

ARUNACHAL PRADESH ASPIRATION & ACHIEVEMENTS



NEIST Jorhat



“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.”

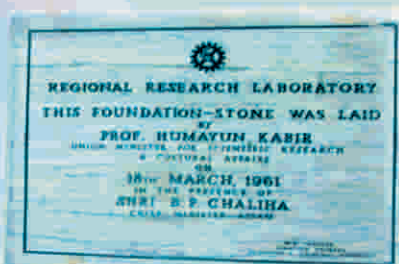
This was recorded by the special committee of the Governing Body of Council of Scientific & Industrial Research, New Delhi on September 1, 1954 and consequently the committee discussed on a proposal for setting up of the third RRL in the country and the first in Assam.



NEIST Branch, Naharlagun, Arunachal Pradesh

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.



Prof. Humayun Kabir, laid the Foundation Stone of North East Institute of Science & Technology (Formerly RRL), Jorhat.

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 RRL) at Jorhat, Assam.



Societal activities carried out by NEIST Branch in Arunachal Pradesh

Arunachal Pradesh, situated in the extreme Northeastern part of India, has long International border with Bhutan to the West (160 Km), China to the Northeast (1080 Km) and Myanmar to the East (440 Km) with total geographical area of 83,743 sq.km. Because of its varied physiographic conditions ranging from altitude of 60m to 5000m the state has varied agro-climatic conditions ranging from tropical to alpine zones. The land is mostly mountaineous with lush green forest, deep river valleys and beautiful plateaus.

The state is recognized as one of the hot biodiversity spot in the world and very rich in flora and fauna.

The local inhabitants are 100% schedule tribe with 26 major tribes and a number of sub-tribes living in 17 small towns and 3649 villages in 16 districts.

The beginning.....

The branch Laboratory of NEIST Jorhat (formerly RRL Jorhat) was formally inaugurated in March, 1981 by the then Lt. Governor of Arunachal Pradesh. The then Hon'ble Chief Minister of Arunachal Pradesh presided over the function. A few members of staff of NEIST, Jorhat at various levels were transferred to initiate the work. Dr. G.S. Sidhu, the then DGSIR, visited Itanagar in July 1981 to examine all aspects like buildings, infrastructure facilities etc. for establishing the branch laboratory. The Governing Body, CSIR, formally approved the proposal for establishment of Branch laboratory in Itanagar in 1982.



The branch laboratory was established with the following objectives:

- ❑ To assess the scope of R&D activities in consultation with the concerned state government functionaries
- ❑ To establish appropriate testing and analytical facilities
- ❑ To undertake sponsored and consultancy work
- ❑ To establish linkage with academic Institutions
- ❑ To organize motivation and orientation programs to develop S&T consciousness in students and entrepreneurs amongst local population
- ❑ To act as clearing house of new innovative technologies developed by National laboratories and
- ❑ To offer technical service and advice as and when called upon.

Considering the above aspects, R&D activities were initiated on agro-technology development and chemical investigation of medicinal, aromatic and other economic plants. In addition, facilities for testing of soil and building materials were also created. All these activities were started in a small industrial shed and in a plot of land measuring 30 acres at Naharlagun allotted by Govt. of Arunachal Pradesh.

Societal Activities

The tribal communities of Arunachal Pradesh inhabit the hilly terrain and depend on forest for their food, shelter and other requirements. They practice shifting cultivation (Jhum) since time immemorial.



A Jhum area showing indiscriminate felling of trees

This results in endangering many valuable plant species including medicinal and aromatic plants due to burning and clearing of forest and create pressure on biodiversity. Since shifting cultivation is directly linked with the livelihood of the local people, it may not be possible to stop it and, therefore, alternative ways for both sustainable economic developments and conservation of biodiversity have been tried through cultivation of medicinal and aromatic plants, production of



A jhum area covered under *Geranium* plantation at Joram village

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mushroom and vermicompost in the rural areas of Arunachal Pradesh. This has not only opened up avenues for earning extra income and employment opportunity but also protect the soil from erosion, maintain ecological balance and biodiversity.

NEIST Branch, Itanagar took up intensive societal activities under the patronage of Department of Biotechnology, Govt. of India through projects in the rural sector of Arunachal Pradesh.

Aromatic Plants

Arunachal Pradesh is a zero-industry state due to geographical isolation, lack of infrastructures like communication, transportation etc. But the state has huge fallow, waste, jhum and degraded forestlands, which are lying unutilized. The soil and climate of the state is very much suitable for growing medicinal, aromatic and other economic plants and thus potentiality for agro-based industries with low-volume-high value products was visualized.

After extensive R&D activities on various aromatic plants and considering the agro-climatic features of Arunachal Pradesh it was found that cultivation of Java Citronella, Patchouli, Lemon grass, Geranium are some of the promising crops in the rural sector of Arunachal Pradesh for sustainable economic development. In view of this:

NEIST Branch conducted 49 exhibition, awareness, motivation and training programmes on cultivation of citronella, patchouli, lemongrass,



Woman SHG's in awareness program at Palin

geranium in 40 places covering 79 villages in eight districts of Arunachal Pradesh. 1355 people including 30 government officials participated in these programmes.



NEIST Br. participated in exhibition

NEIST Branch, Itanagar organized Exhibition cum Farmers Mela on



Participants of Farmer's Mela at Roing Nursery cum Demonstration farm

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medicinal & aromatic plants at Roing on 30th May 2004 where 150 villagers had participated.

- 500 beneficiaries for citronella, 68 for patchouli, 40 for *Geranium* and 40 for lemongrass, were selected from among the participants.
- Nine lakhs citronella slips, seventy thousand rooted patchouli cuttings,



Distribution of citronella Planting Material to ST beneficiaries in remote villages



Cultivation of Patchouli by ST beneficiaries

forty thousand rooted *Geranium* cuttings, three lakhs Lemongrass (BLI-ARUN) slips, were distributed to the selected beneficiaries free of cost.



