | - Member              |
| 16. | Secretary/ Representative of North East Council, Nongrim Hills, Shillong, Meghalaya                           | - Member              |
| 17. | Director ICAR, Umroi Road, Umiam-793103, Meghalaya  | - Member              |
| 18. | Dr.V.B.Singh, Ex-Prof, Horti. Deptt., SASARD-NU, Medziphema, Nagaland   | - Member              |
| 19. | Chairman/Representative, NABARD, Plot Np-c24, G Block,Bandra Kurlar Complex, P.O.Box-8121,Bandra East, Mumbai | - Member              |
| 20. | Representative of M/s. Zopar Exports Pvt.Ltd. (North East Circle)   | - Member              |
| 21. | Mr.Zion Lalremruata, General Secretary, All Mizoram Farmers Union, progressive farmer of NER                  | - Member              |
| 22. | Mr.Shiv Anjan Dalmia, Dalmia Greens, Meghalaya - Successful entrepreneur of NER                               | - Member              |
| 23. | Dr. Lallan Ram, Director, CIH, Medziphema- Dimapur, Nagaland  | - Member<br>Secretary |

**10.2. Members of Technical Advisory Committee (TAC)**

- |     |   |                       |
|-----|---|-----------------------|
| 1.  | Dr. K.K. Jindal,<br>UGC Emeritus Fellow, Retd. ADG Horti. ICAR &<br>Ex-Director of Research, UHF Solan Himachal &<br>CAU, Imphal, Manipur | - Chairman            |
| 2.  | Dr. W.S. Dhillion,<br>ADG, ICAR, New Delhi  | - Member              |
| 3.  | Dr. N.K. Mohan,<br>Chief Consultant of CIH & Ex Chief Scientist,<br>HRS, Kahikuchi, Assam   | - Member              |
| 4.  | Dr. Ramesh Kumar,<br>Dean, LPU, Jhalandar, Ex Director, DFR,<br>Ex Director of Research, PAU, Ludhiana                                    | - Member              |
| 5.  | Dr. R.A.Ram,<br>Principal Scientist, CISH, Lucknow  | - Member              |
| 6.  | Dr. Ramesh Mittal,<br>Dy. Director, NIAM, Jaipur  | - Member              |
| 7.  | Dr. B.C.Deka,<br>Director, ATARI, Barapani, Meghalaya   | - Member              |
| 8.  | Dr. A.K.Srivastava,<br>Principal Scientist, CCRI, Nagpur  | - Member              |
| 9.  | Dr. L.C.Bora,<br>Professor, AAU, Jorhat, Assam  | - Member              |
| 10. | Dr. V.B. Singh,<br>Ex-Professor, Dept of Hort.,<br>SASRD-NU, Medziphema, Nagaland   | - Member              |
| 11. | Dr. Awani Kumar Singh,<br>Sr. Scientist, CPCT, IARI, New Delhi  | - Member              |
| 12. | Dr. Lallan Ram, Director, CIH   | - Member<br>secretary |



## 24. ANNUAL ACTION PLAN 2016-17

Central Institute of Horticulture				
Action Plan 2016-17				
Sl	Components	Physical Tar-gets	Approx. cost per unit	Approx. Financial Implication
			(Rs. )	(Rs. In lakh)
<b>A</b>	<b>Demonstration of production technologies at Institute level</b>			
<b>A.1</b>	<b>Management of existing demonstrations</b>			
	a) Purchase of fertilizers, chemicals, manures etc for farm & polyhouse	13 ha		13.89
	b) Maintenance of Organic model farm(On farm)	3ha		2.50
	c) Repair & re-installation of drip irrigation system in fruit blocks/polyhouses	5ha	3.60	18.00
	d) Preparation of sign board and labelled for each and every mother plants including painting & writing of board with Institute name and logo	18 nos big size (4x 3 ft) with post and 7000 nos labeled (1ft x 9inch)		5.00
	e) Repairing of existing fertigation and fogger system in polyhouse	Area 10000 sqm	10.00	10.00
	f) Laying of black mulching sheet(UV treated) in all fruit crops	250 kg	200/kg	5.00
	<b>Sub total</b>			<b>54.39</b>
<b>A.2</b>	<b>Demonstrations of improved Technology in the Institute</b>			
	a) Plantation of orchids	5000 plant		4.50
	b) Performance of high value vegetables under protected cultivation (tomato var.GS-600, Himsona & Avinash, sweet pepper var.Indra,)	1500 sqm		0.50
	c) Gap filing of flowers & strawberry (rose-4000nos.top graft, Gerbera-2000nos.tissue culture, strawberry-5280nos.)	11280 nos.		6.00
	d) Cultivation of Chrysanthemum(tissue culture)	5000 nos.		1.50
	e) Comparative study on performance of Naga King Chilli under Protected Cultivation & open field condition	500 sq.m each	0.10	0.10
	f) Organic cultivation of Turmeric	0.5ha	0.14	0.14
	g) Maintenance of germplasm of underutilized/unexplored fruits & vegetables of NE	0.05ha	0.20	0.20
	h) Cultivation of marigold var.Pusa Basanti	500 sq mtr	0.20	0.20

