North East Institute of Science & Technology, Jorhat

The beginning ...

"...There were special problems of industry and raw materials in Assam which required investigation. The inadequacy of communication between Assam and other parts of India made it necessary to put a separate laboratory in Assam".

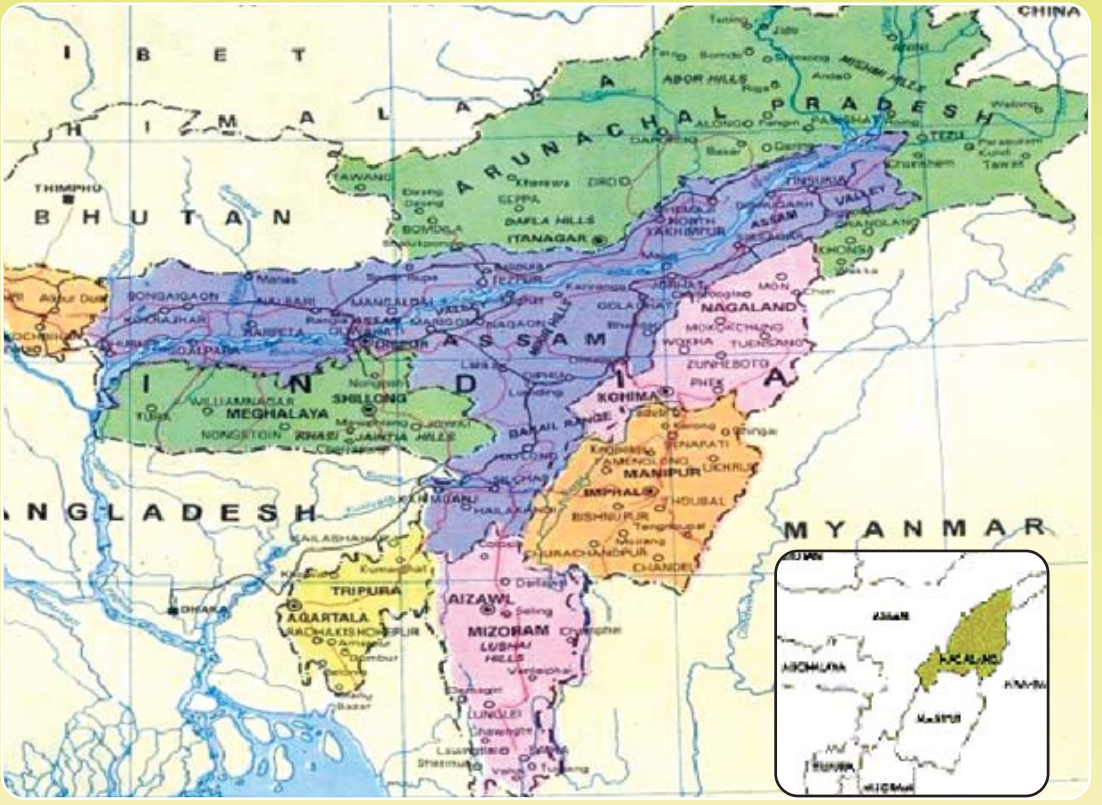
Prof Humayun Kabir laid the Foundation stone of NEIST (RRL) Jorhat

This was recorded by the Special Committee of the Governing body of Council of Scientific & Industrial Research, New Delhi on September 1, 1954 and consequently the committee discussed on a proposal for setting up of the third RRL in the country and the first in Assam.

On March 18, 1961, Prof Humayun Kabir, Minister of Scientific Research & Cultural Affairs, Govt of India laid the Foundation stone of North East Institute of Science & Technology (formerly Regional Research Laboratory) at Jorhat, Assam.

CHARTER

- Put to effective use the immense material resources of the North Eastern Region (NER) of India
- To provide R&D inputs and to develop the economy of the NER in particular and the country in general.
- To function as a link between the state organizations and other national laboratories on problems requiring specialized attention.



The North Eastern Region of India.(Inset : Nagaland)

The states of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, and Sikkim constitute the North Eastern region of the country. A major part of the region including Nagaland is inhabited by tribal community. The region is characterized by poor infrastructure, difficult terrain, geographical isolation, poor socio-economic conditions and a low rate of growth. The region has common borders with foreign countries like China, Myanmar, Bhutan and Bangladesh and thus assumes extra significance. It has abundant forest, mineral, agricultural and horticultural resources. Most of these resources were either unutilized or inadequately utilized. The peculiar climate of the region with gradations from humid alluvial valley through evergreen forests to the snowline produces an immense variety of flora and fauna.

