

97

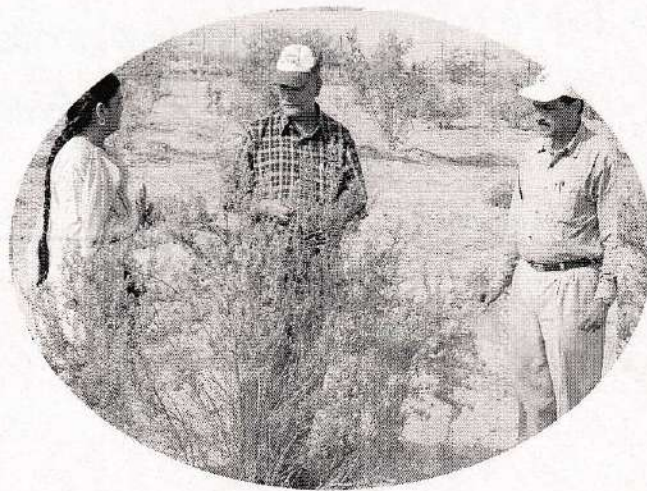
# ANNUAL REPORT

2002-2003



**ARID FOREST RESEARCH INSTITUTE**

P.O. Krishi Mandi, New Pali Road,  
Jodhpur- 342 005 (Rajasthan)



# CONTENTS

	<i>Page No.</i>
1. AFRI at Glance	1
2. Projects completed during 2002-2003	1 - 4
3. Projects continued during 2002-2003	4 - 16
4. New projects initiated during 2002-2003	16 - 25
5. Externally aided projects	26 - 31
6. State-wise research achievements	32
7. Education and training	32 - 36
8. Publications	37 - 42
9. Consultancy	42
10. Conference, meetings, workshops etc.	43 - 44
11. Distinguished visitors	45
12. Miscellaneous	

## ARID FOREST RESEARCH INSTITUTE, JODHPUR

---

### A.F.R.I. - At A Glance:

Arid Forest Research Institute (AFRI), situated at Jodhpur in Rajasthan (India), is one of the eight institutes under the control of Indian Council of Forestry Research & Education (ICFRE), an autonomous council under the Ministry of Environment & Forests, Govt. of India. The Objective of the Institute is to carry out scientific research in forestry in order to provide technologies, to increase the vegetative cover and to conserve the biodiversity in the hot arid and semi arid region of Rajasthan, Gujarat and Dadra & Nagar Havelli.

Twenty-nine research projects were executed during the year. Out of these, two projects under plan and one project under NOVOD were concluded. The Institute has taken up a new project funded by the Medicinal Plants Board. Various components of this project aim at enhancing the agriculture returns by adopting the proper management practices for commercially exploitable medicinal plants of arid and semi-arid areas of Rajasthan. A project formulated on "*Integrated Ecosystem approach to rehabilitate degraded arid and semi arid lands of western India for combating desertification*" under UNDP-GEF has been submitted to MOEF for funding.

Encouraging results were achieved in the fields of development of agroforestry models, afforestation of salt affected lands, soil water -plant relations, tree-crop interaction, remedial measures for Khejri mortality, chemistry of plant parts, growth & yield studies, management of trees for fodder, seed studies and tree improvement etc.

Efforts were made in the field of extension by organising trainings to army troops and cluster members of DDP, demonstration for SFD officials, publication and distribution of extension pamphlets in local language.

### PROJECTS COMPLETED DURING 2002-2003

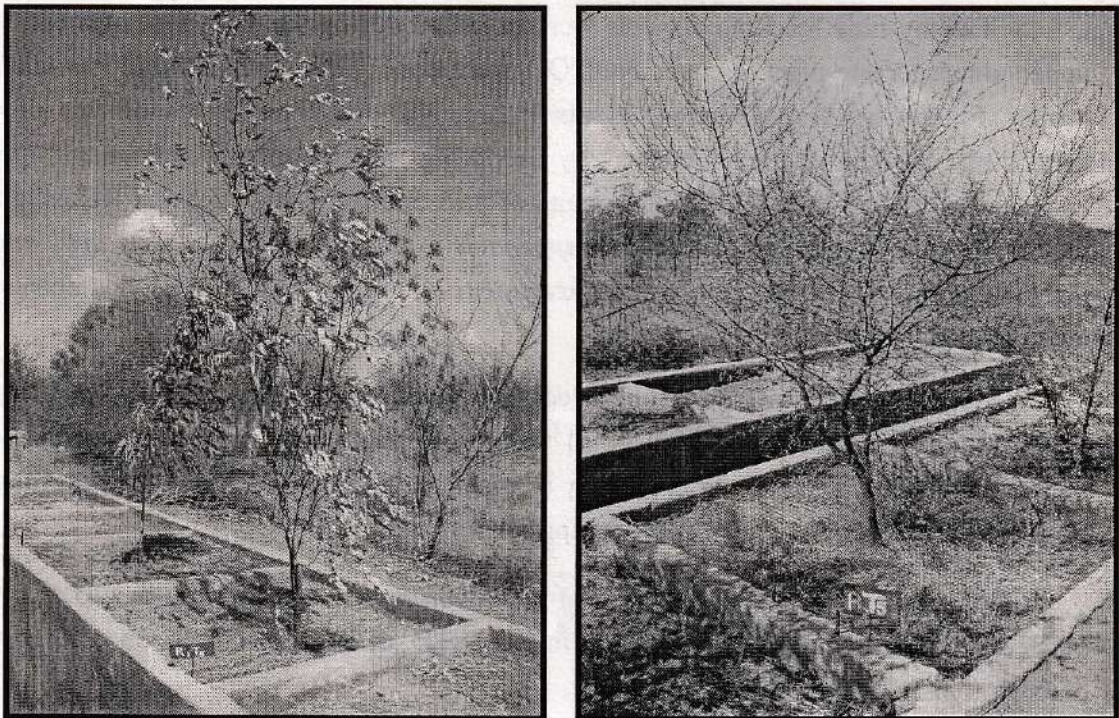
**Project 1.** Investigation of soil water plant relationship in respect of different tree species. [AFRI-5 /FEDD-5/W.B./1998-2001 *Principal Investigator: Dr. G. Singh*]

**Experiment 1:** To screen tree species for efficient water use and growth under arid conditions.

#### Findings:

Data recorded in last four years suggest that the most efficient water user species was *Dalbergia sissoo* at 36.2 mm and 26.5 mm irrigation, *Eucalyptus camaldulensis* at 20.2 mm and 18.1 mm irrigation and *A. nilotica* at life saving irrigation. *E. camaldulensis* produced 12.05-

31.05-14.18 kg per seedling dry biomass as compared to 8.12-18.07 kg per seedling in *A. nilotica* and 7.98-25.88 kg per seedling in *D. sissoo* whereas life saving irrigation produced only 1.51, 3.62 and 0.74 kg per seedling dry biomass in respective species. One and 1.5 fold higher biomass was obtained in 48 months applying 26.5 mm and 36.2 mm irrigation, respectively as compared to the seedlings raised under rainfed for 78 month. *A. nilotica* was better tolerant to severe water stress whereas *D. sissoo* was the least tolerant . Water losses from the *E. camaldulensis* plot irrigated at the rate of 36.2 mm per irrigation was 4.75 mm per day (19 lit per day) during summer as compared to 3.45 mm per day (13.8 lit per day) in *A. nilotica* and 2.62 mm per day (10.56 lit per day) in *D. sissoo* plot. Simple mulching saved the water loss by 0.15 mm per day



Drying of *E. camaldulensis* and *A. nilotica* seedlings under soil water stress (irrigated at saturation initially and left un-irrigated throughout the life).