	i) Cultivation of pineapple under polymulch	1150 sq m	0.15	0.15
	j) Organic cultivation of Ginger	0.25 ha	0.25	0.25
	k) Model vegetable garden	500 sq mtr	0.40	0.40
	l) Establishment of Khasi Mandarin Mother block including mulching and drip irrigation system	D Block 1.0ha	3.1/ha	3.10
	m) Establishment of Pomegranate Mother block including mulching and drip irrigation system	D Block 0.5ha	4.2/ha	2.10
	n) Establishment of Kinnow Mandarin Mother block including mulching and drip irrigation system	D Block 0.5ha	3.66/ha	1.83
	o) Cultivation of oyster mushroom	2nos.	0.25	0.50
	<b>Sub total</b>			<b>21.47</b>
<b>B.</b>	<b>Demonstration of improved Technologies in NE States</b>			
	a) Demonstration on important fruit crops viz. Khasi Mandarin, Mango & litchi in Nagaland, Manipur & Assam	4 ha	0.88	3.50
	b) Demonstration of cole and root vegetables	2 ha	0.10	0.20
	c) Cultivation of turmeric	1 ha	0.00	0.00
	d) Construction of Naturally Ventilated Poly house in Nagaland & Assam for production of planting materials at farmers field	1 units (500 sq. m each)	1560/sq.m	7.80
	e) Citrus rejuvenation programme in Nagaland, Sikkim & Arunachal Pradesh	3 states	0.50	1.50
	<b>Sub total</b>			<b>13.00</b>
<b>C.</b>	<b>Quality Planting Material &amp; Seed Production</b>			
	a) Establishment of scion mother block (gap filling of guava 250, citrus 100, cashew 100 & passion fruit 150 etc )	600 nos.		0.50
	b) Mass multiplication of quality planting material			
	i) Asexually propagated plants (Cashew 18000nos. var.BBSR-1, VRI-3, V-4; citrus 18000nos. var.Khasi mandarin, Assam lemon; mango 4000nos. var.Amrapali, Dusshera & Malika, guava 6000nos. var.L-49, Allahabad Safeda, Lalit & Sweta; rose 4000nos. Var.Bordeux, Avalanche)	50,000 nos		12.00
	<b>Sub total</b>			<b>12.50</b>
<b>D</b>	<b>Accreditation of Horticulture Nurseries in NER</b>	10 nos.	2.00	<b>20.00</b>
<b>E</b>	<b>Human Resource Development</b>			