(I) Introduction of agro-practices in Nagaland

(a) Citronella cultivation

Keeping all the factors as mentioned above in mind the laboratory launched its rural development activities in the region in the years as back as 1970s. While launching its activities , the laboratory identified a few remote places in different regions to form the nuclei or the bases for furtherance of its activities. Accordingly, it made its debut as an S&T player in Nagaland in 1970's by identifying a small village called Yaongyimsen initially to start with. It first opened a sub-station at Yaongyimsen after procurring 3 acres of land. Yaongyimsen is a small village in the Mokokchung district of Nagaland tucked away at a height of about 4000 ft above the sea level and then inhabited by a population of 3800 Naga people belonging to Ao sub-tribe. In 1973 an experimental-cum-demonstration unit of citronella was started and the villagers were motivated to take up demonstration and training for citronella

Massive cultivation of Citronella grass in Yaongyimsen village in 1970's

cultivation. Java citronella is the best source of citronella oil which is a raw material for production of geraniol, citronellol, hydroxy citronellol and other similar high value perfumery bases. The oil is widely used as starting material for various aromatic chemicals in scented soaps, sprays, deodorants, detergents, polishes and in mosquito repellant. The oil is in great demand in the country. Prior to seventies, most of the citronella oil used to be imported. In 1971, out of 350 families of Yaongyimsen village, five families took to this cultivation and brought one acre of land under the citronella cultivation. That was an unique experience with the Naga villagers. For the past hundreds of years they were resorting to only shifting cultivation (Jhuming) and were living completely at the mercy of nature. After this humble beginning, gradually more families of the village started participating in the programme bringing more and more land under citronella cultivation. The laboratory designed, fabricated

The traditional practice of Jhuming cultivation in Nagaland

Prof Y Nayudumma, Former Director General of CSIR visited Yaongyimsen village in 1974

The Jubilant villagers in traditional attire welcomed the CSIR Chief

and installed a distillation plant for distillation of citronella oil for the benefit of villagers and it was at that point of time that the Department of Industries, Govt of Nagaland was brought into the scene.

During the time, three of the important ministers of the Government of Nagaland namely Mr Hokishe Sema, Chief Minister, Mr T N Angami, Minister of PWD and Mr R C Chiten Jamir, the Finance Minister visited NEIST on 30 April, 1973 to discuss with NEIST authority for furtherance of the activities.

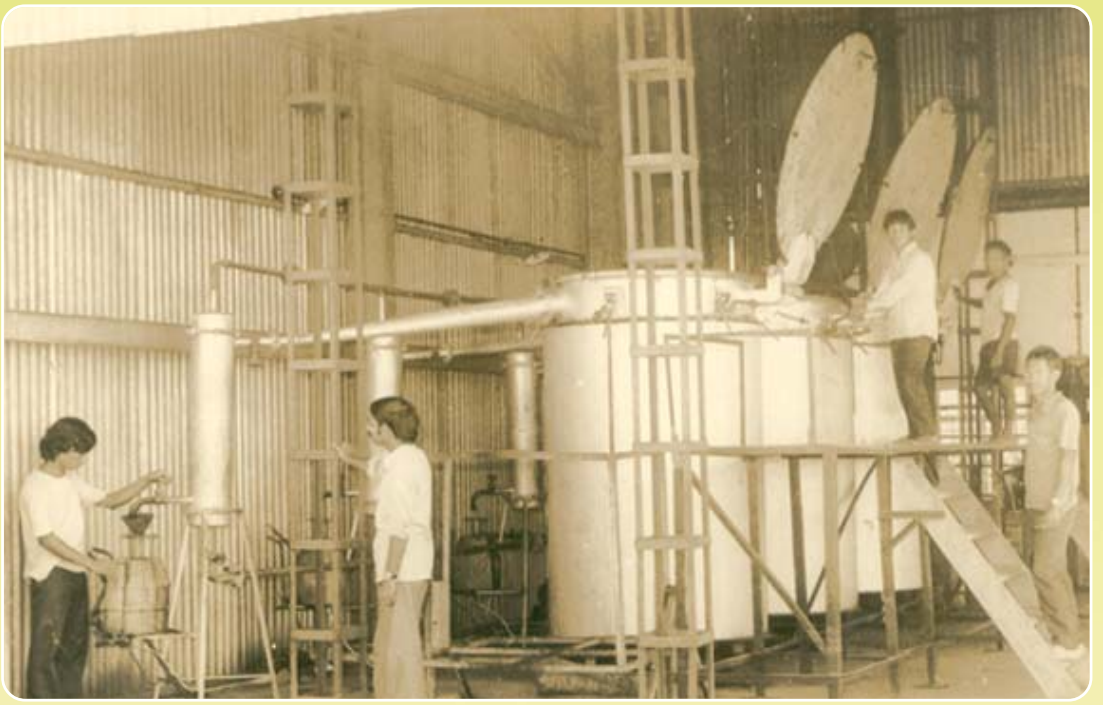
In 1974, Prof Y Nayudumma, the then Director General of CSIR paid a visit to Yaongyimsen village and was overwhelmed to see the spontaneous participation of people of Nagaland for reaping the fruit of science and technology. Prof Nayudumma donated the first distillation plant to the people of Nagaland in presence of dignitaries of Nagaland Government. The Industries Department of the Govt. of Nagaland started distilling the grass with the distillation unit supplied by NEIST and the villagers started selling the grass to the Department and thereby started earning money. The capacity of the distillation unit thus supplied was of 200 kg/batch only and hence soon it was found that it was not adequate to distill the grass. So another 200 kg/batch capacity still was installed. Those two distillation plants were provided free of cost by NEIST. Due to the efforts of NEIST, about 30 acres of land were covered under citronella cultivation in Yaongyimsen village alone. As the cultivation was further extended, the two distillation stills were also become not enough to distil the grass produced by the villagers and to meet the growing demand, new distillation stills of higher capacity were installed. To cope with the increased production of green leaves in 1975-76, a turn key project was undertaken by NEIST Jorhat for installing 600 kg/batch capacity distillation still at Yaongyimsen at a cost of Rs. 2.6 lakhs, provided by the Department of Industries, Govt. of Nagaland. As sufficient surplus land was available under the disposal of the villagers, the acreage increased significantly to an area of approximately 150 acres with the further installation of commensurate increase in the capacity of distillation plant to 2000 kg/batch which was installed by Nagaland Industrial Development Corporation (NIDC). Because of the promotional efforts of NEIST in

