

# **RRL JORHAT ACTIVITIES IN NAGALAND**

The state of Assam, Meghalaya, Nagaland, Manipur, Sikkim, Arunachal Pradesh and Mizoram 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, Burma 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 snow line produces an immense variety of flora and fauna.

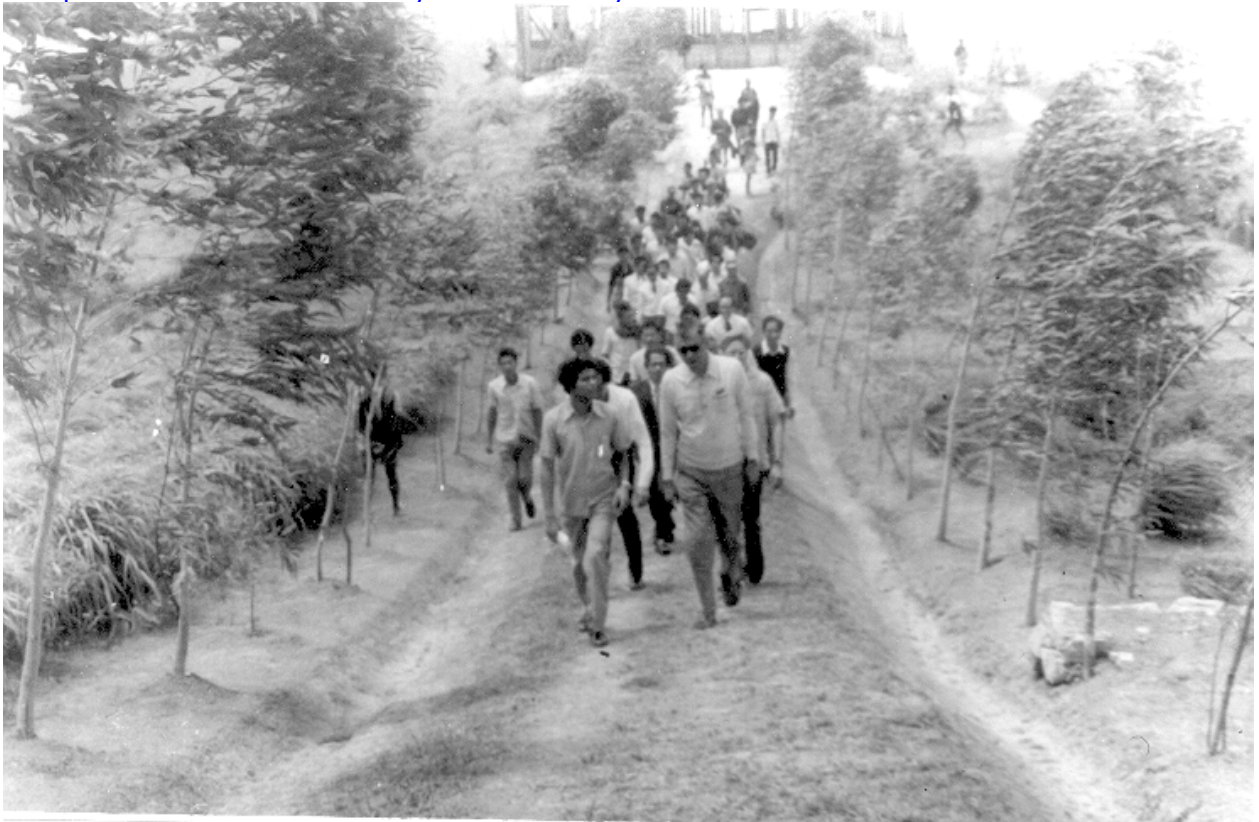
## **(I) Introduction of agro-practices in Nagaland**

### **(a) Citronella cultivation**

keeping all the factors as mentioned above in mind the laboratory launched its rural development activities in the region as far 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 the year 1970 by identifying a small village called Yaongyimsen initially to start with. It first opened a sub-station at Yaongyimsen after procuring 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 tribals 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 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 repellent creams. 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 a 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 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 in 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 RRL on 30 April, 1973 to discuss with RRL 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 RRL 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 all the grass. So another 200 kg/batch capacity still was installed. Those two distillation plants were provided free of cost by RRL. Due to the efforts of RRL, about 30 acres of land were covered under citronella cultivation in Yaogymesen village alone. As the cultivation was further extended, the two distillation stills were also become not enough to distill the grasses 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 leave in 1975-76, a turn key project was undertaken by RRL 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 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 RRL in 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.



Prod Y Nayudumma, director General of CSIR visited Yaongyimen village in 1974



The Jubilant villagers in Traditional attire welcomed the CSIR chief

The activities in Yaongyimsen village acted as a catalyst and persistent requests poured in to RRL Jorhat to introduce such programmes in other villages in Nagaland. Encouraged by the success of Yaongyimsen project, citronella cultivation was later on 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 for commercial cultivation of citronella grass. The Govt. of Nagaland in association with RRL 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 have newly started cultivation citronella grass.



Warm felicitation to Prof Nayudumma by the Village Head



Prof Nayudumma dedicated the Citronella Distillation plant to the

People of Nagaland



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

**(b) *Eucalyptus citriodora***

Establishment 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, *Eucalyptus citriodora* was subsequently 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 in the village. Approximately 25000 seedlings of eucalyptus were provided by RRL sub-station at free of cost. This plantation helped not only in economic upliftment of the villagers but also in keeping the effected ecology in balance due to felling of perennial trees and practice of jhumming.