	a) Farmers Training	40 nos.(50 trainees/batch		20.00
	b) Training of Trainers	06 nos. (40 trainees/batch		20.00
	c) Capacity Building of CIH Staffs & State officials	04 nos.		2.00
	d) Exposure trip cum training	03 nos.		8.00
	<b>Sub total</b>			<b>50.00</b>
<b>F</b>	<b>Certificate Course</b>	4 courses		<b>34.34</b>
<b>G</b>	<b>Seminar/ Workshop/ Conference/Meetings</b>			
	a) National level (3 days event)	1 no		5.00
	b) Technical Advisory Committee (TAC) meeting	1 no		2.00
	c) Board of Management (BOM) meeting	1 no		1.50
	<b>Sub total</b>			<b>8.50</b>
<b>H</b>	<b>Exhibitions/ Trade Fairs/ Meets/Mela</b>			
	a) NE Organic Fest(Exhibition cum Buyer Seller meet) (To organize)	1 no		10.00
	b) National/ State level exhibitions (To participate)	2 nos		6.00
	<b>Sub total</b>			<b>16.00</b>
<b>I</b>	<b>PHM &amp; Marketing</b>			
	a) Post Harvest handling unit for washing, waxing, drying& grading; shrink wrapping unit	1 Unit each		
	b) Value added product			0.30
	d) Geographical Indication Registry of Horticulture Crops	05 crops		21.50
	<b>Sub total</b>			<b>21.80</b>
<b>J</b>	<b>Machineries &amp; equipment</b>			
	a) Farm tools & implements			4.06
	b) Quarks(spectrophotometer for lab use)	1nos.		0.05
	c) Heating mantle (for lab use)	1nos.		0.03
	d) Post harvest machineries & equipments			
	i. Solar tunnel dryer	1 no		3.00
	ii. Juice pasteurizer	1 no		1.00
	iii)Aloevera gel extraction machine	1no		1.86
	<b>Sub total</b>			<b>10.00</b>



<b>K</b>	<b>Chemical &amp; glassware's for laboratory</b>			<b>2.00</b>
<b>L</b>	<b>Minor works</b>			
	a) RCC platform for citrus primary nursery	3 Nos. 50mx-1mx2ft	1.33	4.00
	b) Land development for construction of poly-houses for nursery unit (JCB work)	600sqm	1.00	1.00
	c) Construction of polyhouses for nursery unit	1Nos. (500 sqm)	5.50	5.50
	d) Construction of terracing for farm development	2 ha	5.00	10.00
	e) Soil sterilization unit Size-(30ft x 20ft x 9.6ft), Heating system-heat convector 6 nos. (2.5 kw each), Foundation-cc(1:2:4) (30x30x60cm), Door-2nos. (4'x6'), covering with 8mm thick triple layer UV	1nos.	10.00	10.00
	f) Construction of disinfectant chamber in poly houses (double door)	10 nos.(6x6')	0.25	2.50
	g)Construction of Farm shed (For Block E)		1.00	1.00
	h)Construction of implements shade for tractors, power tillers & other farm implements	1 No. (60 x 20ft)	7.00	7.00
	i) Geomembrane sheet (400-500 micron) lining in existing water harvesting structure to control water seepage	1 nos. (13.5x40.5mtrs x3 mtrs height)	7.00	7.00
	j) Setting up of laboratory platform(working tables, centre tables, cabinets & accessories)	1nos	4.00	4.00
	k) Setting up of model solar water pump unit (including all accessories)	2.5 hp capacity	5.00	5.00
	l) Other minor works			3.00
	<b>Sub total</b>			<b>60.00</b>
<b>M</b>	<b>Publication</b>			
	a) Annual Report 2015 – 2016	1		
	b) Manual/ Technical bulletin			
	i. Manual on post harvest handling and processing of horticultural crops	1		
	ii. Bulletin on production technology of rose	1		
	d) Folders	5		
	e)Decade of CIH	1		
	<b>Sub total</b>			<b>10.00</b>
<b>N</b>	<b>Landscaping of old office compound &amp; present office and avenues (Annual seasonal, ornamental plants and maintenance of landscape area, popup irrigation system)</b>			<b>8.00</b>

<b>O</b>	<b>Others</b>			
	a) Salaries			45.00
	b) Wages			66.00
	c) Medical			10.00
	d) Rate, Rent & Taxes			2.00
	e) Advertisement & publicity			5.00
	f) Domestic travelling Expenses (DTE)			20.00
	g) Professional services			10.00
	h) Contractual staff remuneration			66.00
	<b>ii. Office Expenses</b>			
	a) Office furniture			1.00
	b) Telephone bill			4.00
	c) Electricity bill			5.00
	d) Repair of motor vehicle			3.00
	e) Purchase of rubber stamp			0.10
	f) Stationary			1.00
	g) Office equipment			1.00
	h) Computer			1.00
	i) Contingent staffs remuneration			1.00
	j) Stores			5.00
	k) Printing & binding jobs			0.20
	l) POL			7.00
	m) AMC			12.00
	n) Postage & telegraph			4.00
	o) Training hall furnishing			9.70
	<b>Sub total</b>			<b>243.00</b>
	<b>Grand total</b>			<b>585.00</b>