Warm felicitation to Prof Nayudumma by the village Head

Prof Nayudumma dedicated the Citronella Distillation plant to the People of Nagaland

1983, 281 more families of the village brought around further 210 acres of land under the cultivation and produced around 6000 tonnes of grass valued at Rs 30 lakhs. The annual income per family in 1983 came up to more than Rs 8,000/- through the cultivation. Apart from selling citronella grass, some villagers also getting employment in the distillation plants as skilled manpower who were trained by the laboratory.

The activities in Yaongyimsen village acted as a catalyst and persistent requests poured into NEIST Jorhat to introduce such programmes in other villages in Nagaland.



The Citronella Distillation Plants at Yaongyimsen village

Dr G Thyagarajan, the then Director of NEIST Jorhat with Mrs S Thyagarajan - whose brain child was Yaongyimsen village

The Naga United Society - an NGO has taken up large scale cultivation and distillation unit of citronella grass wth the patronage of DBT and NEIST Jorhat

Encouraged by the success of Yaongyimsen project, citronella cultivation was later extended to other places viz. Mongolomba, Mongsemyimti, Kublung, Kheriphema, Sirhima, Liqumi, Dhansiripar, Chingemi, Lusami and Tizit. The Directorate of Horticulture of Nagaland also started commercial cultivation of citronella. A number of entrepreneurs and NGOs are also engaged in commercial cultivation of citronella grass. The Govt. of Nagaland in association with NEIST Jorhat has planned to go for large scale citronella cultivation and extraction of oil. During 2005-2006, 7 private growers from Dimapur and Chumukedima of Nagaland had newly started cultivation of citronella grass.

(b) Eucalyptus

Success of Java citronella on a commercial scale gave the villagers a new kind of enthusiasm for taking up new ventures and as a result another variety of aromatic oil bearing plant *Eucalyptus citriodora* was introduced in 1979. With this crop a massive scale plantation was taken up with a view to supplying raw materials for distillation of eucalyptus oil. Approximately 25000 seedlings of eucalyptus were provided by NEIST sub-station free of cost. This plantation helped not only in economic uplift of the villagers but also in keeping the effected ecology in balance due to felling of perennial trees and practice of jhumming.

(c) Cultivation of lemongrass

Oil from lemongrass is a main source of synthesizing Vitamin A. The technology was released to farmers in 1980 and within a span of just 10 years, 232 Naga

families took up this cultivation and started earning around Rs. 3000/- per acre per annum by supplying the grass. The laboratory launched promotional activities for cultivation of this plant species in Nagaland and motivated the tribal families for its cultivation. During the current years, more private growers namely Mr N Khasito Aye and Mr Khihokhu Chophi from Dimapur became involved in the commercial cultivation of lemongrass.

