

REPORT AT A GLANCE

The Indian Council of Forestry Research and Education (ICFRE) is the premier forestry research organization of the country with the mandate to formulate, organize, direct and manage forestry research, transfer the technologies developed for states and other user agencies and impart forestry education.

Objectives of the ICFRE are:

- ❖ To undertake, aid, promote and coordinate forestry research and education and their application,
- ❖ To develop and maintain a National Library and Information Centre for forestry and allied sciences,
- ❖ To act as a clearing-house for research and general information relating to forests and wildlife,
- ❖ To develop forestry extension programmes and propagate the same through mass media, audio-visual aids and extension machinery,
- ❖ To provide consultancy services in the field of forestry research & education and in allied sciences, and
- ❖ To do other things considered necessary to attain these objectives.

ICFRE has 8 Regional Research Institutes and 3 Centres in various parts of the country to cater to the forestry research needs of different bio-geographical regions of the nation. The Regional Research Institute are located at Dehra Dun, Shimla, Ranchi, Jorhat, Jabalpur, Jodhpur, Bangalore and Coimbatore and the Centres at Allahabad, Chhindwara and Hyderabad. The activities of these Institutes and Centres are described in separate chapters of the report.

FORESTRY RESEARCH

Significant research achievements during the year are described below :

Planting Stock Improvement Programme (PSIP)

Under the Planting Stock Improvement Programme, ICFRE has established the Seed Production Areas (SPAs), Clonal Seed Orchards (CSOs), Seedling Seed Orchards (SSOs) and Vegetative Multiplication Gardens (VMGs) of important species in the different states of the country.

* Seed Production Area (SPA)	-	1225.62 ha.
* Seedling Seed Orchard (SSO)	-	344.40 ha
* Clonal Seed Orchard (CSO)	-	166.45ha
* Vegetative Multiplication Garden (VMG)	-	56.10 ha

The above created assets were maintained and transferred to State Forest

Departments for future maintenance and use. These are expected to give an additional 10-20% increase in the productivity.

Research Grant Fund (RGF)

Under the Research Grant Fund (RGF) of FREEP two hundred and twenty five projects were sanctioned to Research Institutes, Universities, State Forest Research Institutes, State Forest Departments, NGOs and Private Industries. Out of the total sanctioned projects one hundred and sixty projects were completed during the current year.

Major activities undertaken under RGF:

- ❖ Research covering a wide range of disciplines viz., Agro-Forestry/Silviculture, Artificial Regeneration, Bio-Diversity Conservation, Non-Wood Forest Produce, Forest Protection, Joint Forest Management and Genetics & Tree Improvement, have been conducted.
- ❖ Countrywide coordinated research trials of important forestry species have resulted in identification/collection of rich stock of diverse and good quality planting material.
- ❖ The execution of these grants has resulted in a very constructive outcome through tapping the potential of a number of research establishments in the country and bringing in much needed synergy. It has also resulted in availability of material resources, improvement in scientific infrastructure, capacity building of human resources and thrust in cooperative forestry research in grantee organizations.
- ❖ ICFRE has been able to build a long-term strategic alliance with a number of recognized Universities, State Agricultural Univ., IITs, NGOs etc. This provides a very sound foundation for effectively meeting the ICFRE mandate of coordinating and promoting forestry research in the country through scaling up of collaborative research activities.



A typical Agroforestry model in Yamunanagar



Agri-Silvi-Horti model of Agroforestry

- ❖ Specific information and process documentation for collection/use and marketing of NWFPs has emerged, which has a bearing on improving the economic conditions of local people and will also help in the sustainability of NWFP- based operations.
- ❖ Useful ethno-botanical documentation of the use of forest biodiversity by local communities has also been carried out. Ethnobotanical studies on wild plants of Jaunsar and Bhabar were conducted.
- ❖ Multi-locational trial of a few forestry species was possible by way of RGF.
- ❖ Genetic improvement was implemented in a broader way.
- ❖ Agro forestry models were developed for the Tarai region of Nainital.
- ❖ Identified two new species of *Ochlandra* i.e., *Ochlandra spirostylis* and *O. sodastromiana*.
- ❖ CD-ROM Package for the entire 125 years of Indian Forester was developed.
- ❖ Protocol was developed for *Chlorophytum borivilianum* by using tissue culture technologies.
- ❖ Seed handling techniques for various important forestry species were developed.
- ❖ Identified number of Candidate Plus Trees (CPTs). Tree Improvement trials were carried



