

ARID FOREST RESEARCH INSTITUTE JODHPUR

The Arid Forest Research Institute at Jodhpur was established in 1988 with a view to solve the forestry research problems of the States of Gujarat, Rajasthan and the Union Territory of Dadra and Nagar Haveli.

PROJECTS COMPLETED DURING THE YEAR 2000-2001

Project 1: Studies on various Silvi-pastoral systems in arid zones to maximize the productivity. (AFRI-1/FEDD-1/RD)

Objectives: (a) To improve the productivity of degraded lands by introduction of silvi-pastoral systems. (b) To introduce new tree species and study their performance *vis a vis* existing tree species in silvi-pastoral systems in different climatic conditions.

Results:

Silvi-pastoral trial at Rohat: The experiment was laid out with four tree species namely *Zizyphus mauritiana* (Rhamnaceae), *Prosopis cineraria* (Mimosoideae), *Ailanthus excelsa* Roxb. (Simaroubaceae) and *Dichrostachys nutans* (Mimosaceae) at a spacing of 5m x 5m in three replicates, with 24 plants in each replicate in a Randomized Block Design. *Cenchrus ciliaris* as inter-crop was tried.

Tree survival and growth: Survival of tree species remained more than 98% for all the three species except for *Dichrostachys nutans* (63%) during the experimental period, which suffered casualties due to fungal attack. *Zizyphus mauritiana* registered very poor growth increment due to drought. However collar dia registered increase and values for *Ailanthus excelsa*, *Zizyphus mauritiana*, *Dichrostachys nutans* and *Prosopis cineraria*.

Green grass yield: Green grass yield showed drastic reduction of 23%, 56% and 44% in blocks of *Z. mauritiana* and *D. nutans* and pure block due to significantly high weed invasion. Grass yield registered 20 and 50% increase with *A. excelsa* and *P. cineraria*. Where the weed invasion was lesser and no. of tillers / grass culms, the tiller height was higher as compared to other tree species.

Biomass yield: The results of the trial indicate that *A. excelsa* tree species has the potential to be introduced in silvi-pastoral system in arid zone and *D. nutans*, needs better plant protection measures in the initial stages.

Survival of the tree species: The survival recorded at the age of 42 months showed that *Z. mauritiana* recorded maximum survival of 91% followed by *A. nilotica* 87%, *D. nutans* 80%, *A. excelsa* 79% and *Azadirachta indica* 70%.

Growth: *A. nilotica* attained notable growth while *Azadirachta indica* and *D. nutans* failed to grow.

Biomass estimation: Total biomass yield of *A. excelsa* was almost double the yield of *Z. mauritiana* in fresh as well as dry biomass yield.

Grass yield: Despite total rainfall of 252 mm the grass yield registered 40 to 54% increase in growth with different tree species except for *D. nutans* where a 12% decline in growth was recorded. Probably shelter provided by tree species helped in lesser frost damage to grass culms which was not there in case of *D. nutans* due to very poor tree growth. Four and half years growth of different tree species showed that although *Zizyphus* is the best tree for silvi-pastoral systems in arid zone, *A. excelsa* has the potential to be introduced in silvi-pastoral systems surviving both frost and drought. *A. nilotica* and *A. indica* need protection against frost and their revival is poor. *D. nutans* is susceptible to frost as it didn't have thorns and has palatable fodder, is prone to grazing and needs protection against it.

Project 2: Growth and yield studies in irrigated plantations of IGNP area. (AFRI-10/FRME-1/WB 2-III)

Objectives: (a) *D. sissoo* planted under irrigated conditions in IGNP area. (b) Preparation of volume / yield tables and development of site-index equations and growth and yield functions for these two species.

Results: Combined variable equation performed best among all the models tried for the two species. Provisional yield tables prepared. Payandeh and Wang Model performed better for *Eucalyptus camaldulensis* in comparison to Ek's, Newnham and Goelz & Burk functions while Goelz & Burk Model performed best in case of *D. sissoo* as far as relative accuracy is concerned. *E. camaldulensis*, Chapman-Richard equation performed better than the Gompertz and Schumacher Models in the case of Diameter-age relationship while Schumacher Model produced better results in the case of Volume-age compared to the other two models. In case of *D. sissoo*, Gompertz function produced better results for modeling both the diameter-age as well as volume-age relationships. The coefficients of all the models are taken as functions of stand densities and site classes.