Budget Projection for the year 2016-17		
Sl	Head of Account	Approved Budget for 2016-17 (Rs. in lakhs)
<b>A</b>	<b>Major Head -2552</b>	
1	Salary	30.00
2	Wages	50.00
3	Medical Treatment	10.00
4	Domestic Travel Expenses	20.00
5	Office expenses	50.00
6	Rent, Rates & Taxes	2.00
7	Publication	10.00
8	Other Administrative Expenses	80.00
9	Advertisement & Publicity	5.00
10	Minor works	60.00
11	Professional Services	10.00
12	Other Charges	248.00
	<b>Sub Total</b>	<b>575.00</b>
<b>B</b>	<b>Major Head -4552</b>	
1	Major works	
	a. C/o Boys hostel from trainess	136.00
	b.C/o Farm road (2.5 km)	275.00
	c. Renovation of existing boundary wall	52.00
	d. Deep bore well construction (2500 mtrs)	17.00
	<b>Sub total</b>	<b>480.00</b>
2	Machinery & Equipment	10.00
3	Motor vehicle	10.00
	<b>Sub Total</b>	<b>500.00</b>
	<b>Grand total</b>	<b>1075.00</b>



## 25. RECOMMENDATION OF TECHNICAL ADVISORY COMMITTEE AND BOARD OF MANAGEMENT COMMITTEE

### 25.1. Recommendation of Technical Advisory Committee

#### Minutes of the 9<sup>th</sup> Technical Advisory Committee (TAC) meeting of CIH held on 14<sup>th</sup> January, 2017 at 11:00 AM at conference hall, CIH, Medziphema, Nagaland

During the meeting 8 TAC members were present out of 12 members and 13 invited members were also present. Details of which are given as under:

#### Members present:

- |    |  |                       |
|----|--|-----------------------|
| 1. | Dr.K.K.Jindal, Retd.ADG Horti., ICAR,<br>Ex Director Research CAU          | - Chairman            |
| 2. | Dr. W.S.Dhillion, Director PHT, PAU Ludhiana,<br>currently ADG Horti. ICAR | - Member              |
| 3. | Dr.Ramesh Kumar, Dean,<br>LPU, Jhalandar                                   | - Member              |
| 4. | Dr. R.A.Ram, Principal Scientist, CISH, Lucknow                            | - Member              |
| 5. | Dr.A.K.Srivastava, Principal Scientist, CCRI-Nagpur                        | - Member              |
| 6. | Dr. Awani Kumar Singh, Sr. Scientist, CPCT, IARI, New Delhi                | - Member              |
| 7. | Dr. V.B.Singh, Ex-Professor, SASRD-NU, Medziphema                          | - Member              |
| 8. | Dr. Lallan Ram, Director, CIH  | - Member<br>secretary |

#### Invited members present:

1. Dr.S.K.Malhotra, Agriculture & Horticulture Commissioner, Govt. of India
2. Mrs.Meribeni, Horticulture Specialist, CIH
3. Mr. Anjani Kumar Singh, Horticulture Specialist , CIH
4. Mr. Prabin Das, Marketing Specialist, CIH
5. Mr. Arvind Singh, Technical Consultant, CIH
6. Mr. Manzar Hossain, Post Harvest Technologist, CIH
7. Mr. Gohain, Senior Farm Manager, CIH
8. Mr.Lichamo, Asst. Horticulture Specialist, CIH
9. Ms.Shisarenla, Asst. Horticulture Specialist, CIH
10. Mr.Babu Singh, Administrative Officer, CIH
11. Mr.Ngupani, Sr. Technical Asst., CIH
12. Mr.Tokivi, Sr. Technical Asst., CIH
13. Ms. Imtinaro, PA to Director, CIH

Dr. S.K. Malhotra, Hon'ble Agriculture & Horticulture Commissioner Govt. of India, welcomed all the members and highlighted the mandate and vision the Institute followed by a brief introduction from all the members.