Plantation of BLI-Arun strain of Lemongrass

- Ten processing units for citronella, one each for geranium, patchouli and lemon grass were installed and handed

over to 12 registered societies of Arunachal Pradesh for operation and maintenance.



One of the ten Citronella distillation units established in Tipi under the aegis of DBT & NEIST Branch, Itanagar

- Nearly 360 acres of unutilized and fallow Jhum land have been covered under citronella cultivation by ST beneficiaries of Arunachal Pradesh.



Citronella cultivation in fellow Jhum land at Hime village, Arunachal Pradesh

- The ST beneficiaries so far produced more than 25000 quintals of citronella herb worth more than Rs. 38 lakhs.

- The Societies / NGOs purchase the raw material (citronella herb) from the beneficiaries and produce the oil. So far the societies have produced more than 25 tons of citronella oil worth Rs. 62 lakhs and marketed through our assistance. In this way benefits of the economic benefits were accrued

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by the co-operative societies and the other societies of the 500 beneficiaries each has been price earning approximately Rs. 8000/- per year/acre.



A ST beneficiary bringing his produce to the Citronella processing unit operated by NGO at Karsingsa village

46 beneficiaries have earned Rs. 4.84 lakhs by selling 22 MT of dry Patchouli herb since 2006-07.

The methodology adopted by NEIST Branch, Itanagar was highly appreciated by the Dept. of Biotechnology, the funding agencies of the project. Further, DBT has indicated in their Annual Report of 2002-03 that they would adopt the same methodology for implementing such projects in other parts of the country.

In Lumla circle of Tawang district, Lemon grass grows wild in large stretches of Indo-Bhutan border area.



Lemongrass growing in wild at Lumla Circle

The villagers used to carry the grass by loading on the head and sell to nearby

distilleries of Bhutan at a paltry price. To enhance their earning, NEIST branch Itanagar helped one NGO in procurement and installation of a 600 kg/batch SS distillation unit at Namteseting village of Lumla circle through grant-in aid by DBT, New Delhi.



Villagers carrying lemongrass herb to distillation unit at Namteseting village

Oil production has in the unit already been started and villagers are getting substantial benefit. In addition, one more distillation plant of 200 kg/batch capacity was also provided to the villagers of Lumla through the Industries Department, Govt. of Arunachal Pradesh for the same purpose.

Free counseling service on prospects of cultivation of potential medicinal and aromatic plant has been provided through workshops, seminars, popular articles, electronic media and face to face interaction with various farmers, NGOs, Co-operative societies, officials of Govt. Departments etc from time to time.

Medicinal plants

Quite a good number of high value medicinal plants are available in Arunachal Pradesh which grow wild. The indigenous people of Arunachal Pradesh, who are ignorant of the price and importance of conservation of these valuable medicinal plants, collect these plants indiscriminately from the

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wild source and sell to the traders at throw - away price. This not only results in near extinction of important medicinal plants but also deprive the indigenous people of their proper earning. It was felt necessary to make the local people aware of the importance of medicinal plants and its conservation for sustenance and income generation. In view of this, NEIST Branch Itanagar adopted the following activities:

❑ 44 numbers of awareness, exhibition, Farmer's Mela and workshops on cultivation, processing and marketing of commercially important medicinal plants have been organized at 27 places in 12 districts of Arunachal Pradesh.



Awareness on medicinal plants at Namsu village, West Kameng district

❑ Established three Nursery cum Demonstration Centres at three different altitudes (1000, 4500 and 8160 ft above m.s.l.) for introduction, acclimatization and generation of data on medicinal plants available in Arunachal Pradesh.

❑ Collected and introduced important medicinal plants of the state from wild as well as from outside the state for plantation in these nurseries. The ST villagers are visiting regularly these

centres to get themselves acquainted about the importance of organized



Nursery cum demonstration unit established at Roing jointly with Essomi foundation trust, Roing with the patronage of DBT & NEIST

cultivation and conservation of medicinal plants for their sustenance.

❑ About 83900 planting materials of different medicinal plants have been distributed to 78 ST beneficiaries of Arunachal Pradesh from the above nurseries.

❑ 10 Community Nurseries and 48 Herbal Gardens have been established at different villages of Lower Dibang Valley district of Arunachal Pradesh in association with other NGO's. Planting materials and technical advice have



Community herbal garden at Balek village of Lower Dibang Valley

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been provided to the beneficiaries of these Community Nurseries and Herbal Gardens as and when required.

□ Market potentiality of medicinal plants of Arunachal Pradesh has been explored by conducting producer-buyer meet and buy-back arrangement has been established with 5 traders.

□ Massive awareness programs and wide publicity of NEIST activities have resulted in submission of projects on cultivation and processing of medicinal plants by the local people and NGOs to different funding agencies and financial institutions.

□ More and more potential farmers have been approaching NEIST Branch for financial and technical help to start cultivation of medicinal plants.

□ Provided technical help and guidance for preparing suitable project proposals, for financial help and subsidy.

Edible Mushroom

NEIST Branch Itanagar has developed simple technology for mushroom cultivation utilizing locally available millet i.e. Marowa and paddy to substitute wheat grain for production of spawn. Mushroom not only supplements the nutritional requirement of the village people but also opened avenues for income generation of the local ST women. The following activities have been done by the branch laboratory:

□ 15 demonstration and training programmes on production of edible mushroom in 10 places covering 18 villages in five districts of Arunachal Pradesh.

□ 2500 bags of mushroom spawn were distributed to 130 beneficiaries to start the activity.

□ The beneficiaries have earned Rs.6.20 lakhs by selling edible mushroom in last two years.



Awareness & training on cultivation of edible mushroom conducted at NEIST Branch, Itanagar



Mushroom production centre of a woman entrepreneur under technical assistance of NEIST Branch

□ Dept. of Horticulture, Forest, NGOs and other private entrepreneurs were assisted in mushroom cultivation.