Project 3: Studies on fatty oil of some important oil bearing plants of arid regions. (AFRI-13/NWFP-1/PLAN)

Objectives: (a) To survey the oilseed potential of arid regions. (b) To identify high oil yielding provenance for collection of good quality seeds and for large scale propagation of oilseeds, plant species. (c) To screen out arid zone flora for further sources of fatty oils. (d) To carry out qualitative studies of oil of various species to ascertain their industrial suitability.

Results: Oil extracted from *Pongamia pinnata* seeds studied for their physiochemical properties. A remarkable variation in all these characteristics of oil from seeds of different origins was recorded. The percentage composition of fatty acids showed considerable variation indicating the qualitative difference in oils from seeds of different origins. Considerable weight loss, decline in content of oil, protein and carbohydrate were observed in infested seeds. Free fatty acid and saponification values of oil from infested seeds were increased whereas iodine value showed a sharp decline compared to the healthy seeds.

Project 4: Study on the Biocidal Activity of Extractives of Arid Zone Plants. (AFRI-14/NWFP-2/PLAN)

Objectives: a) To study the biocidal efficacy of various arid zone plant species to explore their pesticidal potential so as to develop eco-friendly plant based pesticides.

Results: The total methanolic extracts of all the parts have shown significant activity against the aphid *Lipapis erysimi* and the order of the efficacy was found as root > seed > bark > branch > wood. Methanolic extract of roots of *C. decidua* against *Streblote siva*, the babul defoliator showed promising antifeedant activity in the root extract of the plant. 100% antifeedant activity has been recorded with NSKP methanolic extract at 0.5% concentration against all the stages of larvae of *Noorda blitealis*, the Moringa defoliator. 0.5, 0.3 and even at 0.1% of Neem Seed Oil (NSO) concentration was found effective in suppressing development of whitefly significantly. The preliminary results of extracts of different parts of other plants namely *Psoralea corylifolia*, *Balanites aegyptiaca* and *Dicoma tomentosa* for the evaluation of their biocidal efficacy were found encouraging.

OLD PROJECTS CONTINUED DURING THE YEAR 2000-2001

Project 1: Effect of different tree density and inter crops on yield and productivity of agroforestry systems. (AFRI-2/FEDD-2/RD)

Objectives : (a) To study the influence of different tree densities on crop yield, tree growth and to find out optimum tree density. (b) To study the effect of different tree-agricultural crop combinations on yield and productivity. (c) To study tree crop interactions in respect of soil moisture and nutrients at different age of plantation.

Achievements:

Effect of tree density on crop yield and plant growth: The field experiment comprised of three densities and the effect of density on tree growth was appreciable.

In-situ runoff agroforestry : During the monsoon period soil moisture studies suggested that the extent of soil water availability, depends on the nature of species and the root length of the plants also depends on the soil depth.

Project 2: Effect of ex-situ rain water harvesting and stand density on tree growth. (AFRI-3/FEDD-3/RD)

Objectives: To study the effect of runoff capture on the growth of standing plantations.

Achievements: A trial on interactive effects of ex-situ water harvesting was laid. A five year old stand of *A. indica* (neem), *P. cineraria* (khejri), *Albizia lebbek* (siris) was converted into an experiment after thinning it to two different densities, 1111 SPH and 555 SPH, which were in sub plots. As such no further significant changes have been observed due to various treatments because of failure of monsoon.

Project 3: Studies on sand dune stabilization in Indian Desert. (AFRI-3/FEDD-4/RD)

Objectives: (a) To study the effect of nitrogen fixing species / grass on the early plant establishment. (b) To assess soil improvement and soil water status in dune area. (c) To improve the productivity of dune area. (d) Improvement in environmental quality.

Achievements:

Nutrient management in sand dune for better growth and biomass production: There was an increase in Soil Organic Matter (SOM) and soil available N ($\text{NH}_4\text{-N} + \text{NO}_3\text{-N}$) due to plantation and vegetation type treatment and were observed that, *Calligonum polygonoides* with *Cenchrus ciliaris* was the best combination for fuel and fodder production where as *C. polygonoides* along with *Carsia angustifolia* was best to control sand drift.