The Naga United Society - an NGO has taken up large scale cultivation and distillation of Citronella grass with the patronage of DBT and RRL Jorhat

**(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 short span just 10 years 232 Naga families took to 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 cultivation. During the current year, two more new private growers namely Mr N Khasito Aye and Mr K hihokhu Chophi from Dimapur became involved in the commercial cultivation of lemongrass.



A lemongrass field at Nuiland, 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 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.



A bamboo seedling nursery with RRL Jorhat technical support at Dimapur

#### **(e) Patchouli cultivation**

The oil of Patchouli (*Pogostemon patchouli*) 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 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 and in a number of places.



A view of a nursery of Patchouli saplings at Chumukedima village, Nagaland



Patchouli plants drying of Patchouli leaves under bamboo shed. Mrs K Nihokhu Chopi, an enterprising woman has taken up large scale cultivation of citronella, lemongrass, patchouli and stevia

**(d) Mushroom cultivation**

The agro-technology as developed by RRL Jorhat for cultivation of edible mushroom was initially transferred to a few growers at 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**

RRL Jorhat developed a small scale technology for manufacture 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 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, Adviser to the then Governor of Nagaland inaugurated this Paper slate unit at Yaongyimsen village in Nagaland. The industry helped in the economic upliftment of the villagers. However, with the death of the entrepreneur, the factory stopped manufacturing in 1979.



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



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



Samples of aromatic oil

## **R&D and other services rendered for industrial development**

1971

- RRL Jorhat adopted Yaongyimsen village of Mokokchung district of Nagaland for overall development of the people through application of science and technology.

1971

- 350 families of Yaongyimsen village started growing of citronella grass under supervision of RRL Jorhat.

1973

- Investigation of site and evaluation of the mineral oil found at Changtongia, Nagaland 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 quarries 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, NPCC, Tuli, Mokokchung, Nagaland.

- Investigation on economical concrete mix design of grade M-300 on behalf of Construction Supdt., NPCC Ltd., Nagaland.

1979



- Establishment of first Seismic station of RRL Jorhat 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, Nagaland Range, Tuensung.

- 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 Director 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 Nagaland mixed bamboo on behalf of NPPC Co., Tuli, Nagaland.

1988-89

- Assessment of damages at Pulp & Paper Mill, Tuli due to recent 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

- RRL 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 and Mining, Nagaland at Mokochung.

### **(III) Earthquake Monitoring in Nagaland**

-The northeastern 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-Burman in the South-east and its intense continental convergence of the northward moving Indian plate at the rate of about 5cm/year, continue to produce great earthquakes of magnitude  $M > 8.5$  every few hundred years, while a significant number of moderate earthquakes ( $M > 6$ ) occur more frequently. With the growing expansion of human habitat and rapid industrial activities the risk to the society posed by these earthquakes has increased tremendously. 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 national 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 Northeastern 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 sat YY1 and KHM are equipped with short period vertical component Johnson - Matheson sensor with galvanometric 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 (i) short period three component digital seismograph system and (ii) Broadband three component digital Seismograph system respectively.

### **Output**

Burma accounts about 50 percent of earthquake activity in the Northeastern region of India. The seismic stations gave us several analog and digital recorded spectrums of the earthquakes in the Northeastern 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 Burma 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 45o 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 weaknesses; 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 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.

## **(IV) Human Resource Development**

1977

- The laboratory in association with the Directorate of Education, Govt. of Nagaland and the Ministry of Education and Social Welfare, Govt. of India, New Delhi organized the 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 Saw deputed by Industry Department, Govt. of Nagaland.

#### 1983-1984

-The laboratory 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 Visesieli, 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 officers namely Sarvashri Kajen Kaba Ao, Ramoklemba Ao, Shamithang Rengma, Renditemsu Ao, Saku Ao and Jokihe Sema.

#### 1985-1986

- A short term training programme on cultivation of mushroom was organized in the Laboratory during the 1st 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 NE states.

#### 1987-1988

- 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 culture, 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 personnel engaged in sustainable management of water supply for the north eastern states during January 4-14, 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.

#### 1988-1989

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

#### 1998-1999

- A short term training on cultivation and processing of aromatic and medicinal plants was organized by the laboratory during 7-18 January, 1999 for office personnel 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.

#### 2000-2001

- 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 4 August, 2000 for the North Eastern states in which representatives from Nagaland participated.

#### 2004-2005

- 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.

#### 2005-2006

-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, Addl Director, DGM. The scientists of the laboratory interacted with the audience participants about the monitoring of seismicity in Nagaland and also briefed one different aspects of seismology.

- During 2005-2006 under a DBT sponsored project, RRL Jorhat set up one demonstration unit at Dimapur for multiplication of plant materials to provide growers free of cost. The laboratory also imparted Training-cm-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 Niland, Nagaland on 22 March 2006 and three operators of distillation plants were given to 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 bamboo, 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.

#### **(V) Future Plan**

For dissemination of technologies and knowledgebase to people in remote areas, it is proposed to set up a study center in Nagaland University campus. Through Study Centre, RRL Jorhat is expecting to 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.