**Experiment 2:** To study the effect of varying level of sewage water on the growth of the plants.

**Findings:**

Data recorded in the experiment indicate that application of municipal effluent at  $\frac{1}{2}$  PET (potential evapo-transpiration) and canal water at 1PET produced same biomass at the age of 2 and 3 years when water requirement of plant was less. *E. camaldulensis* produced 20.1- 9.7 kg per plant as compared to 13.3 - 7.9 kg per plant in *A. nilotica* and 14.8- 9.1 kg per plant in *D. sissoo* by irrigating seedlings with municipal effluent at the rate of 2 PET to  $\frac{1}{2}$  PET rate. Rate

of transpiration was highest in *E. camaldulensis* as compared to the other two species. The ratio of N/P and N/Mg was low and that of Mg/Na, Mn/Zn and N/Na was high in the seedlings irrigated at 2PET level as compared to the corresponding values in T<sub>5</sub> treatment. Plants had ameliorative influence on soil properties as indicated by less nutrient status in the soil without plants as compared to the soil with plant.

**Project 2: Integrated development of Neem in different agro climatic zones – Gujarat (AFRI-21/FGTB-6 (NOVOD)/1999-2002).**

**Components: Selection of CPT/sample trees, Phenological observations, Development of model plantation, Model villages). *Principal investigator: Dr. U.K.Tomar***

**Findings:**

- In the above project a total of 537 CPTs have been identified on the basis of seed bearing capacity and over all growth in three different agro climatic zones (AER2, AER4, AER5) of Gujarat and including winter flowering trees at Jodhpur. Field observation indicate that seedlings raised from winter flowering trees performed well in two seasons of failed monsoon as compare to seedlings raised from seed collected in summer.
- 50 CPTs have been finally screened in for high Az (more than 5000 ppm) and high oil contents after chemical evaluation of about 400 seed samples of these selected CPTs in collaboration with TERI.
- Germplasm (370 seed samples) of above CPTs are preserved at NBPGR, New Delhi
- Established nursery for quality seedlings and raised about 3,00,000 neem seedlings for plantation, distribution to farmers and some seedlings were sold to SFDs and private organization to earn revenue.
- 15 ha of Model plantation established at different location with experiments on water harvesting technique, VAM interaction, type of seedling and spacing trials.
- 12 ha Seedling seed orchards cum progeny trial have also been raised from progenies of high Az and high oil contents.
- Six farmer trainings conducted in Gujarat and benefited 300 farmers/SFD officials on Utilization of Neem and their plantation techniques and distributed quality seedlings.

**Project 3: Studies on the crude protein content and leaf protein concentrates of arid zone shrubs and trees. [AFRI-15/NWFP-3/1995-2005]. *Principal Investigator: Dr. Mala Rathore***

**Findings:**

Crude protein content of seeds, deoiled seedmeals, leaves and shoots of various arid zone plants was determined including the famine food species. Variation in the CPC of neem

(deoiled seedmeals and leaves), *Pongamia pinnata* (deoiled seedmeals) and *Dalbergia sissoo* (pods) from different areas/provenances was studied. A regression model for interdependence of seed quality, oil and protein content was developed. Inverse relationship was observed incase of oil and protein content. Plants were screened for the preparation of leaf protein concentrates depending on the nature of fractionation. Based on the phenol content in the LPC the plants found suitable for LPC extraction were *Moringa oleifera* and *Azadirachta indica*.

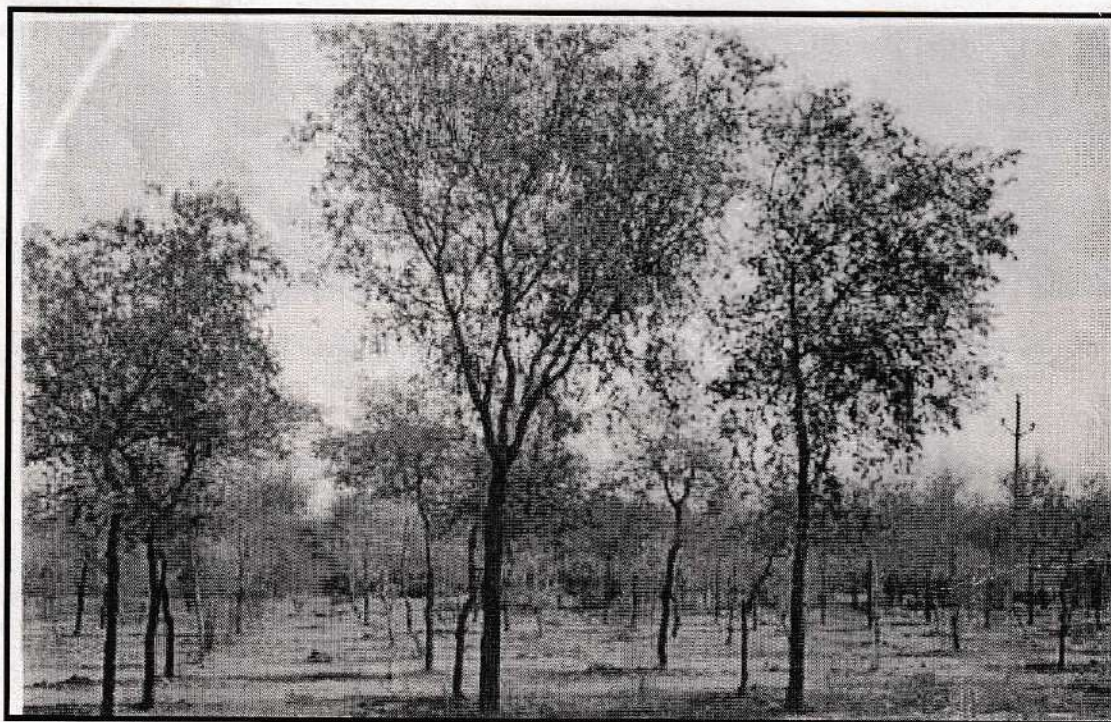
## PROJECTS CONTINUED DURING 2002-2003

**Project 4: Agroforestry research for sustainable production in arid regions of Rajasthan.**  
[AFRI-2/FEDD-2/1999-2003] *Principal investigator- Dr.G.Singh*

### Status:

#### Experiment 1: Effect of intercrops on yield and productivity of agroforestry systems

In 2003, due to drought only plant growth variables and soil properties were monitored. Percent height increment in 2002-03 as compared to that in 2001-02 did not differ both for *Prosopis cineraria* and *Tecomella undulata* plants whereas increment in collar girth of *T. undulata* was significantly more. Soil moisture recorded in top 0-75 cm soil layer did not differ between the species.