A lemongrass field at Nuiland, Dimapur

A bamboo seedling nursery with NEIST Jorhat technical support at Dimapur

(d) Bamboo plantation

As a measure to check the soil erosion problem in hilly areas of Nagaland, the laboratory in 1980's undertook a wasteland development project by way of introducing bamboo plantation and motivating the villagers to take up large scale bamboo plantations. A total of 10 villagers from Dimapur area took up bamboo cultivation in an area of 30 acre during 2005-2006.

(e) Patchouli cultivation

The oil of Patchouli (*Pogostemon cablin*) is used in high grade perfumes. It has the strong fixative properties and thus promotes tenacity of a perfume. The agro-climatic conditions of Nagaland is favourable for cultivation of Patchouli. The laboratory

introduced this particular high value plant species in Nagaland as an alternative commercial crop in 2005 and motivated the growers for its cultivation. As of today, as many as 22 entrepreneurs and growers from the places like Chumukedima, Dimapur, Nuiland, Kuhuboto have taken up commercial cultivation. Distillation plants are also coming up in private sectors in a number of places.

Two views of a nursery of Patchouli saplings at Chumukedima village, Nagaland

(f) Mushroom cultivation

The agro-technology as developed by NEIST Jorhat for cultivation of edible mushroom was initially transferred to a few growers of Kohima villages near Kohima town, the capital of Nagaland. The Nagas were distributed with the right type of spawns suitable for agro-climatic conditions of the areas. They were given intensive training, initially at the laboratory and later on at the sites. They absorbed the technology and started producing edible mushrooms. In 1983 four families took up the cultivation who produced and marketed five tonnes of mushroom valued at Rs. 1,20,000/-. Gradually the number increased and more and more families joined the race to make it a booming business.

(II) Industrial Development and Services

(a) Paper Slate industry

NEIST Jorhat developed a small scale technology for manufacture of paper slate which is used in primary and pre-primary schools. These slates are unbreakable, lighter in weight, cheaper in price and retains abrasiveness longer than the conventional writing slates. The laboratory established a 100 slates/day industrial unit for manufacture of Paper slate in 1976 with a grant of working

Paper slate unit at Yaongyimsen

Patchouli plants

Mrs K Nihokhu Chophi, an enterprising woman has taken up large scale cultivation of citronella, lemongrass, patchouli and stevia

A distillation plant for citronella/lemongrass/patchouli set up by Mr Bito Luhu at Chumukedima, Dimapur

A distillation still under construction and set up by Mrs K Nihokhu Chophi at Nuiland, Dimapur

Samples of aromatic oil

A State of Art Broadband three component digital Seismograph system at Yaongyimsen village

capital of Rs. 5000 from the Govt. of Nagaland. A Naga, nominated by the villagers was imparted necessary training to handle the industry. Sri M Ramunni, Advisor to the then Governor of Nagaland inaugurated this Paper slate unit at Yaongyimsen village in Nagaland. The industry helped in the economic uplift of the villagers. However, with the demise of the entrepreneur, the factory stopped manufacturing since 1979.

Earthquake Monitoring in Nagaland

The North Eastern Region of India is one of the seismically very active segments of the world. The region is tectonically complex area of geologic provinces that have varying structural trends. Further, the region lies between the two continental collision boundaries - the Himalaya in the north and the Indo-burma in the South-east and its intense continental convergence of the northward moving Indian plate at the rate of about 5 cm per year, continue to produce great earthquakes of magnitude $M > 8.5$ every few hundred years, while a significant number of moderate earthquakes ($M > 6$) occurs more frequently. With the growing expansion of human habitat and industrial

activities, the risk to the society posed by these earthquakes has increased. Nagaland lies in the continent collision boundary i.e. Indo-Burma mountain ranges bordering to Burma (presently known as Myanmar). The region, as such, falls in the zone No. V on the Indian seismic zoning gradation.

Prior to the year 1979 International Seismological agencies such as International Seismological Centre (ISC), Newbury, UK and United States Geological Survey (USGS) detected earthquakes in the North Eastern Region of India at the detection threshold magnitude of 4.5. In order to improve the situation of poor detection capabilities, the laboratory jointly with National Geophysical Research Institute(NGRI), Hyderabad, embarked on the programme of establishing two seismograph stations at Yaongyimsen (YYI) and Kohima (KHM) in Nagaland in the year 1979. The stations YY1 and KHM are equipped with short period vertical component Johnson - Matheson sensor with galvamometric photographic recording and Teledyne Geotech Model S 13 sensor with RV 320B portacorder respectively. The timing used at these stations was obtained from Quartz - crystal controlled chronometers. The standard reference time was obtained by recording the time signals broadcast by National Physical Laboratory, New Delhi. Further, the telemetered seismic stations at Bhandari, Chanki and Kongon were radi linked with the analog Central Recording Unit located in the Geoscience Division of the laboratory during the period 1990-1998. Presently, the Stations at (i) near Kohima Science College Campus, Nagaland University and (ii) Yaongyimsen are upgraded into GPS time based short period three component digital seismograph system and Broadband three component digital Seismograph system respectively.