Plant growth and biomass production under the influence of habitat conditions and competitive effect of natural grasses: Interspecific competition was found to limit the growth and biomass production of planted seedlings.

Effect of adult neighbours on regenerative population of *Cassia angustifolia* in dune area for habitat restoration : The emergence of seed was directly related to the soil seed availability. Seedling had greater survival in 0-1.0 m zone and subsequent performance was positively correlated with the emerging population.

The effect of spacing on growth and performance of *Acacia tortilis*, in Indian desert: Plants indicated significant difference in height, collar diameter, crown diameter and biomass of plants due to variations in tree densities. However, growth parameters did not show clear trend of increase or decrease with plant densities except collar diameter. Soil nutrient analysis data of 0-30 cm soil layer indicates an increase in soil organic matter, available phosphorus, ammoniacal and nitrate nitrogen.



Sand Dune Stabilization

Project 4: Woody Plant Water Relations. (AFRI-5/FEDD-5/WB 1-I)

Sub Project: Investigation of soil water plant relationship in respect of different tree species.

Objectives: (a) To find out critical limits of stress tolerance of different tree species. (b) To screen tree species for efficient water use and growth under arid conditions. (c) To study the effect of varying level of sewage water on the growth of the plants.

Achievements:

Screening tree species for efficient water use and growth under arid conditions: Water stress level of -0.1 to -0.5 MPa is best treatment for tree seedlings of *E. camaldulensis*, *A. nilotica* and *D. sissoo* considering water availability in arid zone. Water stress level of -0.5 to -1.0 MPa is critical for growth of *D. sissoo* seedlings. The decrease was also significant for the other two species. Availability of soil nutrients decreased with increase in water stress levels.

The effect of varying level of sewage water on the growth of the plants: Application of sewage water increase the availability of soil organic, available phosphorus and nitrogen, exchangeable carbon did not show adverse effect on physiological function, plant growth and soil properties.

Project 5: Screening of exotic and indigenous plant species for their performance on salt affected soil with different management Project. (AFRI-6/FEDD-6/WB 1-II)

Objectives : (a) To screen different exotic and indigenous plant species for their growth performance on the salt affected soil. (b) To find out the optimum levels of Gypsum and nitrogen to optimize productivity.

(c) To find out the effect of plantation on soil properties in terms of physico-chemical changes and vegetation status.

Achievements: Overall there was no appreciable decrease in survival of bushes as compared to survival in May 1999 despite two-failed monsoon for the trail laid in 1997. Flowering and seed setting was recorded in all the treatments. Weed biomass estimation was carried out by laying quadrats and nearly 6 ton per ha yield of *S. helvolus* was recorded. Flowering is recorded in 60% plants for the trail laid during 1998. Overall survival of *A. lentiformis* showed that full Gypsum treated bushes recorded maximum survival followed by half Gypsum (G1) and Gypsum control (G0). However, Urea and Calcium Ammonium Nitrate (CAN) treated bushes recorded better survival as compared to Urea treated bushes with or without Gypsum application. Growth data also indicate the same trend, for the trail laid during 1999. A trial was laid during 2000, with 3 salt tolerant species namely *A. lentiformis*, *A. nummularia* and *Sueda nudiflora* and three treatments of planting (control, single ridge mound and double ridge mound). Single ridge mound was the best planting practice for survival as well as growth for plant species in a drought year.



Treatment of Gypsum and Urea on salt affected land

Project 6: To screen various plant species for high yielding commercial forestry under irrigated condition in Indian arid zone. (AFRI-7/FEDD-7/WB 2-II)

Objectives: (a) To find out the best performing commercially important plant species under irrigated condition in arid zone. (b) To study the effect of VAM biofertilizer on establishment and growth of plant species. (c) To study the effect of continued irrigation on the soil properties.

Achievements: Data reveal that percent increase in height of *E. camaldulensis* and *D. sissoo* was significantly influenced by fertilizer application, whereas *A. nilotica* did not respond. Fertilizer application was effective in significantly increasing the crown diameter for *A. nilotica* registering 28% crown increment as compared to 21% for control plot whereas for *E. camaldulensis* it was 25% for fertilized plot against 21% for control. *D. sissoo* recorded lesser percent crown increment for fertilized plot as compared to control. Fresh root mass was estimate revealed that total root volume was maximum for *E. camaldulensis*, followed by *A. nilotica* and *D. sissoo*. Percent moisture studies indicate that water requirement of different species vary according to their growth phase.