**AFRI experimental field: *Prosopis cineraria* and *Tecomella undulata* in agroforestry**

### Experiment 2: Effect of tree density on crop yield and plant growth.

In the year 2002, density was reduced to 208 SPH, 139 SPH, and 104 SPH from 416 SPH, 278SPH and 208 SPH, respectively. Due to drought, data on plant growth and soil properties were recorded. Soil water content was high at 139 SPH as compared to the other two densities. Utilizable dry biomass of *P. cineraria* at 12 years of age was 91.8, 56.6 and 24.7 kg per plant at 208, 278 and 416 SPH densities whereas dry leaf fodder production was 4.1, 2.4 and 1.2 kg per plant at the respective plant densities.

### Experiment 3: Maximising food, fodder and fruit yield in agroforestry in arid region.

Data recorded in the experiment indicated thicker collar diameter and higher soil water content under rotational cropping plot than in fixed crop plot (*Vigna radiata*). Soil organic matter in 0-75 cm soil layer showed increasing trend at the age of six year in *Emblica officinalis* plot and eighth year in *Hardwickia binata* and *Colophospermum mopane* plots. Pruned biomass of *C. mopane* was 160 kg per ha (400 plant per ha) with 27% leaf dry biomass whereas *H. binata* produced 122 kg per ha dry biomass with 30% leaf contribution. Pooled available nutrients were generally higher during summer and low during spring season. Fruit production of *C. mopane* in 2002-03 was more in rotational crop (1.25 kg per plant) than in fixed crop (0.89 kg per plant). Litter production was high in *E. officinalis* plot and low in *C. mopane* plot.



AFRI experimental field: *Colophospermum mopane* in agroforestry

**Project 5:** Studies on the pest problems in forest nurseries and their management in arid and semi-arid region. [AFRI-12/FP-2/1993-2003] Principal Investigator- Smt. Seema Kumar

**Status:**

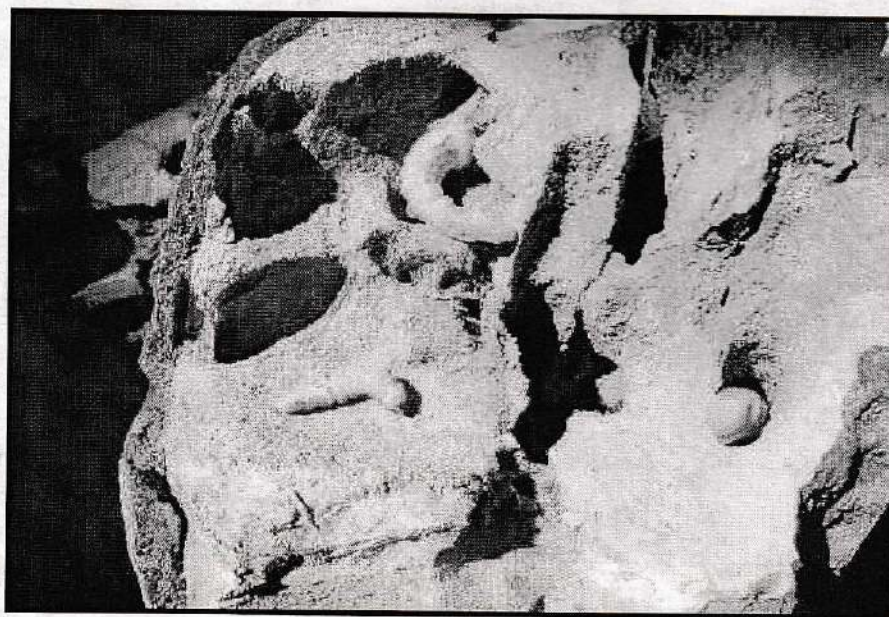
Insects and Non-insects recorded were *Mylocerus nepalensis* & *Mylocerus* sp. on *Eucalyptus* sp., *Mylocerus dalbergiae* on *Dalbergia sissoo*, *Mylocerus* sp. on Amrud and *Mylocerus tenuicornis* on *Azadirachta indica*. Data was further recorded on molluscs *Macrochlamys indica* and *Laevicaulis alte*. Nine stages of *M. indica* were collected..

**Project 6:** "Identification of mortality factors of *Prosopis cineraria* and development of suitable management strategies" [AFRI-26/FP-3/2001-2005] Principal Investigator: Dr. S.I. Ahmed

**Status:**

Preliminary investigations have revealed that this devastating problem has primarily been originated with the combined effects of indiscriminate and successive lopping followed by a secondary infestation of a shoot borer, *Derolus discicollis* Gahen. Epidemic of this species has been recorded for the first time in the year 2000-01. An unidentified root and shoot cerambycid borer has also been recorded infesting Khejri trees in almost all the study sites in the four districts of north western Rajasthan. The borer attack is followed by a tertiary infection of fungus disease. The infected samples reveal the presence of three highly infective species of *Fungi imperfectii* viz., *Alternaria* sp; *Phoma* sp. and *Botryodiplodia* sp. which ultimately cause the die-back disease in mature trees of Khejri as a result of which the tree starts drying from the top.

Farmers have been advised through different forums for control measures. Judicious lopping application of AFRI Paste and removal of heavily infected trees are the main management recommendations.