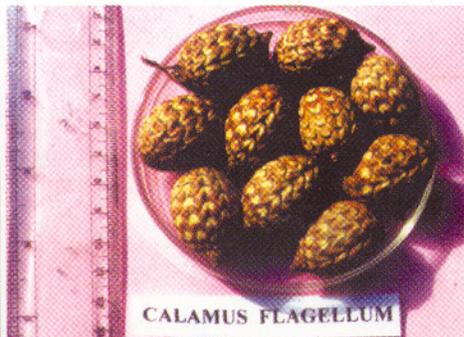
Clonal Seed Orchard of Shisham



A 'Plus Tree' of Shisham (*Dalbergia sissoo*)



Seed stand of *Tectona grandis* at Topslip

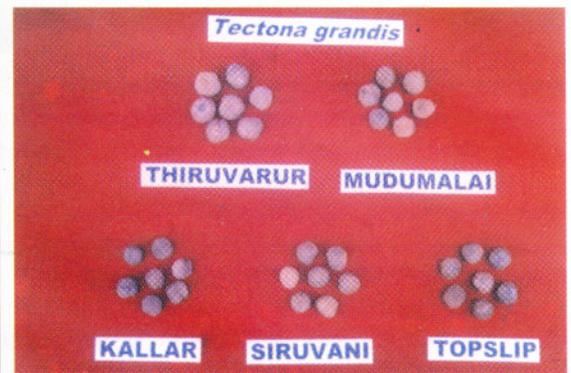


Seed and nursery seedlings of *Calamus flagellum*

- ❖ out for *Dalbergia sissoo*, *Populus*, *Acacia nilotica*, *Tectona grandis*, Eucalypts, *Azadirachta indica* and *Pinus* sp.
- ❖ Socio-economic and marketing studies were carried out for Teak, Eucalyptus, Casuarina and NWFP species.
- ❖ Identified suitable Vesicular Arbuscular Mycorrhizal (VAM) fungi and Phosphate Solubilizing (PSB) microbes for improving the quality of nursery seedlings of various forestry species.



Elucidation of Vesicular Arbuscular Mycorrhizal dependency in forestry species root system.



Seed collected from different proveances of Teak in TamilNadu.

Chief Technical Advisors (CTAs)

During the year, 21 CTAs Workshops/Peer-Review Meetings were organized for coordinated research projects on rotational basis in the ICFRE Institutes in which progress of research projects were reviewed and recommendations made. Suggestions/ recommendations made by the experts were incorporated in the annual action plan for the next year.

Modern Nursery

In order to produce quality planting stock, ICFRE has developed two more modern nurseries at HFRI, Shimla and at RFRI, Jorhat during the year in addition to 6 modern nurseries established earlier in different Institutes of ICFRE.

Planning, processing and execution of new project proposals

Planning, processing and execution of new project proposals and review of ongoing projects were carried out. Following achievements have been made:

- * Research abstracts of ICFRE publications were scrutinized and compiled for IWST, Bangalore; FRI, Dehra Dun; IFGTB, Coimbatore; AFRI, Jodhpur and RFRI, Jorhat.
- * Research Policy Committee (RPC) Meeting was held in May, 2001 at Van Vigan Bhawan, New Delhi in which 295 research projects (106 new and 189 ongoing) approved by RAGs-2000 were finalized.
- * RAG meetings were conducted in different institutes of ICFRE during the year 2001, in which a total of 101 research projects were prioritized as follows:

Sl.	Name of the Institute	No. of Projects
1	Institute of Wood Science & Technology, Bangalore	25
2	Arid Forest Research Institute, Jodhpur	08
3	Forest Research Institute, Dehra Dun	30
4	Rain Forest Research Institute, Jorhat	10
5	Himalayan Forest Research Institute, Shimla	01
6	Tropical Forest Research Institute, Jabalpur	19
7	Institute of Forest Productivity, Ranchi	08

* Monitoring and evaluation of research projects were completed successfully.