Output

Myanmar accounts about 50 percent of earthquake activity in the North Eastern Region of India. The seismic stations gave us several analog and digital recorded spectrums of the earthquakes in the North Eastern region of India during the period 1979-1999. Annual seismological Bulletins, depicting the seismicity of North East India from the operation of analog seismic station are available. The interpretations of analysed spectrum data revealed that (a) majority of intermediate depth earthquakes occurred in Myanmar and close to Nagaland and also as times in Nagaland too, (b) absence of large magnitude shallow earthquake in the region which indicates cessation of active subduction processes, (c) Indian Plate strikes at a dip 45^0 beneath Burmese Plate and penetrates upto the depth of 180 km, (d) low magnitude tremors occurred in Nagaland in association with tectonic lineaments/faults thrusts which are usually known as zones of crustal weakenesses and (e) the earthquake activity, in general, can be attributed to the tectonic movements that have taken place due to the interaction of the Indian, Tibetan and Burmese plates under plate-tectonic stress regime. From the preliminary analyses of travel times for near earthquake phases, the total thickness of crust is found to be about 50 km while thicknesses of upper and lower crusts remain at 25 km each.

There is a need of still more closer network of seismic stations for deciphering the exact role of tectonic lineaments and lineament to lineament interaction in the occurrence of tremors especially in Nagaland.

Human Resource Development

NEIST Jorhat in 1977 in association with the Directorate of Education, Govt. of Nagaland and the Ministry of Education and Social Welfare, Govt. of India, New Delhi organized an Orientation and Motivational Course in Science. The course continued for one month and 10 students from Nagaland participated in the programme.

- Training on cultivation and distillation of essential oil bearing plants was imparted to Sarbashri Alem Ao, Imkong Ao, Waizungba Ao, Shijungtemjen and C Nitovi Swu deputed by Industry Department, Govt. of Nagaland.

- The laboratory in 1983-84 organized short-term training courses on the cultivation of edible mushroom during February 20 to March 1, 1984. The training was attended by Mr Kevingukho, Mr Visesielie, Mr Pezosal and Mr Kevibol from Nagaland. The laboratory also organized an extensive training programme on cultivation and distillation of medicinal and aromatic oil bearing plants during August 1 to September 30, 1984. The training was arranged at the request of the Director of Industries, Govt. of Nagaland and six officer namely Sarvashri Kajen Kaba Ao, Ramoklemba Ao, Shamithang Rengma, Renditemsu Ao, Saku Ao and Jokihe Sema.

- A short term training programme on cultivation of mushroom was organized in the Laboratory during the Ist week of February, 1986. The training included spawn making, composition, culture preparation, cultivation, harvesting, etc. The training was attended by entrepreneurs from Nagaland and other North Eastern states.

- The laboratory organized an extensive training programme on cultivation and distillation of medicinal and essential oil bearing plants during May 12 to June 11, 1987. The training was arranged at the request of the Director of Industries, Govt. of Nagaland. The course included the cultivation aspect of citronella, lemongrass, ocimum, basil, plant improvement aspects; tissue culuture, plant pathology and physiology, farm management, weed control, inter culture, application of fertilizer, farm and plant management, etc. The theoretical and practical aspects on distillation including GLC, TLC, fractional distillation, etc. were also discussed. The training was attended by four officers deputed by Nagaland Government.

- A training course on drinking water was conducted by the laboratory for the government personnels engaged in sustainable management of water supply for the north eastern states during January 04-14, 1988 in which participants from Nagaland took part. The course was sponsored by the Department of Rural Development, Ministry of Agriculture, Govt. of India under National Technology Mission on drinking water.

- A training programme on agrotechnologies of medicinal and aromatic plants along with distillation technology on essential oils was organized for the personnels deputed by the Department of Industries, Govt. of Nagaland for period of three months from September 20 to December 20, 1988.

- A short term training on cultivation and processing of aromatic and medicinal plants was organized by the laboratory during Janurary 07-18, 1999 for office Personnels deputed by the Industries Department, Govt. of Nagaland. A total of 5 trainees selected from various departments by the Industries Department of Nagaland attended the training.

- A training-cum-workshop was conducted in the laboratory jointly with the ITRC, Lucknow on `Strategies on environmental quality related to food, water and health' on August 04, 2000 for the North Eastern states in which representatives from Nagaland participated.