Boring larvae of an unidentified cerambycid beetle infesting Khejri root and shoot system



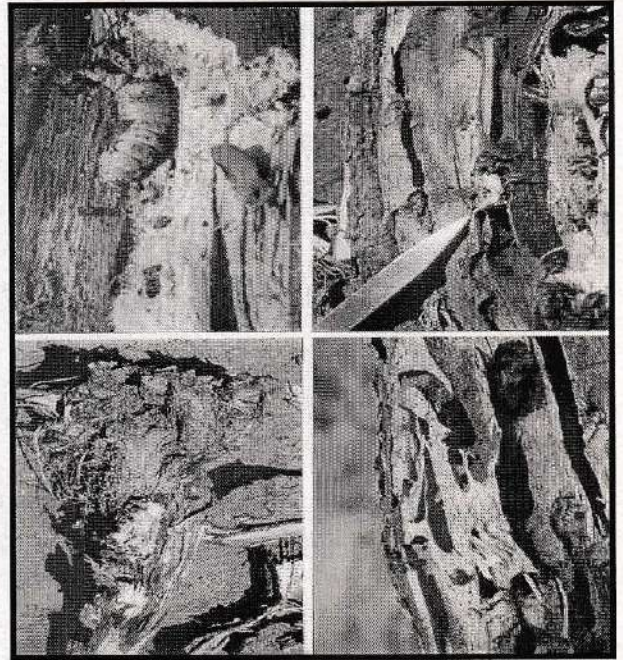
ment in  
igator-

sp. on  
ad and  
olluses

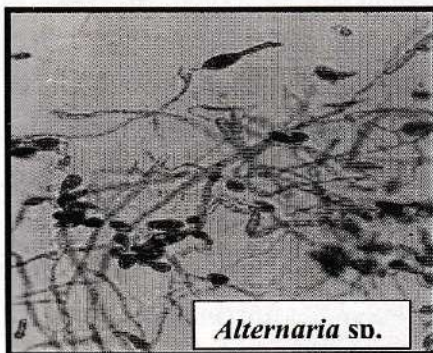
ment of  
principal

primarily  
owed by  
pecies has  
ambycid  
the four  
ection of  
pecies of  
ely cause  
from the

Judicious  
the main



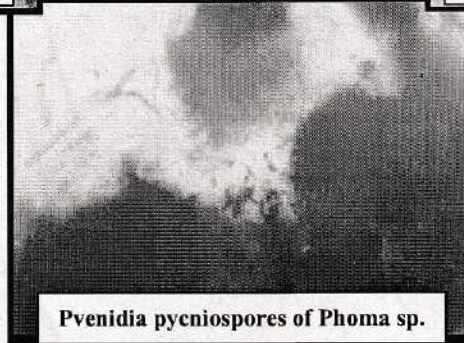
*Derolus descicollis* is a new pest record on *Prosopis cineraria*



*Alternaria* sp.



*B. theobroma*.



*Pseudoperidermium pycniospores of Phoma* sp.

Advanced studies on the Khejri mortality in North-west Rajasthan have been taken up and the observations on various biotic and abiotic aspects have been collected. Out of 859 total localities in four districts viz., Nagaur, Sikar, Churu, and Jhunjhunu, 140 localities have been selected for sample studies. These units/localities have been divided in 16 study sites for the collection of data on biotic and abiotic aspects in order to study the interaction of various factors

with the Khejri mortality. Of them, 10 sites in different districts have been visited and the required data has been collected.

**Biotic stresses:** Studies on the collection, identification, augmentation and updating of checklist of insect pests of *P.cineraria* with particular reference to the insect borers is in progress. Study the bionomics of potential insect borers with particular reference to *Derolus discicollis* is in progress. Studies on the collection and identification of plant pathogens and preparation of a check-list of potential pathogens infecting *P. cineraria* is in progress.

**Abiotic stresses:** Collection of various relevant abiotic factors and studies on their interaction with the khejri mortality is in progress. Study on the nutritional factors for soil (N,P,K,Cu,Fe,Mn,Zn) and plant nutrients (N,P,K,Ca, Mg, Cu, Fe, Zn, Mn) and study their correlation with the concerned problem is in progress. Study the physical and chemical quality of water samples are being collected from the various study areas.

**Project No. 6: Provenance trial on Arid Zone species (AFRI-16/FGTB-3/1992-2003)**  
Principal Investigator: C.J.S.K. Emmanuel.

**Status:**

**NEEM:** The provenance trial of *Azadirachta indica* with 39 seed sources from all over India was laid out in 1992. The studies conducted on floral morphology reveals that maximum mean of inflorescence length was recorded in Palanpur provenance with 23.28 cm. and minimum Kanpur provenance with 11.15 cm. Maximum mean number of flower per inflorescence was found in Palanpur provenances 79.07 and minimum in Kota provenance with 23.28. Maximum mean number of fruits per inflorescence was recorded in Palanpur provenances with 9.27 and minimum in Kanpur provenance with 2.93. Studies on floral biology revealed that anthesis starts in the evening from 5.30 pm and continued upto 9.30 pm. The maximum percentage of anthesis of flowers occurred between 8.30 to 9.30 pm. The dehiscence of anthers started in closed flowers at 9.30 am and continued upto 3.30 pm. Maximum percent of anther dehiscence occurred from 12.30 to 1.00 pm. Initiation of pollen germination started at 1.15 pm in closed flower. Maximum pollen germination takes place from 1.30 - 3.00 pm. Fertilization time was notice after 36 hours at 2.00 pm in opened flower. Duration of stigma receptivity goes from 1 pm to 2.30 am. The data has also been recorded on the oil and azadiractin content of all the provenances. The promising provenances screened for azadiractin are Palanpur 93, Shivpuri 0.92, Mulug 92 and lowest Bikaner 0.11 percent. The promising provenances for oil are Palanpur 50, Satra 49.4, Shivpuri 49.1 and the lowest from Ranchi 37 percent.

and the  
checklist  
s. Study  
is in  
on of a  
raction  
or soil  
ty their  
quality



National Provenance Trial of Neem

2-2003)

**ROHIDA:** The provenance trial of *Tecomella undulata* was planned in the year 1992 with 13 seed sources from Rajasthan. Though the state is facing severe drought but no mortality has been observed in this trial, this indicates that Rohida adapt itself even in drought conditions. The growth data collected indicates that the Sunderpur Bir (Sikar) is superior in growth with a height of 3.81 m followed by Nagaur 3.55m and Goshala 3.39m and the lowest in height is Jaisalmer 1.97m. The Girth is maximum in case of Barmer (Chotan) 30.73cms followed by Nagaur 29.13cms and Bhinslana 29.00cms.

India  
mean  
imum  
ce was  
ximum  
27 and  
s starts  
anthesis  
closed  
scence  
closed  
me was  
from 1  
all the  
nivpuri  
oil are



Provenance Trial of *Tecomella undulata*

**SHISHAM:** Provenance trial for *Dalbergia sissoo* has been laid out in August 1995, from the seeds sent by FRI, Dehradun in the year 1994. This year best performance has been recorded for height in Etawah 8.07m followed by Pilibhit 7.81m, Allahabad 7.35m. Pratapgarh 6.14m and Kasganj 6.13m and the lowest is Agra 4.00m. In case of girth Pilibhit has given the best result 77.00cms followed by Lalitpur 46.99cms, Allahabad 45.30cms, Pratapgarh 45.00cms and the lowest by Agra 30.25 cms.