* A large number of potential Donor Agencies were contacted and a database of 145 Research Projects (79 National and 66 International) of ICFRE Institutes, submitted to 37 National and 16 International Donor Agencies was prepared. Some of the National Donor Agencies are Council of Scientific and Industrial Research, Indian Council of Agricultural Research, Department of Science and Technology, Department of Bio-Technology, National Bank for Agricultural And Rural Development, National Oils & Vegetable Oils Development Board, Cane and Bamboo Technology Centre, Madhya Pradesh Council of Science and Technology etc. International Agencies are Food and Agricultural Organization, United Nation Development Fund, Commonwealth Human Ecology Council, European Union, Japan Bank of International Cooperation, United Nations Childrens' Fund and International Foundation for Science etc.

A comprehensive report for the 10th Five Year Plan (2002-2003 to 2006-2007) with a financial outlay of Rs. 652.63 crores was prepared as per the recommendations of the three sub-group on Forestry Education & Research, Environment Education and Research and Forestry Extension. The report was submitted to MoEF, GOI for approval and financial assistance.

FORESTRY EDUCATION

Significant achievements in Forestry Education during the year are mentioned below:

Grant-in-aid to Universities: Financial support was provided to Universities imparting forestry education in the country for strengthening their infrastructural facilities, teaching aids and organizing educational programmes like study tours etc. A total of Rs. 72.92 lakhs was sanctioned under Grant-in-aid to eight Universities namely, Kerala Agricultural University, Trissur (Kerala), Choudhary Sarwan Kumar Himachal Pradesh Krishi Vidyapeeth, Palampur

(HP), Birsa Agricultural University, Ranchi (Jharkhand), Punjab Agricultural University, Ludhiana (Punjab), Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (UP), Maharana Pratap University of Agriculture and Technology, Udaipur (Rajasthan), Indira Gandhi Agricultural University, Raipur (Chhattisgarh) and Forest Research Institute (Deemed University), Dehra Dun.

Development of Curricula on Forestry and Environment: Curricula on Forestry and Environment were developed for school education viz., Primary, Middle, Secondary and Higher Secondary levels. The curricula so developed has been sent to Ministry of Environment and Forests and Ministry of Human Resource Development, Government of India for implementation in school education systems of the country.

Validation of M.Sc. Forestry Curriculum: Model Curriculum for M.Sc (Forestry) courses was developed and circulated to all the universities for implementation. H.N.B. Garhwal University, Srinagar (UA), CSK Himachal Pradesh Krishi Vidyapeeth, Palampur (HP) and Birsa Agricultural University, Ranchi (Jharkhand) have implemented the curriculum in a phased manner.

Research Support System: Under the Research Support System, award of research fellowships as a support to human resource development within the research system were provided for ICFRE Institutes under various projects. Overall 34 Junior Research Fellowships, 59 Senior Research Fellowships and 13 Research Associateships were provided in the year 2001-02.

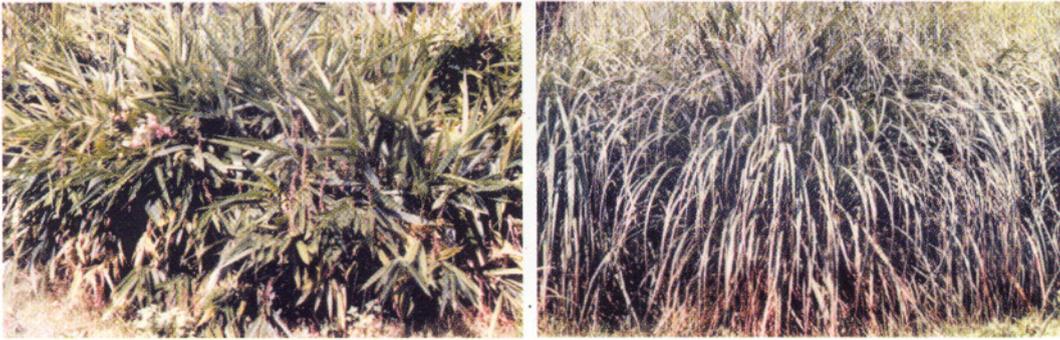
Organization of the National Forestry Liaison Meeting: National Forestry Liaison Meeting was organized by ICFRE on 20th - 21st November, 2001. Participants representing the State Forest Departments including some PCCFs, State Forest Corporations, Forest based Industries, farmers, other National level institutes, and foresters and scientists of ICFRE participated actively in the meeting. It was inaugurated by Shri P.V. Jayakrishnan, Secretary to Govt. of India, MoEF. The recommendations of the liaison meeting were finalized after two days of detailed deliberations in various technical sessions. The recommendations were sent to all State Forest Departments, State Forest Corporations, State Research Units, ICFRE Institutes and other sister Institutes of ICFRE under MoEF.