Irrigated *Dalbergia sissoo* plantation in arid zone

Project 7: Irrigation and water management for tree species. (AFRI-8/SILVI-1/WB 2-IV)**Sub-Project : Studies on VAM association in Irrigated Plantations and agroforestry systems.**

Objectives: (a) Identification of different VAM fungi associated with tree species growing in irrigated plantations and agro-forestry system in arid zone of Rajasthan. (b) Determining the dependency of different arid and semi-arid tree species on VAM fungi. (d) To develop protocol for mass inoculum production. (e) Selection of efficient strains of VAMF. (f) To study the influence of VAMF with *Rhizobium* on leguminous tree species.

Achievements: VAM inoculated seedlings of *P. cineraria* performed better in terms of biomass and percentage of infection than other treatments. The causality percentage was found least in VAM inoculated than SPM. Among the genera *Glomus* was found predominant genera than *Acaulospora*, *Scutellospora* and *Sclerocystis*. Among the species *Glomus fasciculatum* and *G. aggregatum* were found most common species in rhizosphere soil of *A. nilotica*. Rhizosphere soil samples were found rich in spore population. The spore density varied between the species to species and nursery to nursery. Selective strain of VAM fungi (consortium inoculum) for Neem has been prepared for nursery inoculation and field trials.



Dalbergia sissoo

Cordia myxa

Effect of VAM inoculation

Project 8: Disease spectrum of arid and semi-arid tree species. (AFRI-9/SILVI-2 /PLAN)

Objectives: (a) To record out break of diseases in forest nurseries and plantations. (b) To collect, isolate and identify the pathogens. (c) To assess the incidence of the disease. (d) To find out economically important diseases and evolve their management.

Achievements: Mortality due to severe attack by canker disease and mineral deficiency symptoms in *Acacia ampliceps* was recorded. The association of three pathogens viz., *Alternaria* sp., *Botryodiplodia theobromae* and *Phoma* sp. were isolated and identified.

Project 9: Integrated Pest Management for Forest Insect Pests. (AFRI-11/FP-1/PLAN)**Objectives:**

Component I: Evaluation of bio-pesticidal efficacy of some arid zone plant species : (a) To extract the plant / parts and fractionation of crude extracts into different active compounds. (b) To investigate the bioefficacy of the plant extracts / active fraction against major insect pests of arid zone.

Component II: Survey and evaluation of natural enemy complex of Rohida, Babul, Khejri and Neem insect pests : (a) To prepare checklist of potential natural enemy complex of each of the key pests. (b) To study the efficacy of each of the potential bio-control agents.

Component: III: Screening and Bioassay of conventional insecticides against key pests of Neem:

To study the bioassay of conventional insecticides against key pests of Neem.

Achievements: Different concentrations of the extract of *Psoralea corylifolia* were tested against *Myllocerus tenuicornis* and it was observed to be repellent rather than acting as effective biopesticide. The biopesticidal studies show a positive response of *Balanites aegypticea* against *Patialus tecomella*. Amongst the different concentrations viz. 0.1, 0.01, 0.001% listed, the 0.1% was found to be the most effective. *Eupelmid* sp. (Eupelmidae : Chalcidae) and effective egg parasitoid was found to parasitize the eggs of *Halys dentalus*, *Eurybrachus tomentosa* and *Homoecerus prominulus*.

Project 10 : Studies on the pest problems in forest nurseries and their management in arid and semi-arid region. (AFRI-12/FP-2/PLAN)

Objectives: (a) To record outbreak if any. (b) To survey, collect and identify pests of economic forestry importance and develop a reference collection of the same. (c) To study the eco-biology and host range of important pests. (d) To evolve eco-friendly integrated pest management strategies. (e) To bring all the scattered information on pest problem in forest nurseries in a single document.

Achievements : Bibliography of pests of forest nurseries with special reference to arid regions was prepared. No outbreak was recorded in this year. Two species of Diptera belonging to family Agromyzidae were recorded as new hosts of *Ailanthus excelsa*. They fall into the category of leaf miners. The preserved non insect pest specimens are being maintained as reference collection for further studies.