Provenance Trial of Shisham showing mortality

**Project 8:** **International Neem Network Provenance trial.** [AFRI-17/FGTB-2/1995-2005]. Principal Investigator: C.J.S.K. Emmanuel

**Status:**

The International provenance trial on neem was initiated by the FAO Neem Network and the seeds were exchanged between the participating countries during 1995. The field trials have been laid out during the July - August 1996 at Jodhpur, Jaipur, Palanpur, Jabalpur, and Coimbatore, with 18 provenances including control. At present the trial is continuing only at Jodhpur, Jaipur and Coimbatore. The performance of the International Neem Provenance Trial at Jodhpur is good, though lot of mortality has been observed during this year due to severe drought and low humidity in the atmosphere. The best performing provenances in the trial I for height are Ramanguda (IND) 2.76m followed by Sagar (IND) 2.73m, Jodhpur (Control) 2.46m, Yezin (MYN) 2.42m, Geta (NEP) 2.35m and the lowest is Allahabad (IND) 1.56m. The best performing provenances for girth are Sagar (IND) 19.46cms followed by Ramanaguda (IND)

19.18cms, Jodhpur (Control) 17.67cms, Kulapachra (IND) 16.27cms, Doi Tao(THA) 15.57cms and lowest is Ghati Subramanya (IND) 9.35cms. In the Trial II also some of the plants have died due to drought but the general condition is good and the best performing provenances for height are Sunyani (GHA) 5.26m followed by Myne(MYN) 4.74m, Multan(PAK) 4.58m, Tibbi Laran (PAK) 4.53m and Chittagon (BAN) 4.74m. The best performing provenances for girth are Sunyani (GHA) 41.42cms followed by Myne(MYN) 37.38cms, Multan (PAK) 35.14cms, Tibbi Laran (PAK) 31.11cms and Chittagon (BAN) 24.25cms.



International Neem Network Provenance Trial

**Project 9:** Provenance trials on *Acacia nilotica* and *Ailanthus excelsa* [AFRI-18/FGTB-3/WB/1995-2005]. Principal Investigator: C.J.S.K. Emmanuel

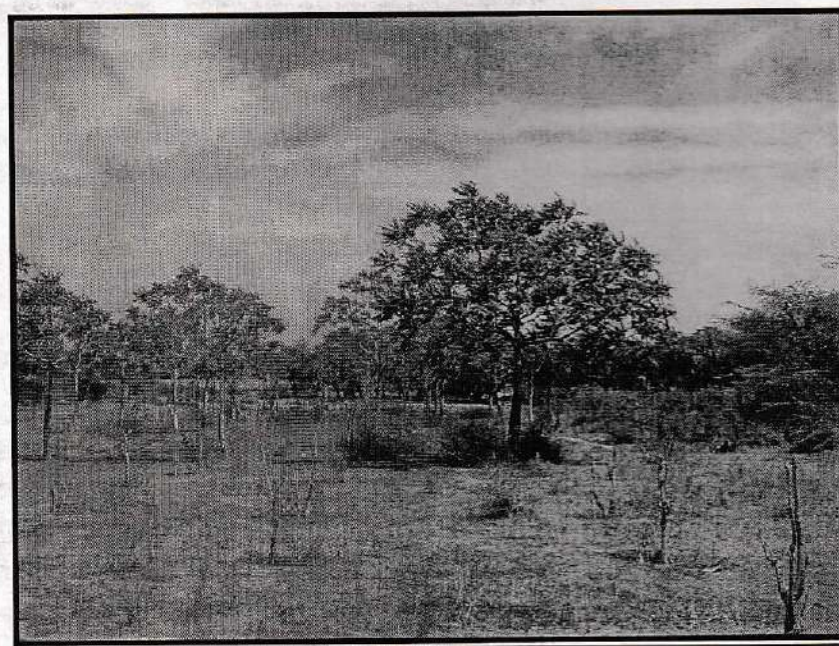
**Status:**

*Acacia nilotica* : provenance trial was laid out in the year 1992 with 28 provenances collected from major states of India. The trial has also been affected due to the prolonged drought conditions in the state, some mortality has been observed in the trial. The data on growth parameter have been recorded and best performing provenances for height are Shivpuri 3.26m followed by Manikpur 3.20m, Gurgaon 3.17m, Hastinapur 3.13m, Haldwani 3.13m and the lowest height was recorded in Akola 2.57m. The best performing provenances for girth are Makdampur 30.33cms followed by Parlekhmundi 29.42cms, Shivpuri 29.17cms, Gurgaon 29.05cms, Jhabua 28.32cms and the lowest girth was recorded from Manikpur 24.14cms. The studies on fodder value has also been conducted on all the 28 provenances.



Provenance Trial of *Acacia nilotica*

***Ailanthus excelsa***: provenance trial was laid out from the seeds collected from 13 different seed sources were sown in the nursery and transplantable seedlings could be obtained from 8 provenances only. The provenance trial was laid out at two different sites at Jaipur and Jodhpur. This trial has also been affected by the prolonged drought and low humidity conditions prevailing in the state. The data collected during this year shows that the Varanasi (3.95m) was the best followed by Sonbhadra (3.59m), Kazipeth (3.50m) and Pinjore (3.40m), Mirzapur (3.41m) and lowest in height was Jodhpur with 1.84m. The best performing provenances for girth are Sonbhadra 53.2cms followed by Kazipeth 52.59cms, Mirzapur 47.07cms, Pinjore 46.62cms, Varnasi 44.54cms and lowest in girth is Jodhpur 28.89 cms.



Provenance trial of *Ailanthus excelsa*

**Project 10: Market survey on selected species AFRI-24/FRME-2/1994-Continuel.**  
*Principal Investigator: Dr. V.P. Tewari*

**Status:**

The data regarding prices of various forest produces viz., timber, fuel-wood, bamboo were collected from the markets of Jaipur and Ahmedabad on quarterly basis. After compilation, the same were sent to the ADG (Stat.), ICFRE, Dehradun on prescribed format for publication of Timber and Bamboo Trade Bulletin.

**Project 11: Stand dynamics of some important tree species of Gujarat. [AFRI-25/FRME-3/2001-2006].** *Principal Investigator: Dr. V.P. Tewari*

**Status:**

A reconnaissance survey of the plantations of *Eucalyptus hybrid* and *Acacia nilotica* in various parts of Gujarat State was conducted and suitable stands were identified for laying out of sample plots. 32 sample plots of *E. hybrid* and 19 of *A. nilotica* have been laid out in Godhara, Vadodra and Nadiyad divisions, Anand and Rajpipla sub-divisions and Panam irrigated plantation project area, Godhra to carry out growth and yield studies on these species. PCCF, Gujarat has been requested for granting permission to fell sample trees in the plots for volume yield estimations.

**Project 12: Screening of exotic and indigenous plant species for their performance on salt affected soil with different management project. [AFRI-6/FRME-4/1997-2003].** *Principal Investigator: Dr. Ranjana Arya*

**Status:**

A total of seven experimental trials exist at the salt affected area of Gangani in Jodhpur district laid out in different years (from 1997 to 2001).