FORESTRY EXTENSION

The following are the activities undertaken under Forestry Extension during the year.

EXTENSION SUPPORT FUND (ESF):

Twenty four ESF projects worth Rs. 17.2 million, were sanctioned during previous years to various organisations such as State Forest Departments, State Forest Corporations, Universities, State Research Institutes and NGOs. Following fourteen technologies have been disseminated so far and have been demonstrated to urban and rural industries, farmers, fishermen and other users during the year.

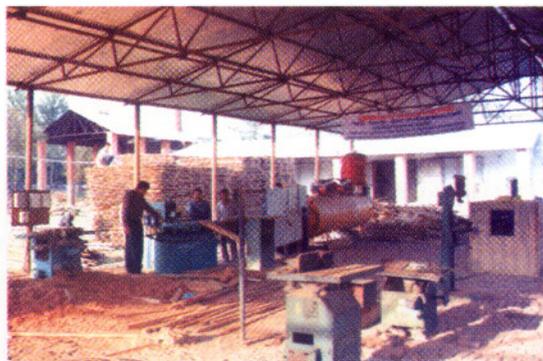


Cultivation of medicinal plants

1. Sawing and conversion technique of Eucalyptus.
2. Seasoning of timber with special reference to Eucalyptus.
3. Preservative treatment of secondary species and Eucalyptus timber in particular.
4. Plasticization of wood and bending techniques.
5. Colouring and ammonia fumigation of wood.
6. Utilization of Poplars for doors and windows.
7. Poplars for pencil making.
8. Technology for utilization of juvenile wood of Poplars/Eucalyptus for furniture and joinery.
9. Macropropagation of bamboo seedling in nurseries.
10. Reusable packing boxes.
11. Cultivation of medicinal plants and their processing.
12. Clonal propagation and planting of superior clones of Poplars.
13. Micro propagation and farming of selected clones of *Cymbidium* sp. of orchids.
14. Biodiversity conservation.

Ten permanent demonstration centres have been developed in different parts of the country where the end users may get training and technical knowhow of different technologies as and when required. These centres are located at the following places :

- (i) Small Industries Research and Development Organisation (SIRDO), Bhimtal, Nainital.
- (ii) Garhwal Mandal Vikas Nigam Ltd., Kotdwara, Uttaranchal.
- (iii) Kerala Forest Research Institute, Peechi, Kerala.
- (iv) Yavatmal Zilla Nilgiri Vriksha Utpadak and Prakriya



Demonstration Centre at GMVN Ltd., Kotdwara

Sahakari Sanstha, Yavatmal,
Maharashtra.

(v) Birla Institute of Scientific
Research (BISR), Ranchi,
Jharkhand.

(vi) Punjab Forest Department
has three sub-centres located
at Hoshiarpur, Phillaur and
Patiala.



Solar Kiln at KFRI, Peechi

(vii) Tripura Forest Development and Plantation Corporation Ltd. (TFDPC),
Agartala, Tripura.

(viii) State Forest Research Institute (SFRI), Itanagar, Arunachal Pradesh.

(ix) Tamil Nadu Forest Department, Mettupalayam, Chennai.

(x) Karnataka State Forest Industries Corporation Ltd. (KSFIC), Bangalore.

Demonstration of technologies at different sites and seminars/ workshops and exhibition.

- ❖ Workshop on Extension Support Fund Projects, was held on 19-21 September, 2001.
- ❖ Participated in International Trade Fair at Pragati Maidan, New Delhi from 14th to 27th November, 2001 and demonstrated different ICFRE technologies.
- ❖ All tested technologies of ICFRE were demonstrated during the National Forestry Liaison Meeting held on 20-21, November, 2001 at FRI, DehraDun.