□ One day training programme was held at Deotolla village, North Lakhimpur, Assam in collaboration with UDDAYAN, a self help group (SHG), Deotolla village North Lakhimpur on 29 November, 2009. A total of 15 beneficiaries participated in the training and about 30 packets of mushroom spawns were distributed among the beneficiaries free of cost for cultivation of mushroom.



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Another one day training was conducted in Burum village, Papum Pare Dist. Arunachal Pradesh in collaboration with local NGO, Action Aid Society of Arunachal (AASA), Naharlagun Arunachal Pradesh on 16 July 2009. Total 62 nos. of beneficiaries from seven nos. of self help groups (SHG) from Sood, Borum, Tarajuli, Norchi and Kemchi villages of Papum Pare district actively participated in the training programme. More than 90 packets of mushroom spawn was distributed free of cost for helping them to initiate cultivation of mushroom.

The NEIST-Jorhat, recently introduced a special Rural Development Programme (CSIR-800 Programme) for the 'AAM ADMI' with the aim to engage rural farmers for production of protein rich mushroom within 100 days. The programme was successfully launched at Dalgaon in Darrang district of Assam on 9 July 2009 and at Borum village, Arunachal Pradesh during 16-17 July, 2009. Mushroom spawn packet along with polybags for cultivation were distributed among the participants accordingly. It was observed that 'AAM ADMI' of rural areas could get a protein rich item of food within very short time of 20 days. The beneficiaries received a net profit of Rs. 60-80 at grass root level.

Mushroom Spawn Production Unit Established

Realizing the difficulty in procuring spawn by the beneficiaries from other sources NEIST branch, Itanagar established a mushroom production unit jointly with M/s Sompurna Green Himalayan Society, Nirjuli, a NGO for economic development of the rural people. Necessary equipments and

training on spawn production were also provided by NEIST. The unit to be maintained by the NGO will provide mushroom spawn to ST beneficiaries including SHG's of Arunachal Pradesh at no profit no loss basis.

Vermicompost

Vermicompost boosts the production of vegetables and other economic crops. Crops produced by using vermicompost fetches higher price and minimizes pollution. Marketing of vermicompost gives additional income to the local people of Arunachal Pradesh.

Training on production of eco-friendly vermi-compost using the African earthworm, *Eisenia foetida*, was



Training on vermicompost production at NEIST branch (Inset- earthworm, *Eisenia foetida*)

provided to 58 ST women in different villages of Arunachal Pradesh.

34 beneficiaries for vermi compost production were selected.

25000 vermi-culture were distributed to the beneficiaries. The beneficiaries have earned Rs. 9.54 lakhs by selling vermi compost during last two years.

Three commercial vermicompost units were established by private



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Commercial vermicompost unit at Sonajuli

entrepreneurs using NEIST Branch technology on vermi-culture.

□ NEIST Branch developed a method of constructing vermicompost bin using locally available low cost and easily



Low cost vermicompost bin developed at NEIST Branch, Itanagar

available material. It costs only Rs. 650/- as compared to the cemented one costing Rs. 5000/-.

□ The Branch laboratory introduced organic fertilizer i.e., vermicompost for production and marketing to the Self Help Groups (SHG) under Action Aid Society of Arunachal (AASA), Naharlagun, Arunachal Pradesh. The technical guidance, support and activity monitoring was done by the branch laboratory to produce and market the

vermicompost for the benefit of ST population of the SHGs. They produced about 4,200 kg of vermicompost in about 2 months and sold it in local market, local agri-clinic showroom, and nursery and for the kitchen garden at Rs 10/kg.



Low cost vermicompost bin at Borum Village

R&D ACTIVITIES

Agro Technology

A number of medicinal and aromatic plants have been introduced and acclimatized in the medicinal & aromatic plants farm situated at Naharlagun, Arunachal Pradesh. Among these, Java citronella (*Cymbopogon winterianus*), Palmarosa grass (*C. martini*), Lemon grass (*C. flexuosus*), Patchouli (*Pogostemon patchouli*), Mint (*Mentha piperita*), *Artemisia annua*, Yam (*Dioscorea floribunda*), Aswagandha (*Withania somnifera*), Vetiver (*Vetiveria zizanoides*), Kalmegh (*Andrographis paniculata*), Safed musali (*Chlorophytum arundinaceum*, *C. borivillianum*), Sarpagandha (*Rauvolfia serpentina*), Pipali (*Piper longum*),



Stevia (*Stevia rebaudiana*), *Asperagus racemosus* (Yellow var.) etc. are worth mentioning.

Agro-Practices Developed

□ Agro-practices of Patchouli (*Pogostemon patchouli*), Kalmegh (*Andrographis paniculata*), Mint (*Mentha piperita*), Bhingaraj (*Eclipta alba*), Ulat Kambal (*Abroma augusta*), Manjistha (*Rubia cordifolia*), Stevia (*Stevia rebaudiana*), Chandramuli (*Kaempferia galanga*), Pippali (*Piper longum*), Lemongrass (*Cymbopogon flexuosus*), Sarpagandha (*Rauvolfia serpentina*) have been developed.

□ Patchouli (*Pogostemon patchouli*), an important essential oil bearing plant, was introduced for the first time in Arunachal Pradesh and agro-practice was developed. This was released to eight parties of Arunachal Pradesh. Production of essential oil and its marketing has already started.

□ *Stevia rebaudiana* was introduced for the first time in Arunachal Pradesh and agro-practice under the climatic conditions of Itanagar was developed and released to one party of Arunachal Pradesh.