Project 11: Studies on the proteins of arid zone shrubs and trees for their potential as food and fodder. (AFRI-15/NWFP-3/PLAN)

Objectives: (a) To select potential plants (shrubs and trees) as protein sources. (b) To determine the protein contents of different parts viz. seeds, leaves, branches of trees, shrubs, and herbs of arid zone. (c) To prepare and investigate the leaf protein concentrates as unconventional source of fodder.

Achievements: Crude protein content studies on the species taken up last year are being continued. In addition, *Prosopis juliflora*, *Parkinsoina aculeata*, *Prosopis cineraria*, *Acacia senegal*, *Dichrostychnus cineraria* and some herbs were selected and LPC prepared.

Project 12 : Provenance trials on *Acacia nilotica* and *Ailanthus excelsa*. (AFRI-16/FGTB-1/WB 3-I)

Objectives: (a) To screen the available geographic variation for timber yield. (b) To screen the available geographic variations for higher fodder yield.

Achievements: The data on growth parameters have been recorded, the rating of the provenances varied from year to year. Seeds of *Acacia nilotica* collected from 45 sources, from all over India were studied for various seed parameters and seedlings were raised and distributed to SFD and various sister Institute for raising Provenance trials. The provenance trial was laid out at two different sites Jaipur and Jodhpur. The data collected shows that the Pinjore was the best followed by Bikaner and Kazipeth. Fresh collection of the *Ailanthus excelsa* provenances was established from the seeds collected from 35 provenances.

Project 13: Provenance trial on Arid Zone species. (AFRI-18/FGTB-3/PLAN)

Objectives: (a) To find out the promising provenance for growth. (b) To find out the promising provenance for adaptability. (c) Utilize the best provenance for Plant Improvement work.

Achievements: The growth data collected from the provenance trial of *Azadirachta indica* indicates that no single provenance showed good results consistently. This year Jaisalmer (Rajasthan) provenance was found superior in growth followed by Jhansi (Uttar Pradesh) and Palanpur (Gujarat). The provenance trial of *Tecomella undulata* was planned in the year 1992 with 13 seed sources from Rajasthan. The growth data collected so far indicated that the Sunderpur bir (Sikar) is superior in growth followed by Nagaur and Bhaislana (Jaipur). Provenance trial for *Dalbergia sissoo* was laid out in August 1995, with the seeds collected from 13 provenances with 3 replicates and 6 plants in each line at a spacing of 4 x 3 meters. The line design was chosen considering low number of plants in each of the provenance. Thirteen provenances were used in the trial. The local provenance did not show good results.

Project 14 : To develop vegetative propagation technique for *Acacia nilotica* and *Ailanthus excelsa*. (AFRI-19/FGTB-4/WB 3-II)

Objectives: To develop a cost-effective method / technology for cloning superior genotypes of *Acacia nilotica* and *Ailanthus excelsa*.

Achievements: Maximum of 15% rooting was observed when *Acacia nilotica* cuttings from adult trees were treated with 5000 ppm IBA solution for 30 seconds. Best rooting response was obtained from *Ailanthus excelsa* treated with 1000 ppm. There was high mortality rate during the hardening phase, seedlings planted in the field did well, 80% rooting was achieved from one year old and 40% from two year old seedling whereas, branch cuttings did not root. Stem of the saplings (2 year old) was divided in to three parts i.e. upper part (UP), middle part (MP) and basal part (BP). Maximum 40% rooting was recorded in cuttings from middle portion at 1000 ppm IBA. Maximum 80% rooting was achieved from one year-old and 40% from two year old seedlings after 30 days of growth in mist chamber conditions, whereas, branch cuttings did not root.

Project 15 : To develop tissue culture technique for *Acacia nilotica* and *Ailanthus excelsa*. (AFRI-20/FGTB-5/WB 3-II)

Objectives: To develop technology for faster multiplication of superior planting stock material.

Achievements: *Acacia nilotica*, cultures are being maintained for the last one and half years by repeated sub culturing on shoot multiplication medium. The shoot multiplication rate is not very fast. During rooting experiments, it was found that hormone free ½ MS medium or ½ MS with IBA gave high rooting percentage (70%), though not cent percent. *Ailanthus excelsa*, nodal segments with vertical orientation were used to standardize the stem multiplication efficiency and eliminate the intermittent callus formation. Shoot multiplication was found to marginally increase by the use of 200-mg/l tryptophan in the earlier used MS medium supplemented with 2 mg/ IBA. Good callus was found to initiate. Highly embryogenic looking, compact, nodular calli resulted. This will be now utilized to develop regeneration system based on somatic embryogenesis and organogenesis, whichever feasible.