Visit of Shri S.K. Pandey, IFS, Director General of Forests, Ministry of Environment and Forests, Government of India on 21st December, 2001



Dr. Rameshwar Dayal explaining about the natural dyes to Dr. K.V. Srinivasan, Advisor, DSIR, New Delhi during Brain Storming meeting on Natural Dyes held at FRI, Dehra Dun

Production of extension materials

During the year CDs were prepared from 15 Beta cam films. Dubbing of each film was done in local languages. VHS copies of film were prepared for dissemination of technologies.

Publications**Books**

- Forestry Statistics India 2000
ICFRE Annual Report 2000-2001 (English & Hindi)

Brochure

ICFRE Brochure

Bulletin

Timber/Bamboo Trade Bulletin

Newsletters

1. Quarterly ICFRE Newsletter Vol.1, No.1, Oct.-Dec., 2001
2. Quarterly ICFRE Newsletter Vol.1, No.2, Jan.-March, 2002

Implementation of Information Technology Policy of ICFRE

For implementation of information technology policy of ICFRE Local Area Networks (LAN) have been established at all the institutes of ICFRE.

Further, Wide Area Network (WAN) linkages through leased lines have been provided at IFP, Ranchi; TFRI, Jabalpur; IWST, Bangalore; AFRI, Jodhpur; and IFGTB, Coimbatore for internet connectivity and electronic communication. 1 Mbps leased line for internet connectivity at ICFRE, Dehra Dun was made fully functional.

Three advanced Sun Microsystem Servers have been installed at ICFRE Hq. viz., Proxy Server, Library Server and MIS Server. The Servers are running on Sun Solaris and have Redundant Array of Inexpensive Discs (RAID) implemented to guard against hard disc crashes and loss of data. The system is relatively immune to virus attacks.

Softwares like MS Office, Oracle 8i for NT and Sun Solaris I planet suit have been purchased and installed.

❖ Indian Forestry Research Information System (IFRIS)

The following modules have been made operational at ICFRE (Hq)/FRI.

A. The Management Information System (MIS)

- Personnel Information System
- The Accounting System
 - Program Budgeting
 - Project Accounting System
 - Financial Accounting System
 - Inventory Accounting System
 - Pay Roll System
 - Project Database
 - The Grant System

B. The Research Information System

- The Research Documentation System
- Monitoring & Evaluation System

C. The Library Information System

- Bibliographic database
- CD-ROM Service

During the year, in accordance with IT Policy, all scientists down to Scientist-SC level have been provided with computers and peripherals with access to networks and internet. Two trainings on LAN server management were organized and attended by 37 scientists/computer personnel from institutes of ICFRE.

The Financial Accounting System (FAS)/Payroll module have been implemented at regional institutes. HFRI, Shimla; IFGTB, Coimbatore; RFRI, Jorhat; IFP, Ranchi; AFRI, Jodhpur; FRI, Dehra Dun; IWST Bangalore; and TFRI, Jabalpur have successfully closed the financial year 2001-2002. Subsidiary systems have also been implemented during the year.

Subsidiary Systems

- * Information Management of a Laboratory. A case study on Mycorrhiza (Pathology).
- * Record Management for Pathology Museum (Pathology)
- * Specimen Culture Management System (Pathology)
- * Soil Publication Management System (SPMS)
- * Study Faculty Information System : A case study of Deemed University
- * Information Management for Research Scholar : A case study of Deemed University (FRI)

Bibliographic databases and CD-ROM, services are fully operational at NFLIC, headquarters. Steps have been taken to improve access to journal articles by initiating a content page service. The table of contents of journals available at NFLIC, Dehradun are scanned and sent to all institutes through e-mail. On receipt of request for particular articles, these are scanned and sent in full through e-mail.

Internet Services are fully functional at all institutes.

FORESTRY STATISTICS

Forestry Statistics India 2001: The data from 22 states have been received, analysed and incorporated.

Timber/ Bamboo Trade Bulletin (TBTB) : TBTB for all the four quarters of the year was published and disseminated to SFDs and other end-users.

Web-paging: Forestry Statistics India 1996 & 2000 has been incorporated in ICFRE web page (www.icfre.org).

SPSS-software: SPSS-software was installed for statistical analysis of biometrical problems for 5 clients at a time.

Biometrical assistance: Provided biometrical assistance to scientists of FRI, Dehra Dun on seed technology and entomology.

World Bank Aided "Forestry Research, Education and Extension Project (FREEP) (2001-2002)".