New Strain

Lemongrass oil, obtained from the fresh herb of *Cymbopogon flexuosus* valued for its citral content has a very good demand both in Domestic and International market. Previously, India was the major producer and exporter of

lemongrass oil, but with time this has declined considerably due to low production and competition from other countries. The low production of Lemongrass oil in India was due to non availability of any strain with high biomass yield, oil and citral content. NEIST Branch, Itanagar has developed by hybridization method a better strain of lemongrass, **BLI-ARUN**, having high biomass, essential oil and citral. This strain recorded about 60 tonnes of



Dr. H.S. Maiti, Director CGCRI, Kolkata and Dr. P.G. Rao, Director, NEIST Jorhat jointly releasing the Agro- technology of BLI-ARUN to Nyimi Extraction Pvt. Ltd. Itanagar (Inset-a single clone of BLI-ARUN)

fresh herb/ha (av. of 5 years) and 0.77 to 0.88% essential oil (FWB) and more than 85% citral. As per BIS specification the minimum requirement of citral should be 75%. Market evaluation of the oil indicates that the oil is directly exportable. Agro-technology of this strain has been developed and released to four entrepreneurs. One of the entrepreneurs, M/s Shelly Welfare Society, Doimukh, Arunachal Pradesh

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installed one 600kg/batch SS Distillation unit at Sonajuli. The recovery of



Satisfied with the performance of BLI-ARUN M/S Shelly Welfare Society, Doimukh has installed 600 kg/ batch SS distillation unit at Sonajuli for production of lemongrass oil

oil was 0.70 % which is quite satisfactory in commercial scale.

Mutation breeding of BLI-ARUN strain of lemon grass by colchicine treatment to develop another better strain of lemon grass with higher biomass, oil and citral is underway. Clones having 1.25 – 2.00% essential oil and 75.6 – 88.2% citral have been selected. Further work is underway to attain the objectives.

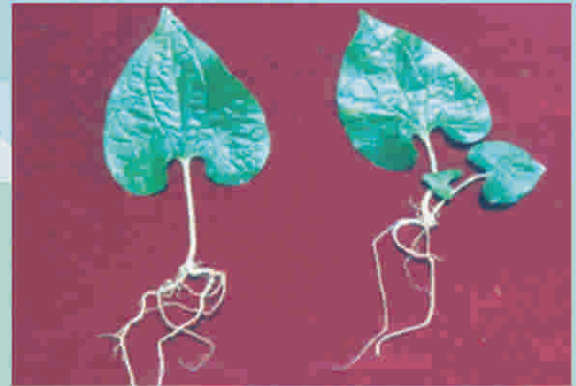
Germplasm Bank

A live Germplasm bank has been established at NEIST Branch Itanagar. More than 50 different plants having medicinal, aromatic or other economic value are planted and being maintained here.

Cheaper method of Pipali propagation

Multiplication of pipali (*Piper longum*) is generally done by nodal cutting with 2-3 pairs of leaves. NEIST Branch Itanagar has standardized multiplication technique of *Piper longum* using

different portion of leaf. Yield performance of saplings developed by modified method have been evaluated and found that saplings raised from



Photograph showing rooting using single leaf (left) and shoot formation (right) in *Piper longum*

whole leaf recorded highest yield of fruit as compared to conventional nodal cutting.

Botanical expedition

□ In 1981 and 1982, NEIST Jorhat conducted an appreciable plant resource survey in Tirap district of Arunachal Pradesh. A total of 170 plant species of medicinal and economic importance were collected, identified and preserved in the herbarium.

□ In 1985-86, ethno-botanical information were collected by NEIST Jorhat for about 50 medicinal plant species from Arunachal Pradesh.

□ In 1991-92, an ethno-botanical survey was conducted by NEIST Jorhat in Tirap district. Medicinal plants have been in use among the indigenous population of Arunachal Pradesh as folk medicines have been documented.

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□ A joint survey on availability of *Panax* sps. in Arunachal Pradesh was conducted.

Chemical Science

□ Fifty-four species of medicinal, aromatic and economic plants and plant products have been collected from different places of Arunachal Pradesh on the basis of local use, published information and taxonomic relationship. All these have been properly identified and preliminary screening for presence or absence of alkaloid, flavonoid, terpenoid, saponin, essential oil, fat, dye, tannin etc have been done. Promising plants and plant products have been selected for detailed chemical investigation.

□ Three species of Pine tree (*Pinus roxburghii*, *P. wallichiana* and *P. markusii*) occur in Arunachal Pradesh. The turpentine oil from oleoresin of these species has been evaluated chemically at the request of Forest Department, A.P. The quality of turpentine oil obtained from *P. roxburghii* is at par with turpentine oil of commerce.

□ Nine alkaloids were isolated and characterized from *Stephania rotundifolia* & *Cosciniun fenestratum*. A new monoterpene triol was isolated from *Alstonia scholaris* flower.

□ Essential oils from *Blumea lanceolaria*, *Michelia montana*, *Litsea kingii*, *Cinnamomum cecidodaphne*, *Illicium griffithii* and *Satyrium nepalense* have been isolated and GLC and physico-chemical properties studied.

□ Isolation of chemical constituents from *Elaeocarpus lanceofolius*, *E. prunifolius*, *Phoebe goalparensis*, *Neolitsea cuipala*, *Kayea assamica* & *Baccaurea sapida* has been carried out.

Three new compounds have been reported.

□ Fixed oil from 32 forest seeds of plants occurring in Arunachal Pradesh have been extracted and physico-chemical properties studied.

□ *Coptis teeta*, a high value medicinal plant available in certain locations of Arunachal Pradesh was being traded to neighbouring countries. Bench scale extraction of berberine (5.1%) from *C. teeta* root has been optimized.

□ Structural life of indigenously used roofing material viz. *Livistonia jenkinsiana* has been increased by 20-25% by chemical treatment.

Applied Civil Engineering

The Applied Civil Engineering Section of the NEIST Branch Laboratory Itanagar, Arunachal Pradesh has been rendering services on R&D activities particularly in the field of Geotechnical Engineering related to improvement of subsoil bearing capacity for building & bridge construction, evaluation of design parameters of important structures of Hydro-electric Power Projects, Design of Roads, Landslides, etc. The section has been currently engaged in Nature Disaster Management works in association with organizations like NIDM and DST, New Delhi.