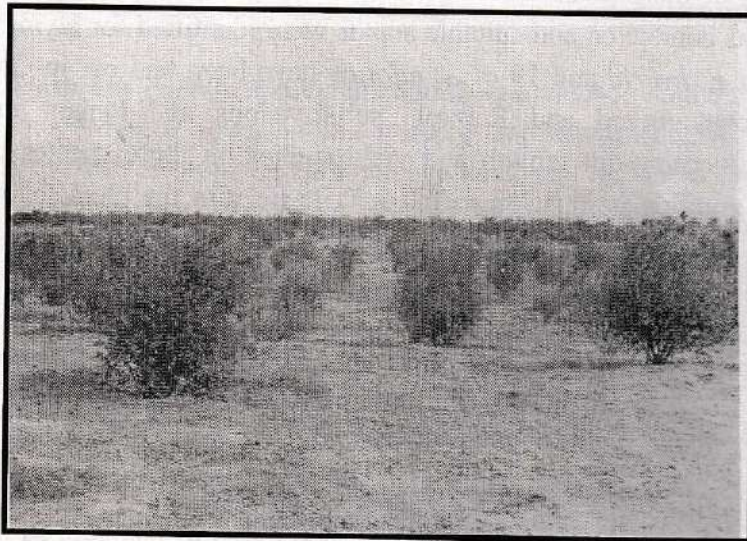
**Experiment 1:**

Trial on *Atriplex lentiformis* was laid in 1997 with three levels of gypsum and six nitrogen levels leading to 18-treatment combinations. Analysis of biomass data taken in December 2001 on 52 months old bushes showed that contribution of leaf component to the total biomass is decreasing. This year the leaf to branch ratio was 3.8:7.8 in different treatments for fresh biomass. Regenerative growth was very poor in the bushes, which were cut for above ground biomass in Dec. 2001, due absence of rainfall. No irrigation was provided despite very severe drought. Bush survival was recorded in March 2003 and decrease in survival was observed ranging from 8 to 47 % in different treatments compared to survival in Nov 2001. Analysis of soil salinity status in May 2002 showed that EC values are in normal range in the plant pit except where waterlogging persisted. However, salinity status was high in the inter row spaces.. Weed evaluation indicated that only 8 plant species appeared this year. *Sueda fruticosa*

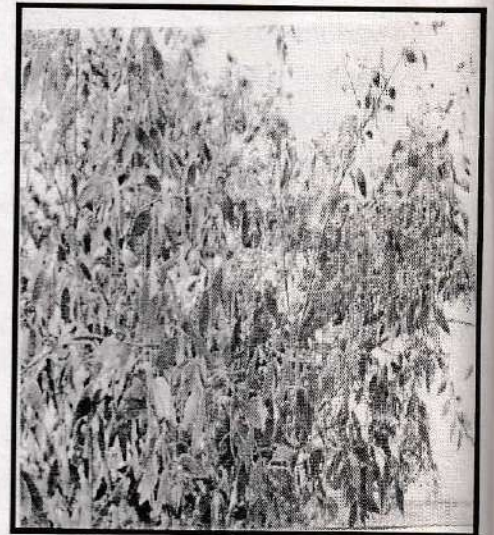
was the dominant herb and *Sporobolous* spp was the dominant grass. 0.25 kg per m green weed biomass was available from inter row spaces in the month of October 2002, 90 % of which was from *S. fruticosa*.

### Experiment 2:

Trial of *Salvadora persica* was planted in 1997 with two levels of gypsum and four levels of nitrogen (0, 20, 40 and 60 g of urea). Plant survival recorded in September 2002, five years after planting, showed no appreciable decrease in survival in all the treatments despite very poor monsoon years. Absolute growth data at 60 months of age showed that due to very low rainfall, there is slight decrease in mean height and crown diameter of *Salvadora persica* in July 2002 over its values in October 2001. However, treatments were significantly influencing the growth.



Five year old *Salvadora persica* plantation

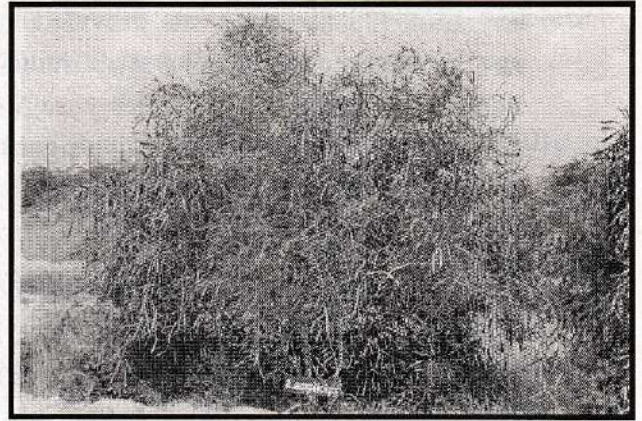


*Salvadora persica* in fruiting

### Experiment 3:

*Acacia ampliceps* was planted with and without gypsum in Sept 1998. Trees of *Acacia ampliceps* suffered some causality in summer months. Phyllodes started yellowing in April and gradually tree died. Irrigation (40 lit/plant) was given in April–October, January and March. Presently casualties are under control. The overall survival was 76% for gypsum treated plants as compared to 69% in control for deep soil area and 61 and 67.5% in shallow soil area, respectively. Growth status recorded at 52 months (for the 1998 planted trees) showed there was almost no increase in growth this year. Data indicated that soil depth is positively influencing the plant height and crown diameter.





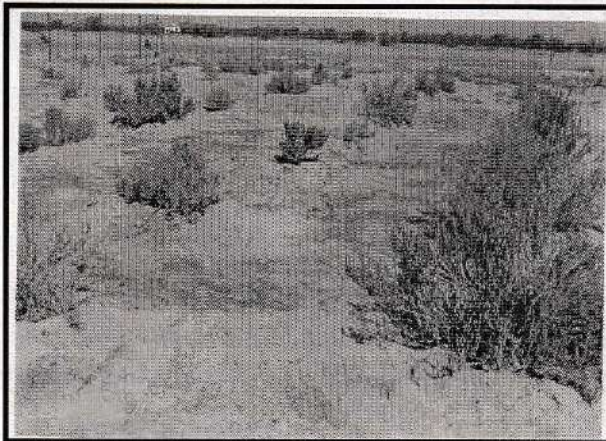
Three years old *Acacia ampliceps* plantation on salt affected soils in Gangani

#### Experiment 4:

A trial of *A. lentiformis* was planted in August 1999 on double ridge mound with three levels of gypsum from two nitrogen sources, Urea and calcium ammonium nitrate (CAN) were applied in August 2000. Survival of 30-month-old bushes of *A. lentiformis* ranged from 33% to 72% in different treatments.

#### Experiment 5:

An experimental trial of *A. amnicola* was laid out in August 2000 with three planting treatments and two gypsum levels. In spite of severe drought there was no casualty. Height on Double Ridge Mound and bund planting was same for both the Gypsum levels which was higher than elevated slope planting.