- Training and demonstration was imparted to Self Help Group participants under NGO `AIDA' at Dimapur, Nagaland during 27-30 April, 2004 for cultivation of citronella, lemongrass and patchouli.

- The laboratory in collaboration with the Directorate of Geology & Mining, Govt. of Nagaland organized a public awareness campaign-cum-seminar at Mokokchung on 20 September, 2005. The awareness campaign was inaugurated by Mr Imkongtemsu, Deputy Commissioner, Mokokchung district and presided over by Mr S K Kenye, Additional Director, DGM. The scientists of NEIST interacted with the audience participants about the monitoring of seismicity in Nagaland and also briefed on different aspects of seismology.

- During 2005-2006 under a DBT sponsored project, NEISTJorhat set up one demonstration unit at Dimapur for multiplication of plant materials to provide growers free of cost. The laboratory also imparted training-cum-demonstration at the premises of the Naga United Society, an NGO functioning at Dimapur, Nagaland during 14-17 July, 2005. Altogether 72 growers and entrepreneurs were given training on agrotechnologies for citronella, lemongrass, patchouli and bamboo. Mr Takodung Ao, Assistant Director of Industries Department, Nagaland acted as the key person. The laboratory distributed citronella, lemongrass and patchouli saplings free of cost. Bamboo seedlings grown at laboratory's nursery were also provided to growers.

- A demonstration programme was held at Dimapur and Nuiland, Nagaland on 22 March 2006 and three operators of distillation plants were given advanced training.

- A 500 kg capacity per batch distillation plant was set up at 5th Mile, Dimapur, Nagaland at the premises of Naga United Society and trial run was given on 14 July 2005.

- A demonstration farm was set up at 5th Mile, Dimapur where 50,000 cuttings of patchouli were multiplied. Around 50,000 bamboo seedlings were grown at Khoboto, Dimapur. Mixed cultivation of bamboo and sal tree, bamboo and soyabean, bamboo

and colocasia have been introduced in Kuhuboto, Dimapur as a measure to get immediate return during the gestation period of bamboo cultivation.

- An awarenss programme on 'Geological Hazards and its Mitigation' was organized at Wokha, Nagaland jointly by the Directorate of Geology & Mining (DGM), Govt. of Nagaland and NEIST, Jorhat during 4 – 6 December 2006 with a view to raising the level of awareness of the Nagaland public about the earthquake hazards and its precautionary measures. The programme was inaugurated by Sri WT Konyak, DC of Wokha. Among the target groups for the programme included the District Administration of Wokha, Heads of the Departments of Wokha, Principals of Colleges and Headmasters of schools, Pastors of the Wokha Town Churches, Representatives of Lotha Hoho, Lotha Eloe and Lotha Students' Union, Students of Mount Tiyi College, Representatives of Police, Assam Rifles, CRPF and others and the resource persons included among others Sri Wnthang, Jr Director, DGM, Nagaland, Sri K Arhomo Lotha, Jt director, DGM, Nagaland and Scientist of NEIST. As a part of the Programme the participants were taken to important geological sites like Nagaland University Complex, Longsa sandstone deposits, Wokha landslide affected areas, Rate hole mining at Bhandari, Merapani and Lateritic-Bauxite deposits of Merapani.

- A two day programme on Awareness and Training for Mushroom cultivation was held during 28-29 January 2009 at Chukitong village, Wokha, Nagaland in collaboration with Yanke Multipurpose Welfare Society Ltd., Wokha, Nagaland. A Total of 64 beneficiaries from nearby villages participated. NEIST scientists discussed the relevance of the programme in upliftment of rural economy. The inaugural ceremony was presided by Dr YY Kikon, Chairman of the Society. Dr LE Lotha, District Horticulture Officer, emphasized upon the need of people's participation in such endeavours. The details of setting up a Mushroom Spawn Production Unit at the location were discussed and training was conducted on different aspects of Mushroom cultivation. Secretary of the society also expressed keen enthusiasm in setting up of spawn production unit in a suitable building of the society. Cultivation materials like mushroom spawn, polybags, writing materials were presented to the beneficiaries.

R&D and other services rendered for industrial and societal development

1971

- NEIST Jorhat adopted Yaongyimsen village of Mokokchung district of Nagaland for overall development of the people through application of science and technology.
- 5 out of 350 families of Yaongyimsen village started growing of citronella grass under supervision of NEIST Jorhat.

1973

- Investigation of site and evaluation of the mineral oil found at Changtongia, Nagaland was undertaken on behalf of Industries Department, Govt. of Nagaland.
- Turn-key job for fabrication, construction, erection and commissioning of a citronella distillation unit for Industries Department, Govt. of Nagaland to cope up with 50 acres of citronella cultivation.