Activities

1. Investigation of suitability of soil for Burnt clay Brick at Bree Village, Ziro-I circle, Ziro A.P.: Industry department, Arunachal Pradesh.

Objective: To reduce the cost of building materials particularly burn clay bricks which are usually supplied from Assam, efforts to facilitate home

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production of Bricks in Arunachal Pradesh.

Activities Undertaken :

- (1) Samples were collected from Ziro and Basar area of Arunachal Pradesh.
- (2) Complete Engineering properties were found out for the area.
- (3) Chemical properties of the samples were evaluated
- (4) Model bricks were made and tested

The output:

Soil samples collected were found suitable for brick making and Industrial scale of Burnt Clay.

2. Laboratory work to explore material (durable plant materials) properties & to develop suitable additives/technology for Rural Housing particularly in Arunachal Pradesh.

Objective : To increase the life of roofing material in view of the growing scarcity of the sources Brick production is possible in Arunachal Pradesh.

Activities Undertaken :

- (1) Three kinds of roofing materials namely Takou plant (*Livistonia*), Jeng plant (*Calamuseretus*) and Bamboo plant (*Bambusa*) were considered and samples were collected from many places of Arunachal Pradesh.
- (2) Total engineering properties were evaluated
- (3) All samples were treated with a particular chemical and observed its durability behaviours
- (4) 10 years efforts have been made to observe its durability and strength.

The output:

The results revealed that Normal life of such roofing materials can be increased upto 20-25% by chemical treatment and strength is the main criterion for its sustenance. Structural life of indigenously

used roofing material viz. *Livistonia jenkinsiana* has been increased by 20-25% by chemical treatment.

3. Evaluation of new methods/ techniques for improvement of weak bearing capacity of soil for footing foundation treated with sand replacement and granular piles.

Objective: To utilize the unused lands for development purposes.

Activities Undertaken :

- (1) 32 nos. of model tests were carried out to observe the following:
 - (a) Improved Bearing Capacity of the weak subsoil.
 - (b) Settlement behaviour of the Foundation.
 - (c) Foundation - Soil interaction behaviour.
 - (d) Finite element studies incorporating Sg - peripheral restraintment in the form of Skirting & Padding.

The output:

- (a) Economic length of granular piles in weak subsoil is 12.5D, where D is the diameter of Pile.
- (b) The economic Slenderness ration, which offers the total length of the granular Pile at field, is governed by its settlement & improved bearing capacity for particular subsoil, graphical solution of which is adoptable.
- (c) Achievement of 45% economy in construction of granular piles over costlier traditional practice below footing foundation at field. This achievement is after the implementation at the Oil field of Assam (Galeky, Rudrasagar, etc. of ONGC Sibsagar)
- (d) Developed a series of practical design curves for achieving Improved-bearing capacity (B.C.).
- (e) Developed mathematical model for new Relationship for improvement of B.C.

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The Landslide prone zone of NH-52(A) at Karshingsa, which is delivering its recorded Big Landslide during July to Sept., 1998

4. Study of landslide in part of the road NH-52(A) from Bandardewa to Itanagar in Arunachal Pradesh under DST- sponsored "Jai Vigyan Technology Mission" for Natural Hazard Assessment in Himalayan-Landslide Components.

Objective: To identify the high potential landslides area of NER of India and to probe a suitable common remedial measures for its perfect management for the common people of those landslide prone areas.

Activities undertaken :

- (1) Collection of soil and rock samples were commenced in the year 2007 from three different places of Arunachal Pradesh.
- (2) Field and laboratory investigations were started along with survey of the occurrence of its severity at Arunachal Pradesh.

Consultancy

1. Investigation of suitability of soil for Burnt clay Brick at Bree Village, Ziro-I circle, Ziro A.P. Industry
2. Geotechnical investigation for recommendation of SBC and type of foundation for 4-Storey RCC building site at D-Sector, Naharlagun (New Building for Deptt. of Agree Culture; PWD, Govt.of A.P; Chief Engineer, PWD, Govt.of A.P.)
3. Subsoil investigation for Bridge construction at Longding over river Tissing; PWD, Govt.of A.P.: Chief Engineer, PWD, Govt.of A.P
4. Evaluation of properties of construction materials like rocks, cement, soil sand etc. for Dam, Tunnel, Power House etc. for Ranganadi Hydro-electric Project (RHEP) NEEPCO Ltd., Yazali; Chief Engineer, RHEP, Yazali
5. Evaluation of properties of building materials like cement, soil, sand, concrete etc. for general construction of PWD, A.P; Chief Engineer, PWD, Govt.of A.P.
6. Subsoil investigation for Mini-Hydel Project near Pasighat, Department of Power; Govt.of A.P. East Siang; Chief Engineer, Power, Govt.of A.P.
7. Evaluation of properties of building materials like cement, soil, sand, concrete etc. for general construction of PWD, A.P; Govt. of A.P.: Chief Engineer, PWD, Govt.of A.P.
8. Evaluation of subgrade parameters (CBR-value, OMC, Engg. Properties etc.) and recommendation of suitability of soil for construction of Road in Mariyang, PWD, A.P; Chief Engineer, PWD, Govt. of A.P.