30 months old *Atriplex amnicola*



*A. amnicola* on double ridge mound

#### Experiment 6:

Another trial was laid with 3 salt tolerant species namely *A. lentiformis*, *A. nummularia* and *Sueda nudiflora* and three planting techniques in August 2000. Due to severe drought,

irrigation (25 lit/plant) was provided in Nov, Jan and March. Circular dished mound (CDM) structure recorded overall 83% survival followed by 81% in double ridge mound and 47% in control in March 2003. Species-wise *Sueda nudiflora* recorded highest survival in all the three treatments. Plant growth was also significantly higher on soil structures as compared to control.

#### **Experiment 7:**

A trial with two tree species, *Acacia colei* and *Azadirachta indica* was laid with three treatments of planting in August 2001. Due to very severe drought, fortnightly irrigation of 25 l/plant was provided from October 2002 to March 2003. Highest mean percent survival was recorded for DRM (69.0%) followed by CDM structure (52.7 %) and control (23.8%) after 18 months of planting. Species wise *Acacia colei* showed better survival than *Azadirachta indica*. Rodent control measures: Experimental area suffered with serious rodent problem. Periodic rodent control measures were applied.

### **NEW PROJECT INITIATED DURING THE YEAR 2002-2003**

**Project 13: Studies on the role of trees in reclamation of water logged area and their impact on soil [AFRI-29/FEDD-6/2002-2006]. Principal Investigato: Sh. N. Bala**

#### **Status:**

**Expt. 1. Transpirational capabilities of different species and their impact on soil at different age.**

Survey was conducted along the IGNP area for plantation sites in waterlogged area. Block plantations by Eco Task Force and State Forest Department were identified. 8 plots were laid in *Eucalyptus camaldulensis* plantations. Soil samples were collected from the plots and tree height and GBH were recorded from the plot.

**Expt. 2. Performance of some Eucalyptus and Casuarina species under water logged condition.**

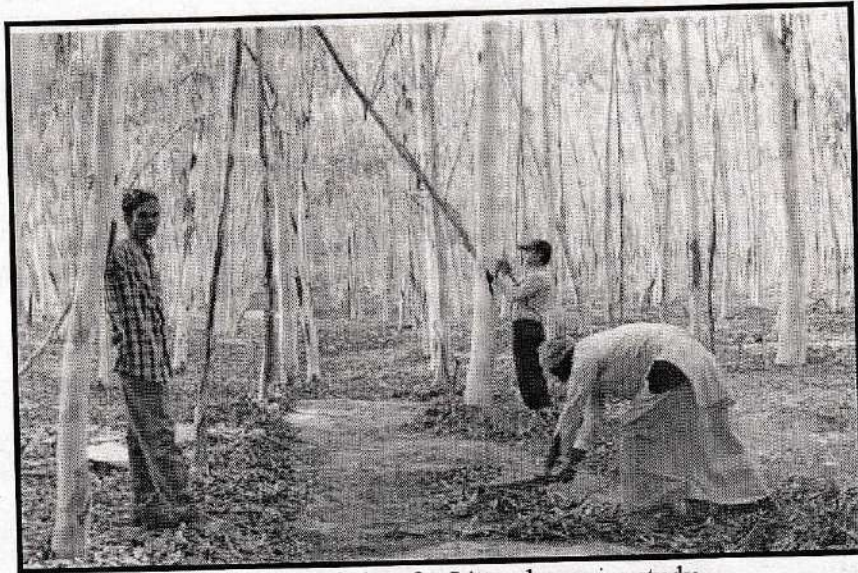
Survey was conducted all along the IGNP area for suitable waterlogged site for experimental purpose. 5 ha waterlogged area at 1357 RD IGNP near Nachna has been selected.

Seeds of *Eucalyptus camaldulensis*, *E. fastigata*, *E. grandis*, *E. nitens*, *E. platypus*, *E. regnans*, *E. rudis*, *E. saligna*, *E. spathulata*, *Casuarina cunninghamiana*, *C. glauca* and *Corymbia tessellaris* have been procured from CSIRO Australia and seedlings are being raised in AFRI model nursery. Fencing work of the area is in progress.

**Project 14: Litter dynamics and soil changes during stand development in plantation forest.** [AFRI-30/FEDD-7/2002-2006]. Principal Investigator: Sh. N. Bala

**Status:**

Survey was conducted along the IGNP area for availability of plantations of different species and age groups. Accordingly four age groups were classified (0-5 year, 6-10 year, 11-15 year and >16 years) and six species were selected for the study. 76 litter plots of 10 x 10 m<sup>2</sup> area were laid in plantations of *Eucalyptus camaldulensis*, *Acacia nilotica*, *Acacia tortilis*, *Tecomella undulata*, *Prosopis cineraria* and *Dalbergia sissoo* at Nachna, Bikampur, Sada and Ramgarh area along IGNP. 152 soil samples were collected from 76 litter plots. Tree height and GBH were recorded for trees inside the plot.



Laying out of plots for Litter dynamics study

**Project 15: Multilocational trials of *Eucalyptus* and *Dalbergia* clones.** (AFRI-31/FGTB-7/2002-2006). Principal Investigator: Dr. U.K. Tomar

**Status:**

Areas have been finalized for raising 16 ha clonal trial of *D. sissoo* and *Eucalyptus camaldulensis* in Gujarat and Rajasthan 8 ha in each state. Clonal material of *D. sissoo* (approx. 6000 cuttings) and *Eucalyptus camaldulensis* (approx. 2000 cuttings) has been raised from 61 and 22 clones, respectively. In *D. sissoo* 95 % sprouting was recorded, whereas, in *Eucalyptus* it was only 5%. In *D. sissoo*, 4300 plants were transferred for hardening and at present 3400 plants are surviving after three months of hardening period. Therefore, average 72% rooting is recorded after one month and hardening success is about 79%. Therefore over all out put in *D. sissoo* is about 57%. No success was achieved in *Eucalyptus* clonal material. Fresh 9000 stem cuttings of each *D. sissoo* and *Eucalyptus* were raised in mist polyhouse. This time some of the *Eucalyptus* stem cuttings were rooted. Data on rooting response will be recorded in April 2003. About 3400 clonal plants of *D. sissoo* are growing well in greenhouse.