1974

- Prof Y Nayudumma, Director General, CSIR visited Yaongyimsen village and dedicated the distillation plant to Yaongyimsen village, Nagaland.
- Study on suitability of sand for cement concrete, cement plaster and renderings on behalf of Executive Engineer, Nagaland Pulp & Paper Mills, Tuli, Nagaland.
- Fabrication and installation of a distillation unit for citronella oil on behalf of Divisional Forest Officer, Govt. of Nagaland.

1975-76

- Investigation on concrete mix design from M-130 and M-200 with river shingles (gravels) on behalf of M/s Nagaland Construction Co., Mokokchung.
- Investigation on the suitability of stones of quaries at Mile-24, Mile-32 on Amguri-Mokokchung Road on behalf of M/s Nagaland Pulp & Paper Co. Ltd., Tuli, Mokokchung.
- Recommendation for concrete mix design on behalf of M/s Natural Project Construction Corporation, Nagaland.

1977

- Concrete mix design for M-150, M-200 using Kanaighat sand crusher stone dust on behalf of Construction Supdt.,National Project Construction Corpn Ltd., Tuli, Mokokchung.

1978

- Advice on bearing capacity of foundation soils of lime kiln area of NPCC on behalf of Project Engineer, NPPC, Tuli, Mokokchung, Nagaland.
- Investigation on economical concrete mix design of grade M-300 on behalf of Construction Supdt., NPCC Ltd., Nagaland.

1979

- Establishment of Seismic stations of NEISTJorhat at Yaongyimsen village and at Kohima, Nagaland.

1980

- Analysis on stability of hill slopes on behalf of Pulp & Paper Mills, Tuli, Nagaland.

1982

- Advice on protective measures to be adopted at Paper Mill site on behalf of Nagaland Pulp & Paper Mills Co. Ltd., Tuli, Nagaland.
- Agropractices for Edible Mushroom released to Dilzvon Angami, Kohima, Nagaland, Little Flower School, Nagaland, T Keviyiesa, D-Block, Kohima, Nagaland, Brig. Vishwanathan, Assam Rifles, Tuensung, Nagaland.
- Evaluation of properties of coal samples on behalf of NPPC, Tuli, Nagaland.
- Evaluation of pulp and other raw materials for paper making on behalf of NPPC Ltd., Tuli, Nagaland.
- Evaluation of strength of pipes on behalf of Nagaland Concrete Pipe Industries, Dimapur, Nagaland.
- Fabrication and supply of a 150 kg grass holding capacity direct fired citronella distillation plant on behalf of Sema Ao, Changtungia, Nagaland.
- Study of Akka Tusu species for building of bamboo stacks on behalf of NPPC Ltd., Tuli, Nagaland.

1983

- Agro-technology for cultivation of Jor Lab C2 (Java citronella) on behalf of Director of Industries, Govt. of Nagaland.

- Advice on strength properties and chemical composition of MS Rods on behalf of Chang & Co., C/o S S Agarwal & Co, Kher Mahal, Dimapur, Nagaland.
- Study and standardization of mixed coke of bamboo and reedships and evaluation of physical strength properties on behalf of Nagaland Pulp & Paper Co. Ltd.,Tuli, Nagaland.

1984-85

- Suitability of soil for making burnt clay brick on behalf of Secretary, Nagaland State Mineral Development Corpn. Ltd., Kohima, Nagaland.
- Agro-technology on Mushroom cultivation on behalf of Directorate of Agriculture, Govt. of Nagaland, Kohima.

1985-86

- Consultancy on JorLab C2 and Palmarosa on behalf of Director of Industries, Govt. of Nagaland, Kohima.
- Suitability of soil for making burnt clay brick in a semi-men used plant at Dimapur on behalf of Nagaland State Mineral Development Corpn. Ltd., Kohima.

1986-87

- Evaluation of properties of cement on behalf of PWD Dimapur, Nagaland.

1987-88

- Evaluation of yield percentage and strength properties of pulp from mixed bamboo of Nagaland on behalf of NPPC Co., Tuli, Nagaland.

1988-89

- Assessment of damages at Pulp & Paper Mill, Tuli due to earthquake on behalf of NPPC, Tuli.

1991-92

- Cultivation technology on Edible Mushroom on behalf of SDO, Tuli, Govt. of Nagaland.

1994-95

- Cultivation technology on Java citronella on behalf of Pikato Agro Forestry Enterprises, Nagaland.
- Characterization of Ni-Co bearing magnetite undertaken on behalf of Geology & Mining, Dimapur.

1998-1999

- NEIST Jorhat trained 5 persons in cultivation and processing of aromatic plants deputed by Industry Department, Nagaland.