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- 9 Evaluation of subgrade parameters (CBR-value, OMC, Engg. Properties etc.) and recommendation of suitability of soil for construction of 5-different Roads in Along, PWD, A.P; Chief Engineer, PWD, Govt.of A.P.
- 10 Evaluation of Road materials for CBR-value & Impact value for new proposed road of PWD, A.P, Boleng Division; Chief Engineer, PWD, Govt.of A.P.
- 11 Evaluation of Shear parameters and other physical properties of soil samples for analysis of Landslide in different locations of road sections under RHEP, NEEPCO Ltd. Yazali, A.P. Chief Engineer, HREP, NEEPCO, Yazali.
- 12 Evaluation of Road materials for CBR-value & Impact value for new proposed road of PWD, A.P, Mechuka Division. : Chief Engineer, PWD, Govt.of A.P.
- 13 Evaluation of soil properties like C& and other properties for Power House and Switch Yard of Kameng Hydro-Electric Project, NEEPCO Ltd. Bhalukpong; Arunachal Pradesh; HoP; KHEP, NEEPCO Ltd.; Bhalukpong; A. P.
- 14 Evaluation of Subgrade Parameters for soil samples as road materials for construction of 8 different roads in Pasighat under RWD Pasighat Division, RWD, Pasighat Div; Govt. AP.
- 15 Laboratory tests on different Rock/Soil samples and Field work for different sites e.g. Bichom Dam Site, Tenga Dam site, Kimi Power House, Penstock & Tunnel Sites of Kameng Hydro Electric Project, NEEPCO Ltd.; HoP; KHEP, NEEPCO. Ltd. Bhalukpong; A. P.; Bhalukpong, Arunachal Pradesh.
- 16 Geotechnical investigation for evaluation of design parameters for various Structures of Hydroelectric project site of Dikrong (Pare) Hydro Electric Project (DkHEP), CES (I) Pvt. Ltd.; Doimukh, Arunachal Pradesh (Phase-I). Consulting Engineering Services (I) Ltd., Guwahati.
- 17 Geotechnical investigation for evaluation of design parameters for various structures of Hydroelectric project site of Talong Hydro Electric Project, CES (I) Pvt. Ltd.; Seppa, Arunachal Pradesh; Consulting Engineering Services (I) Ltd., Guwahati.

Projects Completed

- ❑ Drug & drug Intermediates from *Coptis teeta* (Mishmi teeta) & other Berberine- bearing plants of NE region funded by NEC, Shillong, 1990-93
- ❑ Promotion & cultivation of aromatic plants and production of essential oil for the benefit of ST population of Arunachal Pradesh funded by Dept. of Biotechnology, Govt. of India, 1997-2002
- ❑ Central scheme on development of agrotechnology and cultivation of medicinal plants; funded by Min. of Health & Family Welfare (ISM&H), Govt. of India, 1999-2003
- ❑ Creating awareness and promotion of medicinal plants available in Arunachal Pradesh for the production and marketing of medicinal herbs towards sustainable development of ST population of Arunachal Pradesh; funded by Department of Biotechnology, Govt. of India, 2002-06

ARUNACHAL PRADESH ASPIRATION & ACHIEVEMENTS



- ❑ Geotechnical investigation for evaluation of design parameters for various structures of Hydroelectric projects from laboratory tests of different rock samples of Dikrong (Pare) Hydro Electric Project, Doimukh; A.P.: 2005-07
- ❑ Geotechnical investigation for evaluation of design parameters for various structures of Micro-Hydroelectric project site of Talong Hydro Electric Project, Seppa, A.P.: 2006-07.
- ❑ Testing and analysis services rendered for 2980 samples of cement, soil, sand, bricks, concrete cube, timber, aggregates etc. received from APPWD, CPWD, GREF, BSNL, NBCC and other private parties.

Linkages

- ❑ NEIST Branch organized CSIR Diamond Jubilee Exhibition at Naharlagun from 3rd to 6th July 2003. The Exhibition was inaugurated by the then Hon'ble Chief Minister, A.P. Sri Mukut Mithi.



Dr. P. G. Rao, Director NEIST explaining the CSIR activities in the CSIR Diamond Jubilee Exhibition held at Naharlagun

- ❑ Linkage has been established with RMRC, Dibrugarh & IICT, Hyderabad for evaluating biological activity of extracts and pure compounds of medicinal plants of Arunachal Pradesh.
- ❑ One Digital Broad Band Standalone seismic station has been installed recently at Yazali.
- ❑ Imparted training on cultivation, processing and chemical analysis of medicinal & aromatic plants to final and pre-final year students of NERIST, Nirjuli during the period 2002 to 2006.

COMMENTS OF DISTINGUISHED VISITORS

Dr. G.S. Sidhu, DGSIR, New Delhi on 25.07.1981

"I look forward to the day when the laboratory unit will be able to show that its role in the development of the state has been significant"

Dr. Monmohan Singh, Member, Planning Commission on 21.03.1982

"A promising beginning and lot of potential for growth"

Sri H.S. Dubey, His Excellency the Lt. Governor of Arunachal Pradesh on 22.04.1982

" Visiting medicinal plants farm, Seismic Survey Station and the laboratory was a heart-warming experience for me. I felt as if I have gone through a scientific horoscope predicting on a bright and affluent future for Arunachal Pradesh"

ARUNACHAL PRADESH ASPIRATION & ACHIEVEMENTS



Sri G. Apang, Chief Minister, Arunachal Pradesh on 04.01.1983

“ It is interesting to see the experiments being made on local grasses and herbs to extract essential oils. I am sure this branch will give immense service to the people of Arunachal Pradesh”.

Dr. J. D. Verma, Econ. Adviser, Nirman Bhavan, New Delhi on 26.05.1983

“ RRL’s effort to make use of the local raw material & exhibits its achievements will have an important and rewarding impact on the local economic development”.

“ I believe that the institute is doing very hard work in research. The findings of the institute will be very much useful not only for the local people but also for whole country”.

Sri N. Willy, MLA, Seppa, Arunachal Pradesh on 14.07.1983

“ I believe that the institute is doing very hard work in research. The findings of the institute will be very much useful not only for the local people but also for whole country”.

Sri T. Ngemu, Minister, Arunachal Pradesh on 29.07.1983

“Will go long way to improve economic condition as a whole”.

Prof. P.R. Sengupta, Director, NERIST Nirjuli on 16.11. 1983

“It was indeed a pleasant experience talking to young professionals and hearing a glimpse of good work they are doing in this distant region”

Sri Doi Ado, MLA, Arunachal Pradesh on 22.10.1985

“I am quite satisfied seeing the performance of RRL at Naharlagun. This institute will bring new things for Arunachal Pradesh”

DR. D.K.Guha, Dean & Professor, IIT, Kharagpur on 10.04.1986

“ I am very happy to see good work being carried out here inspite of limited resources.”