The Chairman began the meeting as per the agenda laid before the members as mentioned below:

**1. Confirmation of 8<sup>th</sup> TAC meeting held on 16<sup>th</sup> Feb., 2016 (Meeting minutes and action taken report)**

Dr. Lallan Ram, Director, CIH presented the action taken report of the minutes of the last Technical Advisory Committee meeting held on 16<sup>th</sup> Feb., 2016 which was approved by the members with certain suggestions of inclusion of low-chilling temperate fruits under varietal evaluation for sub-tropical areas of North East, using of recommended bio-enhancers and bio-pesticides rather than institute producing of its own due to lack of infrastructure and manpower.

**2. Achievements of CIH 2016-17**

The Achievements of the Institute for the period from April, 2016 to Dec., 2017 was presented by the Director, CIH in a power point presentation.

**3. Annual Action Plan of CIH for the year 2017-2018**

**a. Management of existing demonstrations:**

1. Instead of intercropping with Dhaincha, it was advised to go for moong bean in young plantations.
2. It was advised to delete Monocrotophos from the list of pesticides for open cultivation due to their toxic effects.

**b. Demonstration of Technology in the Institute**

1. It was advised by Chairman to shortlist the 23 nos. of demonstration as per priority and importance as it was not possible to take up so many demonstrations with limited manpower.
2. It was advised not to establish Mangosteen and Rambutan block as they were strictly of the subtropical region of India and have limited scope.
3. It was advised to cultivate Pusa Cherry -1, a new variety of Cherry tomato, Shwarna (Yellow) & Bomby (Red) variety of coloured capsicum, Hilton & Kian variety of Cucumber and Pusa Rasdav variety of Bittergourd under protected cultivation for demonstration of high value vegetables, which could be grown throughout the year. It was also mentioned that, all the varieties mentioned were available in IARI, Pusa, New Delhi.
4. It was advised to go for 10 different colour variety of Gladiolus for varietal evaluation and to go for staggered plantation at an interval of 15 days for longer availability of flower.

5. It was advised to use Pusa Narangi variety of Marigold for demonstration.
  6. It was advised to lay down Organic Nutrient Management demonstration with pig manure and other organic combinations where piggery is an important avocation.
  7. Demonstration and plantation of Khasi Mandarin in Meghalaya should be abandoned as it is home of its origin. Chairman advised that the same be laid in Sikkim where it is topmost crop under Horticulture Technology Mission.
- c. Quality Planting Material:**
1. It was advised to work out the demand and supply ratio of quality planting material in North East Region to ascertain the position of requirements.
  2. It was advised to use soil health materials like magnetized microbial soil in the quality planting material produced by the Institute.
- d. Human Resource Development:**
1. It was advised to organize Organic Farming trainings for the farmers of Sikkim.
  2. It was advised by Chairman to organize training both for officials & farmers on the topics of crop regulation, canopy management, pruning and quality management of kiwi fruit – an emerging crop in the North East.
  3. It was advised to give training on Climate mitigation of adverse Climate conditions for Trainers Training instead of the broad topic on climate management in Horticulture Crops.
  4. It was also advised to go for training on Soil Fertility Management in fruit crops instead of the topic on Diagnostic & Recommended Integrated System in Cultivation of Fruit crops for Trainers Training.
  5. It was advised to train the farmers on dry flower making technology.
- e. Post Harvest Management:**
1. It was advised to strengthen the infrastructure for Post Harvest Management and to take it up phase wise.
- f. Minor works:**
1. It was advised to reduce the cost for construction of low cost poly house using local material like bamboo.
  2. It was advised to include Micro Irrigation in poly house with a budget allocation of Rs.5 lakhs
  3. It was advised to construct Rain Water Harvesting structure as demonstration to be utilized for a particular demonstration plot initially for nursery production.
- g.** It was advised to reduce the budget allocated for landscaping of the institute from 10 lakhs to 5 lakhs and use the savings improving other infrastructure.