Forestry Research, Education and Extension (FREE) Project was launched on 30th September, 1994 with the assistance of the World Bank. Important project related office and scientific equipments, computers etc. amounting Rs. 5.0841 crore were procured.

- An amount of Rs.3.1321 crore was utilized during the year for the creation of office/residential buildings, laboratories and nurseries etc. Project related office and scientific equipments, computers etc. amounting to Rs.5.0841 crore were procured.
- During the year, 31 ICFRE Officers/scientists undertook study tours and 45 officers/scientists awaited long term training in various research fields.
- The World Bank Supervision Mission from 30th April 2001 to 25th May 2001 carried out review of progress of ongoing projects and various activities against Annual Action Plan under FREEP by visiting various institutes and field experiment sites and ICFRE. The mission also visited New Delhi from 5th to 7th Nov. 2001 for terminal review of the project. During both the visits, the mission had observed the progress as satisfactory.

Integrated Development of Neem -"Development of Neem in various Agro-ecological Regions of India (Punjab, Haryana & Western Uttar Pradesh)".

Findings: Candidate Plus Trees (CPTs) were identified in Punjab (142), Haryana (364) & Western Uttar Pradesh (640). Eighteen provenances were delineated viz., Roorkee, Meerut, Khurja, Moradabad, Badaun, Udham Singh Nagar, Agra, Ambala, Kurukshetra, Panipat, Patiala, Rohtak, Gurgaon and Hissar.

Germination behaviour of seeds of CPT's and different provenances was recorded. Germination behaviour was also evaluated in respect of 3 Agro-climatic zones i.e., Hot Arid Eco-region, Hot Semi-Arid Eco-region and Hot Sub-Humid Eco Region. Phenological observations were recorded on selected CPT's of different zones for both phases in Vegetative and Reproductive phases.

Nursery Performance: Nursery was established and seedlings were raised in respect of CPT's and provenances. Meerut provenance showed highest height growth followed by Hodal, Moradabad, Rohtak & Panipat provenances. Nitrogen 1000ppm+Phosphorus 500ppm+Potash 500 ppm was found to enhance the height growth, collar diameter and shorten nursery period as compared to control. 145 CPT's were short listed having 50% plus oil content. These CPT's will be utilized in further mass multiplication and neem

improvement programme to enhance productivity. Vegetative propagation techniques including rooting of softwood cutting (Clonal propagation - nodal) and air layering for mass multiplication of high oil and Azadirachtin yielding variety of trees was standardized.

Review of Activities by Hon'ble Minister

Thiru T.R. Baalu, Hon'ble Minister for Environment and Forests reviewed the activities of ICFRE on 25th September, 2001 at New Delhi. Shri P.V. Jayakrishnan, Secretary, Shri S.K. Pande, Director General Forests, Ms S. Chaudhary, Additional Secretary and other senior officers of the Ministry were also present during the review. Shri R.P.S. Katwal



Review of activities by Hon'ble Minister

Director General initiated the discussion. Subsequently, all Directors presented their institute's on going research activities, achievements, technologies developed and future strategies for their respective zones.

ICFRE CASH AWARD

ICFRE cash awards for the years 1997-98, 1998-99 and 1999-2000 were awarded to the following :

1997-98

Sl.	Name	Field
1.	Dr. Luxmi Chauhan	Wood and Bamboo anatomical research.
2.	Dr. Ashutosh Kumar Tripathi, Dr. S.K. Bannerjee, Dr. Sadhna Tripathi and D.C. Kori	Forest Protection.
3.	Dr. Rameshwar Dayal	Forest utilization.
4.	Dr. R.K. Srivastava	Forest Conservation.
5.	Dr. K.K. Jha	Forest (Silviculture) Research.

1998-99

Sl.	Name	Field
1.	Shri H.S. Singh	Forest Conservation.
2.	Prof. N.P. Tadoria & Dr. V.B. Bhatt	Forest (Silviculture) Research.
3.	Shri Y.C. Tripathi	Non-Wood Forest Products.

1999-2000

Sl.	Name	Field
1.	Dr. Alind Rastogi	Forest Utilization.
2.	Dr. A.K. Mahapatra	Forest Extension.
3.	Dr. Anurag Raizada	Forest Conservation.
4.	Dr. Mohan Varghese, Dr. A. Nicodenus, Dr. B. Nagarajan & Shri K. Subramanian	Forest (Silviculture) Research.
5.	Dr. V. Mohan	Forest Protection.
6.	Dr. H. Lalrannghinglova	Non-Wood Forest Products.