Sri S.C.Vaish, Chief Secretary, Arunachal Pradesh on 24.03.1986

“It was a pleasure to watch the laboratory grow”

DSri R. Narayana, Director of Industries, Arunachal Pradesh on 05.02.1986

“The progress made in the research especially on agrobased industries will go a long way in improving the economic condition of the people of this state”

Sri Tadak Basar, Minister, Arunachal Pradesh on 17.02.1987

“Very impressive and dignified growth of this branch is observed. I hope this is going to serve Arunachal Pradesh at the deepest required needs”

Sri T.R.Das, Secretary, Industries, Arunachal Pradesh on 17.02.1987

“Within a short span of time RRL Br at Itanagar is coming up well and it is hoped that this laboratory will help AP for industrial development”

ARUNACHAL PRADESH ASPIRATION & ACHIEVEMENTS



Sri Tsering Tashi, Minister, Arunachal Pradesh on 20.01.1988

"I am confident that this laboratory will explore the hidden natural resources of Arunachal Pradesh"

Dr. M.P.Dhir, Director, CRRI, New Delhi on 23.03.1988

"Good start. Keep it up. This Centre can contribute notably to the economy of Arunachal Pradesh"

Sri A.G. Oka, I.G. Forest, Min. of F& E Govt of India, New Delhi on 13.02.1989

"The research work done on medicinal, aromatic and other MEP could be of considerable useful for forest development in the area"

Sri R.A.Verma, MLA U.P.Govt. on 27.04.1989

"Effort being made in connection with research highly appreciable"

Sri R.K.Tikku, Secretary, NEC, Shillong on 20.07.1989

"A commendable effort"

Sri K.S.Nair, MLA, Karala Legislative Assembly on 13.3.1990

"The effort of this institution is very valuable for promoting agriculture in our country"

Prof. U.R.Ghatak, I.P.C.S, Calcutta on 20.03.1990

"I am deeply impressed by the sincerity of the scientists and the staff of the institute"

Sri S. Prakash, MLA, & Chairman, Assurance Committee, UP Vidhan Sabha on 02.06.1992

"This laboratory is doing beneficial work for citizen of Arunachal Pradesh & other parts of NE . No doubt the people of weaker section of this area will be able to improve their financial position by help of this lab."

Sri Dera Natung, Minister, Arunachal Pradesh on 21.07.1992

"RRL Naharlagun is quite impressive to see. I have been given impression that RRL is doing quite a commendable job in exploring natural resources in Arunachal Pradesh. I wish a grand success in their endeavor to make people of Arunachal aware of self-reliance and sound economic growth. I must congratulate the scientists and others working in this RRL for yeoman service"

Sri A. P. Choudhury, Executive Director, CHT, Mins. of Petroleum, New Delhi on 21.01.1995

"Very pleased to see the Laboratory doing very innovative and useful research work serving the people in the region. Well kept promises. The Scientist and other workers deserved compliments."

Prof. K. Vasudeva, IIT Delhi on 21.01.1995

"Future depends on the commitment of the youth"

Dr. T.S.R. Prasada Rao, Director, IIP Delhi on 21.01.1995

"Laboratory is doing a good job to meet the local needs. Let us hope that this will help Arunachal Pradesh to develop economy"

ARUNACHAL PRADESH ASPIRATION & ACHIEVEMENTS



Prof. M. M. Sharma, UDCT Bombay on 21.01.1995

"I was pleased to visit the centre and wish scientists success in their endeavor"

Lolitha B. Singh, Ministry of Chemicals and Fertilizers, New Delhi on 21.01.1995

"Very good work on natural products of relevance to Arunachal Pradesh"

Shri Robert K. Boggs, US Consul-General, Eastern India, Calcutta on 23.05.1997

"This Research laboratory obviously is making an important contribution to the commercialization of Arunachal Pradesh's natural endowment"

Dr. E. Pelinck, DG, ICIMOD, Kathmandu, Nepal on 05.03.1997

"Appreciated the explanations provided about the role of RRL. Looking forward to future collaboration"

Shri C. T. Mein, Minister, Arunachal Pradesh on 21.02.2000

"I am very glad and highly impressed to visit RRL Itanagar. They have done some good works in the field of medicinal plants and their products. I feel Horticulture Deptt. of Itanagar should cooperate with them for future development in medicinal plants."

Shri Ajay Kumar, Commissioner, S&T, Arunachal Pradesh on 19.06.2001

"This is a unique centre which if fully developed could have made significant contribution to the development of Arunachal Pradesh."

Shri Nabam Tuki, Minister of Arunachal Pradesh on 24.08.2001

"I could know that Dr. Saha and his team of officers are doing noble service for encouraging and educating rural unemployed youth for aromatic and medicinal plant cultivation and its marketing. It is the alternative lifeline for all round development of the state. Please go ahead"

Dr. V. P. Gupta, Adviser, DBT New Delhi on 18.10.2002

"I visited citronella fields and distillation units established by Dr. Saha and his team. I am very much impressed with their efforts and the outcome of their hard work. This is really very useful work which has benefited the local people."

We found the farmers and other beneficiaries of this programme, very much satisfied with their plantation and farm income. Dr. Saha and his group deserves our appreciation for introducing the new crop in the area which is very much remunerative and at the same time it is promoting industrial activity."

Dr. Darshan Shankar, Director FRLHT, Bangalore on 04.06.2003

"My visit here has given me an insight into the ground conditions under which R&D and S&T work can be done in this state."

Shri. S. Ngemu, Minister, Arunachal Pradesh on 08.12.2003

"I was very much impressed by the activities that are undertaken here."

Dr. S. K. Sharma, Adviser Ayurveda, Mins. of Health and FW, New Delhi on 28.01.2004

ARUNACHAL PRADESH ASPIRATION & ACHIEVEMENTS



“There is a lot of potential in the area of development of products from the medicinal plants of Arunachal Pradesh. RRL (Itanagar) can play an important role in the product development.”