**4. Suggestions by the members:**

- a. It was advised to double the number of quality planting material & vegetable seed production and concentrate only on major crops whose varieties are suitable in the North East Region.
- b. It was advised to train the farmers on propagation techniques.
- c. In order to make the demonstration of the Institute more successful and easily manageable, it was advised to carry out the demonstration in the farms run by the State Horticulture Departments.
- d. It was also advised that, demonstration in the farmers' field should be monitored properly for its success and impact.
- e. It was also advised to produce quality planting material of temperate fruits in collaboration with the State departments where temperate fruits are grown.
- f. It was suggested by the members to go for Crop Regulation in Guava to avoid rainy season crop and that the Post Harvest Technologist should produce some value-added products instead of allowing wastage of the fruit during the rainy season.
- g. It was advised to promote the use of Low Tunnel Technology for early/off season summer squash production during the months of December to January.
- h. It was recommended that impact analysis study was very important and it should be carried out for all the activities of the Institute.
- i. It was also recommended that all-out effort should be made for the strengthening of the Institute by increasing the number of staff. Regularization of the staff should be done at the earliest for smooth functioning of the Institute to achieve its mandate. The Director of the institute was requested to take up such issues in the Board of Management Committee of the institute where Agriculture and Horticulture Commissioner is Chairman and overall guiding force of the institute.

The chairman Dr K K Jindal gave the closing remarks whereby he thanked all the members for their input on the various agenda items discussed in the meeting and the future guidelines. The Chairman also congratulated the Director and the staff of the institute for achieving over ten years in the development of horticulture sector in the North-Eastern region and publishing the success stories of the institute in overall development of horticulture. However, he further stressed that the institute should come up with a vision document for 2030 for the future course of the institute. He reiterated that there should be interface meeting with the stakeholders, specially State Horticulture Departments, SAU, CAU and ICAR institutions in the North East regions before Technical Advisory Committee meetings to get their views on the development of horticulture in the North East Hill Region through the programs of CIH. To conclude the Chairman praised the Hon'ble Agriculture and Horticulture Commissioner DAC Govt. of India for his constructive advice and dynamic leadership, while also thanking all invited and TAC members.

## 25.2. Recommendation of Board of Management

### **Minutes of the 12<sup>th</sup> Board of Management meeting of CIH, Nagaland held on 28<sup>th</sup> February, 2017 at 11:00 am at room no. 112, Khrishi Bhawan, New Delhi.**

The BOM meeting was held under the chairmanship of Dr. S K Malhotra, Agri. & Horti. Commissioner, DAC & FW, Govt. of India with 08 members and 02 invited members to review the progress of activities of CIH, to deliberate and consider for the approval of the Annual Action Plan 2017-2018 of the Institute as prepared under the guidance of the Technical Advisory Committee. List of members present is in Annexure -I.

The chairman welcomed the members and had a brief moment of introduction by all the members. He shared that the institute is being review by a High Powered Committee and that there were suggestions on changing the nomenclature of the Institute as Central Institute of Horticulture for the North East, as the vision & mandate of the Institute is for the North East. The chairman started the meeting by discussing and deliberating on the agendas laid before the members.

1. **Confirmation of the minutes of 11<sup>th</sup> BOM meeting:** The minutes of the 11<sup>th</sup> BOM meeting held on 18<sup>th</sup> March 2016 at Khrishi Bhawan, New Delhi was confirmed by the members.
2. **Achievements of CIH 2016-17:** Dr. Lallan Ram, Director, CIH presented a power point on the achievements made by the Institute in the year 2016-17 which was appreciated by the Board and some suggestions were given for the betterment of the Institute.
  - i) In order to control the infestation of fruit fly and stone weevil in mango crop, it was advised to follow the integrated pest management technology in mango developed by CISH, Lucknow. Further, as per the demonstration trial at CIH farm, Amrapali and Dashehari varieties were found suitable under the foothill conditions, thus it was advised to popularize only those varieties to the farmers.
  - ii) Along with the promotion of tissue culture banana var.G-9, it was also advised to promote the cultivation of local varieties of banana as many North East States have their own varieties which are highly accepted by the local population.
  - iii) It was advised to demonstrate and popularize new technology of cultivation as well as new varieties developed by various national level Institutes.
  - iv) As the main mandate of the institute was mass multiplication of quality planting material, it was advised that, tissue culture laboratory should be established in the Institute.
  - v) Through demonstration trials of vegetables in the Institute, it was advised to promote the use of low cost rain water harvesting and micro irrigation system to the farmers.
  - vi) It was suggested that, the institute should identify some bankable projects and organize a meeting with farmers, FPO's and other stakeholders by inviting officials from NABARD for dissemination of information to the state level farmers.