Project 16 : Planting Stock Improvement Programme. (AFRI-23/(WB-PSIP)

Sub-Project : Development of Seed Production Area.

Objectives: (a) To develop seed production area of target species. (b) To compare the performance of seeds collected from the SPAs. (c) To prepare the management plan of SPAs.

Achievements: Sample plots laid out in selected and unselected stands have been analysed as per the proforma received from ICFRE and based on the analysis, culling operations were carried out in 40 ha of seed stands of *Acacia nilotica* and 55 ha of seed stands of Teak in Gujarat. 10 ha of seed stands of *D. sissoo* selected under rainfed conditions and 15 ha of seed stands of *Acacia nilotica* at Mandera beet, Bharatpur have also been selected for conversion into SPA. Moisture conservation work has been implemented. Management plan of SPAs has been prepared and discussed with the concerned SFDs. These areas have been handed over to State Forest Departments for future management.

Sub-Project : Development of Seedling Seed Orchards.

Objectives: (a) To develop Seedling Seed Orchards of target species for quality seed. (b) To select CPTs.

Achievements: The target for this activity was achieved for 20 ha of *Acacia nilotica*, 20 ha of *D. sissoo* and 15 ha of *E. camaldulensis*. 7 ha of provenance trial cum SSPA of *E. camaldulensis* has been raised at Jodhpur from seeds obtained from CSIRO, Australia. The Seedling Seed Orchards of target species i.e. 10 ha of *A. nilotica*, 5 ha of *D. sissoo* and 2 ha of *E. camaldulensis* have been raised at Anupgarh and Sangeeta distributory, Rajasthan. 50 CPTs of *A. nilotica*, 50 of *D. sissoo*, 30 of *E. camaldulensis*, 13 CPT of *Tectona grandis*, 25 CPTs of *A. nilotica* at farmers field in Rajasthan and 50 CPT of *Tectona grandis* and 20 CPTs of *A. nilotica* in Gujarat have been re-screened. All the selected CPT's of targeted species have been analysed as per the DANIDA format for the selection of Plus Trees with a few modifications for the traits to be assessed. Seeds from these CPTs were collected and seedlings from these have been raised in the nursery of AFRI. Seedlings are also being raised from seeds of 216 CPTs of *E. camaldulensis* procured from CSIRO, Australia in AFRI nursery.

Sub-Project : Vegetative Multiplication Garden.

Objectives: (a) Mass multiplication of selected clones. (b) Multi-locational clonal testing of selected clones.

Achievements: Base population of 72 clones of *D. sissoo* and 26 clones of *E. camaldulensis* have been planted in 5 ha area for the purpose of establishment of Vegetative Multiplication Garden. The polyhouse has been installed at AFRI. Five ha VMG is being maintained and casualty replacement completed. Fresh cuttings numbering 32,643 of *D. sissoo* and 14,134 of *E. camaldulensis* have been raised in the mist chamber.

Sub-Project : Development of Clonal Seed Orchard.

Objectives: (a) To produce quality seeds. (b) To improve the productivity.

Achievements: 29.0 ha of CSO has been established for various species.

Sub-Project : Development of Seed Bank facilities.