Dr. T. Tarak, Minister (Health & FW), Arunachal Pradesh, Itanagar on 22.03.2004

“Very impressed & pleased to see the laboratory and its facilities available for development of agro-medicinal plants throughout the state.

Shri Ninong Ering, Dy. Speaker, Arunachal Pradesh L. Assembly, Itanagar on 22.03.2004

“The aromatic & medicinal plants that are being nurtured will help the local populace in encouraging them to take up plantation and which will lead them to self employment. I am very much impressed.....

Dr. U. Prakash, Director, CFTRI, Mysore on 26.10.2004

“Obviously this was a memorable visit to any of the Regional Labs of CSIR labs. Perhaps Itanagar RRL Jorhat lab branch is the ‘Pearl’ in the necklace of Regional labs of CSIR.....

Prof. P. C. Kesavan, DAE Homi Bhabha Professor & Distinguished Fellow on 26.10.2004

“... the work being done here reveals the relevance that science & technology provide basic human needs in the rural and tribal areas of Arunachal Pradesh & entire NE region.

Prof. G. D. Sharma, V.C., Nagaland University, Kohima on 26.10.2004

“ Focusing on the medicinal & aromatic plants and road materials they have initiated the lab to land program. I have lot of appreciation.....

Sri Takam Sorang, MLA , Arunachal Pradesh on 01.03.06

“Great privilege to see scientific discovery of new technology and new species by resource scientists headed by Dr. Saha. His effort to create awareness among the people is very much appreciable and our people should understand his new technology which will generate not only revenue to them but also booming up the economy of the country”

Sri V. Satish, Zonal Organizing Secretary, NE Region, BJP on 27.10.06

“ ... seen the laboratory, its activities. RRL Arunachal Pradesh is doing an excellent job.

Dr. H.S. Maiti, Director, CGCRI, Kolkata on 15.03.07

“ I am highly impressed with the activities of the institute particularly considering its social relevance. My congratulations for maintaining the high standard of the institute’s activities

Prof. N Upadhyaa, Director, NIRD, Guwahati on 27.03.07

“ In the remotest part of the country, the scientific flavour makes a live laboratory – not confined to the periphery of NEIST but reached out to villages with a mission approached for poverty alleviation through medicinal, aromatic and other rural based technologies. Dedicated to the people of this region.”

ARUNACHAL PRADESH ASPIRATION & ACHIEVEMENTS



ACTIVITIES OF OTHER CSIR LABORATORIES IN ARUNACHAL PRADESH

Central Mechanical Engineering Research Institute, Durgapur

- ❑ CMERI, under the RSWNET Programme of CSIR, has implemented project "Development of Post Harvest Processing Technology & Enhancement of farmers' economy of Arunachal Pradesh".
- ❑ CMERI, in collaboration with an NGO, Tribal Development Foundation, Arunachal Pradesh has installed integrated systems starting from pre-treatment after harvest to packaging of dried ginger, turmeric, chilli, powder in various districts of Arunachal Pradesh.

Central Road Research Institute, New Delhi

- ❑ Investigations for pavement specification for charduar-tawang road (1988-90)

CSIR Centre for Mathematical Modelling and Computer Simulation, Bangalore

- ❑ Estimates of inter-seismic deformation in northeastern India from GPS Measurements In this study carried out by CMMACS, estimates of inter-seismic deformation in northeastern India were made based on GPS measurements at eight permanent stations (2003-2006) and six campaign sites (1997-2006). GPS sites in Arunachal Himalaya indicate that 16 mm/yr shortening occurs both in the Lesser as well as Higher and Tethyan Himalayas.
- ❑ GPS Measurements in Arunachal Pradesh and Meghalaya, North Eastern India, 2002. Under this project two GPS stations namely at Bomdilla and Lhou villages were established.

GPS Station at Bomdilla

It is located about 7 kilometres east of Bomdilla town off the Bomdilla-Dirang road. A path off the Bomdilla-Dirang road near the Bomdilla ridge leads to the GPS station which is about 3 kms away located on the first in-situ exposure that is seen along the path on the

top of a high ledge formed by the exposed rock. The antenna height is 0.1288 m and the measurements were made using a Trimble Zephyr Antenna and a 4000 SSI Trimble Receiver.

GPS Station at Lhou Village, Tawang

The station is located 2 km from the Village of Lhou off the Jung-Bomdilla highway. The town of Jung is 17 km away from the station. The station is located in almost sub - horizontal gneiss in the hanging wall of the Main Central thrust. The antenna height is 0.1239m. Measurements were made using a Trimble Choke ring antenna with a 4000 SSI Trimble receiver.

National Geophysical Research Institute, Hyderabad

- ❑ Project Seismic structure and tectonics of the Indian plate in Arunachal Himalaya as a component of Evolution of the Indian Lithosphere: focus on Major Earth Processes, Resources and Resources with special reference to Deccan Traps
- ❑ An MoU was signed with Oil India Ltd. to conduct Magnetotelluric survey in the manabhum area, Arunachal Pradesh, India, under which the laboratory is working for delineating oil-bearing structures.

National Institute for Interdisciplinary Science and Technology, Thiruvananthapuram

- ❑ Signed MoU for licensing of technology for processing fresh spices with Arunachal Agri-Biotech Pvt Ltd, Itanagar, Papum Pare district, Arunachal Pradesh 791 111.

Indian Institute of Chemical Technology, Hyderabad

- ❑ DST sponsored project Control of malaria through integrated information technology tool in Arunachal Pradesh (2004-06)
- ❑ DST sponsored project Rapid Epidemiological mapping of endemic zones of Malaria in Arunachal Pradesh through Geographical Information System (GIS).



Women Entrepreneurs of Mushroom Cultivation



Mushroom spawn production unit at Arunachal Pradesh