2003-2004

- CSIR Golden Jubilee Exhibition was held at Kohima and was inaugurated by Sri Shyamal Dutta, Governor of Nagaland during 28-30 June 2003.

2004-2005

- Training and demonstration given to Self Help Group for cultivation and processing of citronella, lemongrass and patchouli at Dimapur, Nagaland.

2005-2006

- Earthquake Awareness Programme organized in collaboration with Directorate of Geology & Mining, Govt. of Nagaland at Mokokchung.
- NEIST participated in the North East Agri-Expo 2006 on Emerging Horizons in Agribusiness organised by the Confederation of Indian Industry (CII), jointly sponsored by the Ministry of Agriculture, Ministry of Development of North Eastern Region and the

Ministry of Rural Development, Govt. of India, hosted by the Govt. of Nagaland held at Dimapur during 27 - 31st March 2006.

2006-2007

- Analysis of *Taxus baccata* plant sample on behalf of M/s T Murry Aluminium Conductors & Cable Industries, Dimapur, Nagaland.
- NEIST offered consultancy for contract farming on citronella cultivation to M/s Fortress Agromatrix, a private company of Kohima, Nagaland.
- Consultancy offered for Preparation of pre-feasibility study report on manufacture of coke breeze from Konya coal of Tuensang district, Nagaland to Directorate of Geology & Mining, Govt. of Nagaland, Dimapur.
- Consultancy for Evaluation of six samples of dimensional stones of Nagaland offered to Director of Geology & Mining, Govt. of Nagaland, Dimapur.

2007-2008

- Consultancy on Manufacture of coal briquettes for gainful utilization of Nagaland coal to Directorate of Geology & Mining, Govt. of Nagaland, Dimapur.
- NEIST scientists have assessed, evaluated, monitored the execution and provided necessary guidance for several projects of Nagaland funded by the Council of Advancement of People's Action & Rural Technology (CAPART), Ministry of Rural Development, Govt. of India.

2009-2010

- Projects accomplished on study of avilability and suitability of Nagaland coals for generation of Thermal power (Desulphurization).
- Projects accomplished on testing and evaluation of conventional and renewable fuel sources.
- Agreement signed between NEIST and M/S Bito's Aromatic Oil Industry, Chumukedima, Dimapur for handing over of Aromatic Oil Distillation Plant on 9 April 2009 by NEIST under the CSIR project titled 'Rural Development through Aromatic plant and Mushroom and their processing in North East India'.
- Agreement signed between NEIST and M/S Yanke Multipurpose Welfare Society Ltd., Chukitong: Wokha, Centre - Dimapur for handing over of equipments for Mushroom Spawn Production Unit viz., Oven, BOD incubator, Laminar Air Flow, Autoclave Vertical, Mushroom drying cabinet and Heating Mantle, Ganesh Pneumatic Hand Sprayer and Water Still Distillation Unit by NEIST to the former on 26 October 2009.

Future Plan of CSIR-NEIST

For dissemination of technologies and knowledgebase to the people in remote areas of Nagaland, it is proposed to set up a study center in Nagaland University campus. Through Study Centre, NEIST Jorhat will provide interaction with students and entrepreneurs, provide training and support to existing beneficiaries. It is also proposed to have closer interaction with students and Faculty Members of various colleges for human resource development.

Activities of Other CSIR Laboratories in Nagaland

Road Construction

CRRI, New Delhi

Completed Projects on 'Landslides on NH-39:Kohima-Dimapur Road' during1986 – 1990, on 'Measures for landslide spots on Dimapur – Kohima Highway (NH-39)' and on 'Investigation and recommendation for suitable correction measures for landslide spots on Dimapur – Kohima Highway (NH-39)'during 1991 – 2001.

RGGVY Related Work

CIMFR, Dhanbad

Undertaken projects on 'Quality Inspection, Monitoring and supervision of RGGVY work at 10 districts of Nagaland' during July 2009.

Water Treatment Plant

CGCRI, Kolkata

DST has sponsored a project to install two iron removal plants in each of the eight states in the north eastern part of India. The two iron removal plants based on ceramic membrane technology installed at Dimapur, one at Walford Colony and the other in Chakhesang Colony in Nagaland and were inaugurated on February 11, 2006.

Bamboo Cultivation

IHBT, Palampur

1,000 plants of *Phyllostachys pubescens* from IHBT Palampur were sent to Nagaland Bamboo Development Agency for field trials in Nagaland in March 2006.

Smelting studies on magnetite

NML, Jamshedpur

The Smelting studies conducted on nickel-chromium-cobalt bearing magnetite belt at Pokphur, Tuensang district, Nagaland for techno-economic feasibility in collaboration with Govt. of Nagaland.