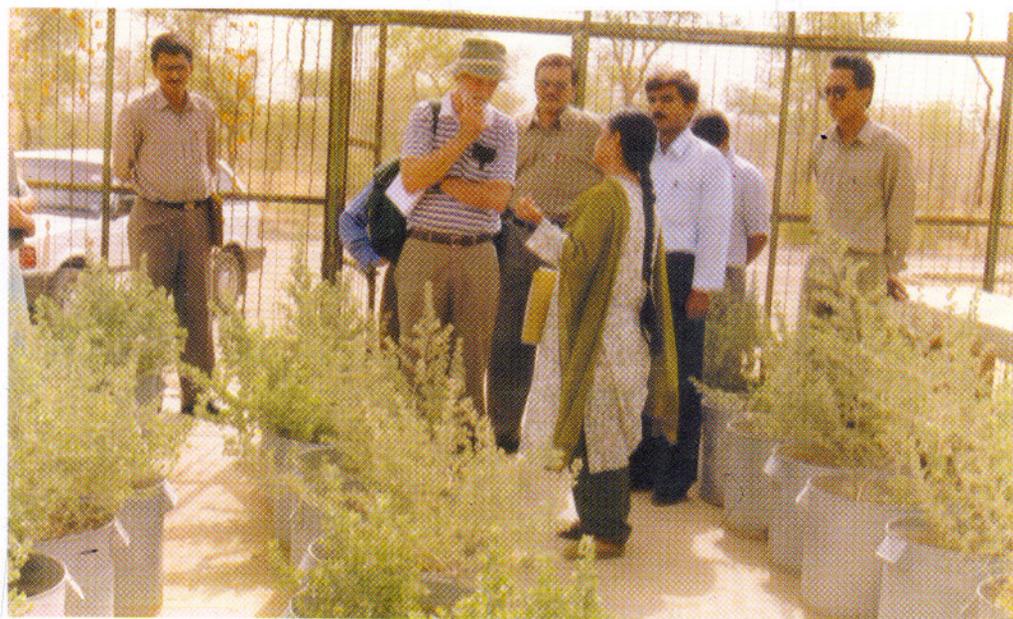
Objectives: (a) To establish seed bank facilities. (b) To procure seed testing equipment. (c) To test the seeds of important tree species for various seed parameters. (d) To evaluate seed lots for germinability and storability. (e) To test seed for qualities. (f) To develop testing protocols of various species for pre-treatment.

Achievements: Seed germination and seed-testing laboratories with the desired equipment have been established. Seeds were tested for various parameters. Seeds of *Acacia nilotica*, *Dalbergia sissoo* and *Prosopis cineraria* showed higher percentage germination in vermiculite then the filter paper or sand incubation. Studies showed that initial moisture content had no effect on the long-term storability of Neem seeds. Comparison of Neem seeds collected from both the flowering periods indicated that the seeds collected in winter season had higher seed weight, larger in size and had less moisture content than the seeds of summer season. Seed size and pre-treatments affected the percentage of germination and seedling vigour of *Acacia nilotica* and *Prosopis cineraria*.

Sub-Project : To develop model nursery.

Objectives: (a) Production of superior quality of seedlings. (b) Standardization of potting mixtures and containers (root trainers) for various arid zone tree species

Achievements: All the physical infrastructure development works targeted to be undertaken at Model Nursery have been completed. A total of 1,20,000 seedlings of tree species were raised in root trainers and polythene bags. Standardized container for raising seedlings of species like, *Prosopis cineraria*, *Tecomella undulata*, *Acacia nilotica* and *Dalbergia*.



Discussion on pot culture trial with World Bank expert

EXTENSION

Facilities generated and services rendered

Library and documentation - computer facilities: Work for installation of Local Area Network (LAN) and Wide Area Network (WAN) at the Institute were initiated during the year. Tree CDs were obtained from National Forestry Library and Information Center (NFLIC), Dehra Dun.

- ✓ **Other Extension Activities are reported in the Introduction - Forestry Extension, ICFRE.**

FINANCIAL STATEMENT DURING 2000-2001

I. PLAN		EXPENDITURE (RS. IN LAKH)
A.	REVENUE EXPENDITURE	
	(a) Research	152.37
	(b) Administrative Support	33.02
	(c) Others specify	15.00
B.	LOAN AND ADVANCES	
	(a) Loan Advances (Conveyance)	0.85
	(b) House Building Advance	- -
C.	CAPITAL EXPENDITURE	
	(a) Building & Roads	- -
	(b) Equipments, Library Books	- -
	(c) Vehicles	- -
	(d) Others specify	- -
TOTAL FOR PLAN (A+B+C)		201.24
II. NON-PLAN		
A.	REVENUE EXPENDITURE	
	(a) Research	- -
	(b) Administrative Support (Salary)	- -
TOTAL FOR NON-PLAN		201.24
III. FUNDED PROJECT		
A.	World Bank Project	84.35
	NABARD Project	0.75
	NOVOD (NEEM)	7.74
TOTAL FOR FUNDED PROJECT		92.84