- vii) The members appreciated the Institute for conducting certificate course, however, it was opined that, it was very important to ascertain the impact of such programmes. It was advised that, follow up action should be done for all the certificate course, skill development course and trainings conducted by the Institute and the action taken report should be submitted in TAC and BOM meetings.

**3. Action plan 2016-17:** Power point presentation of Annual Action Plan 2017-18 was presented by Director CIH and was deliberated upon. The Action plan 2017-18 was approved with the following suggestions by the members.

- i) It was advised that, the Institute should promote the cultivation of fig and that a demonstration trial should be carried out in the Institute.
- ii) For every demonstration that is done in the Institute, the technology to be adopted should be mentioned in the Action Plan.
- iii) It was advised to increase the production capacity of quality planting material.
- iv) It was advised that, in case RKVY does not sponsor the Skill development course, then the Institute should utilize the funds under MIDH. However, it was suggested to submit a proposal to RKVY for sponsoring of the skill development trainings. Further, as the Institute has only two skill development course, it was advised to start another course by taking the curriculum from any of the four numbers of Certificate course and get it approved as per ASCI norms.
- v) It was mentioned that, the cost norms for construction of polyhouse as mentioned under MIDH guidelines should be followed.
- vi) As construction of training hostel was a priority, it was advised that, CPWD should be requested to submit the estimate for the complete hostel and the sanction should be done as per the availability of the budget allocated to the Institute.

**4. The chairman gave time to all members to share their suggestion and inputs, which are mentioned as follows.**

- i) Dr.Kirti Singh – He shared that, the Institute should have a good library and that fund should be allocated for maintaining of the same. He also expressed that, review meetings should be held every six months.
- ii) Vice Chancellor, CAU - He shared that their Institute have a project for promotion of orchards and for which they require large number of quality planting material of Khasi mandarin, lemon, aonla, jackfruit, papaya, tree bean etc and so for these, CIH was requested to supply the quality planting materials and link them with accredited nurseries.
- b) He advised CIH to be focused and do more demonstration trials on problem areas of the North East.
- c) In order to achieve the vision of Farmers double income of the Hon'ble Prime Minister, a horticulture based approach on integrated farming system was required. However, there are number of issues and challenges that need to be addressed like



water harvesting, efficient use of water, irrigation facilities, climate resilient crops, post harvest technology and value addition which the State functionaries cannot tackle alone. Thus Institutes like ICAR, CAU, SAUs and CIH need to work together. In this regard, the Chairman opined that, joint discussions and meetings were required to discuss important issues of regional and national level and resolve unresolved issues.

- iii) Representative of NABARD – He shared that, packaging and marketing was an important issue to be addressed and that promotion of Integrated pack house under MIDH was required to be done.
- iv) Representative of Zopar – He inquired on whether accreditation of flowers were carried out or not. In this regard, the Chairman shared that, the guidelines for accreditation of flower nurseries was in process.
- v) Mr.Zion, Progressive Farmer of NER – He shared that, the fruiting of Tree bean and Avocado were declining after few years of fruiting and requested for suggestions on how to tackle with it and also shared that, the Mizoram farmers are going to harvest a large quantity of ginger and for which he requested to guide in marketing of the same. The Chairman requested them to approach the State Government & NABARD as there were various market intervention schemes. For the decline of Tree bean and Avocado, he was advised to approach the Research Institutions.
- vi) Dr.V.B.Singh – He shared that the staff position of Institute should be strengthened for achieving greater goals.

The chairman ended the meeting by thanking all the members for their valuable inputs and that since marketing was a major issue for the farmers of North East Region, he advised that the Institute should conduct 3 days trainings on formation of Farmer Producer Organisation (FPOs), suggest and guide them on how to link with SFAC and how the government can support them in creating Kisan Mandis. He shared that the next review meeting will be held in Nagaland at the Institute itself.





CENTRAL INSTITUTE OF HORTICULTURE  
MEDZIPHEMA, NAGALAND





# NATIONAL CONFERENCE

on

*Advances in Indian Floriculture with Focus on North East & Hill Regions*

Chief Guest



Shri. P.

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DIRECTOR, HORTICULTURE

DR. LALLAN RAM  
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