MAJOR RESEARCH FINDINGS OF THE COUNCIL

- *Chukrasia* spp. and *Albizia chinensis* have been classified as suitable for use in construction, door frames and shutters, packing cases and crates, cabinet making, tool handles, furniture, flooring etc. on the basis of their physical and mechanical properties.
- Using fly ash as an ameliorant for sodic soils can effectively solve the problem of its disposal and at the same time improve the bio-productive potential of land, which was otherwise lying waste due to sodicity.
- The treatments containing oil cakes have shown better performance on the growth of the Eucalyptus in comparison to the chemical fertilizers. Biomass production was maximum under Neem cake treatment followed by Mustard cake.
- The mixed plantations were more efficient in improving the soil attributes in comparison to monoculture plantations. Among the monoculture plantations, *Leucaena leucocephala* has proved more efficient in ameliorating the sodic soils followed by *Prosopis juliflora*, *Dalbergia sissoo*, *Acacia nilotica*, *Eucalyptus* hybrid and *Terminalia arjuna*.
- Identified *in situ* indicator species for *Taxus baccata*, *Nardostachys jatamansi*, *Picrorrhiza kurroa* and *Colchicum luteum* which are all red listed species. Vegetative techniques for the multiplication of *Taxus baccata* and the cultivation packages for *Nardostachys jatamansi* and *Picrorrhiza kurroa* have been developed.
- Cost-effective micropropagation protocols were developed for mass propagation of *Dendrocalamus strictus*, *Bambusa arundinacea*, *B. arundinacea* var. *gigantea*, *D. membranaceous*, *B. nutans* and *Oxytenanthera stocksii*.
- *In vitro* propagation methods were standardised for mature tissues of *Azadirachta indica*. Difficult to root clones of *E. tereticornis* and *E.*

camaldulensis were rejuvenated and 100% rooting achieved. Fast-growing *Acacia* hybrids (*A. mangium* X *A. auriculiformis*) obtained from West coast paper mills, Dandeli were established in culture for clonal propagation through axillary bud multiplication. Methods were developed for the micropropagation of tropical hybrid *Eucalyptus urophylla* X *E. grandis*.

- Developed complete micropropagation package for large-scale production of genetically enhanced planting stock of teak. Somatic embryogenesis system was developed for *Eucalyptus tereticornis* for transformation studies.
- The biomass productivity and nutrient cycling in teak plantations in Tamil Nadu was investigated. Productivity models for different agroclimatic zones were developed and prediction equations established. Nutrient cycling at different ages was estimated and correlation between productivity and soil nutrients was established.
- The clonal propagation technology for mass multiplying the high yielding neem tree has been standardized. A total of 140 superior trees selected in different locations of Tamil Nadu were multiplied clonally and a clone bank/vegetative multiplication garden has been established with 60 clones.
- Established 10 ha of Agro-pasture Model with Neem as tree species and Sorghum as fodder.
- Vegetative propagation method for Neem has been standardized. Stem cuttings from 1 year old branches, 1.5 to 2.5 cm in diameter, have been found to be appropriate for good rooting.
- One-year growth data reveals that some of the species have potential for future energy programme. The results indicate that *Mallotus albus*, *Tephrosia candida* and *Anthocephalus chinensis* have a good potential and can be exploited for the future energy generation programme.
- Charcoal root rot in *Azadirachta indica* and *Tecomella undulata* and seedling blight in *Hardwickia binnata* is first time recorded from India.
- *Derolus descicollis* (Coleoptera: Cerambycidae) has been recorded for the first time in India. It is responsible for large scale drying and mortality of Khejri trees in four districts of Rajasthan.
- The total of 640 plant species belonging to 92 different families have been collected from the cold desert areas. Three hundred forty five species have been identified as unique species. Twenty seven species of medicinal importance, have been declared as red listed medicinal plants. Five dominant indigenous shrub species viz., *Capparis spinosa*; *Ribes* spp., *Caragana* spp., *Colutea* spp. and *Crategus* spp. besides *Rosa webbiana* were short listed for afforestation and eco-restoration in cold desert areas.