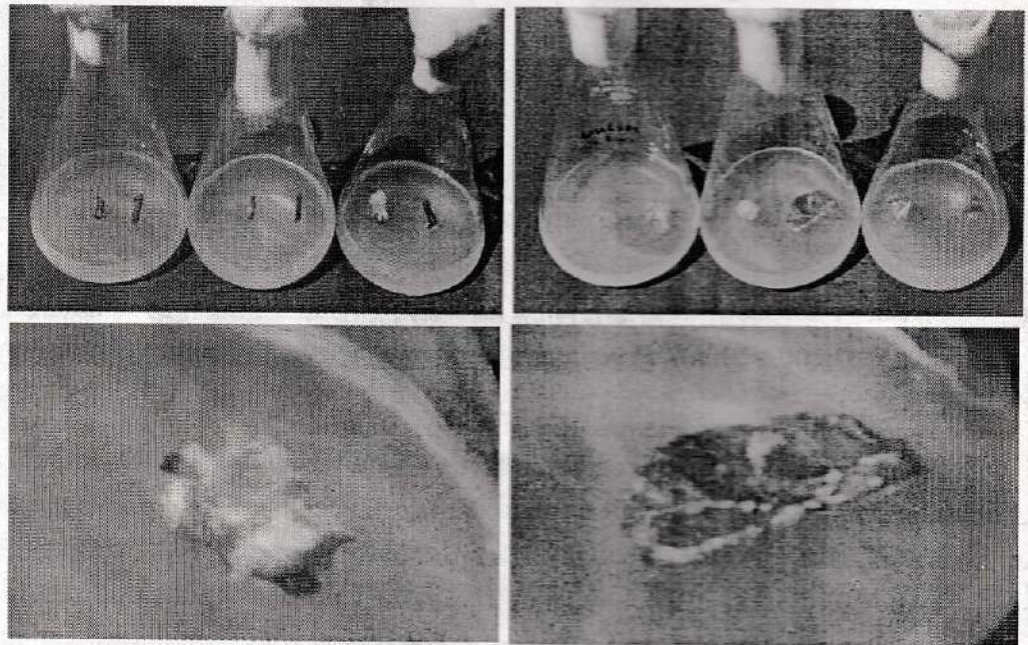
Clonal material of *Dalbergia sissoo*



*Eucalyptus camaldulensis*

Procuring 2000 ramets of Eucalyptus clones belonging to 25 different clones from IT Badrachalam is in process.

**Project 16: Micropropagation of an Important Medicinal Plant of the Arid and Semi arid regions –*Commiphora***. (AFRI-32/FGTB-8/2002-2006). *Principi*  
Investigator: Dr. Tarun Kant



Various stages of callus induction from Stem and leaf explant

**Status:**

Survey of the areas in and around Jodhpur were conducted to mark the *Commiphora* plants naturally growing. Explant material was collected from the mature plants growing in and

around the Kailana Lake area. The material was subsequently cultured on MS tissue culture media with the aim to test the bud-break response. Some of the material was also used for vegetative multiplication by rooting of cuttings. Cutting raised plants were procured from JNV University, Jodhpur and SFD Nursery, Jaisalmer and are being maintained under laboratory conditions and used as explant source. 50 Seedlings were procured from Guggul Herbal Farm at Mangliawas (Ajmer District) and are being maintained at the green house presently and is serving as a source of juvenile explants. Surface sterilization procedure has been standardized. Experiments have been conducted using stem nodal- and inter- nodal segments and leaves. The explants were cultured on MS media supplemented with varying levels auxins viz, NAA, IAA, IBA and 2,4-D with the aim to achieve callus induction. It was observed that callus induction took place from the stem segments cut at the internodes and only in media supplemented with NAA and IBA. No callus induction could be achieved so far on Media supplemented with 2,4-D and IAA. It was observed further that callus induction occurred from the stem segments that were juvenile rather than the one which were woody, hard and appeared mature. Callus induction started from inside the stem as evident from swelling of the stem segments from followed by bursting up of the outer surface of the stem. Later on the entire stem segment gets converted into callusing mass. Callus induction from small juvenile leaf starts from the entire leaf lamina. The orientation that is adaxial or abaxial side up does not make any difference. The entire leaf explant initially swells up and then callusing starts. However in case of older large leaves, callus induction starts from the mid rib prominent veins only. This is an interesting observation not reported earlier. Experiments on subculturing the primary callus obtained from various explants is being carried out and a proper and optimized subculture regime is being worked out with the aim to finally achieve somatic embryogenesis and shoot morphogenesis. Experiments on micropropagation through bud-break by culturing nodal segments is underway and is being optimized.

**Project 17: Genetic Improvement of *Tecomella undulata*.(AFRI- 33/FGTB-9/2002-05)**  
*Principal Investigator: C.J.S.K. Emmanuel*

**Status:**

Survey has been conducted for the selection of Candidate Plus Trees (CPTs) in both irrigated and unirrigated areas. So far 30 CPTs have been selected in the irrigated areas and 3 CPTs have been selected in unirrigated areas.



Marking of Candidate Plus Trees

**Project 18:** Screening of high oil and azadirachtin in Neem (AFRI-34/FGTB-10/2002-05) *Principal Investigator: C.J.S.K. Emmanuel*

**Status:**

CPTs were identified under NOVOD Project and The CPTs found with high Az and high oil were used for collection of vegetative propagules for raising germplasm bank and their further multiplication. So far 8500 cuttings from 31 CPTs from Gujarat have been collected. All these cutting are planted in Mist Polyhouse for rooting experiments. Sprouting and rooting has been observed in some of stem cuttings.

**Project 19:** Raising of Arboretum cum Botanical Garden for Native Flora of Rajasthan (AFRI-34/Silvi-6/2002-06) *Principal Investigator: Shri K..K. Chaudhuri,*

**Status:**

- Work for the clearance of the site for raising the plants at the site for raising proposed arboretum cum botanical garden for native flora of Rajasthan has been completed.
- Seed collection and raising of planting stock of the identified species to be planted at the proposed arboretum cum botanical garden has been initiated.

- Administrative approval and financial sanction for a project grant of Rs. 4.75 lakh for undertaking various works for raising of proposed arboretum cum botanical garden has been received from the Ministry of environment & forests, Government of India. However, due to non-receipt of required funds in time actual utilization of the sanctioned grant could not be started during the year.

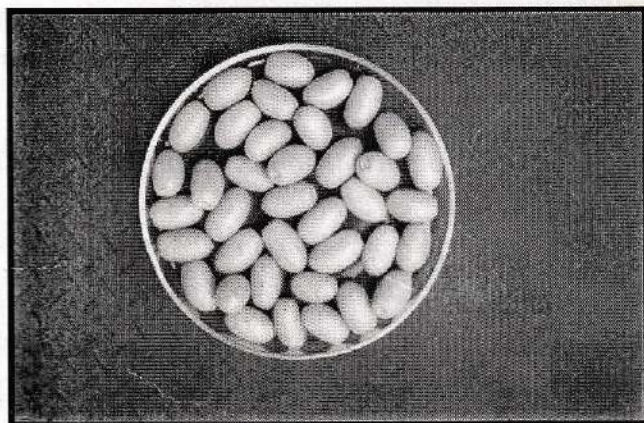
**Project 20: Studies on seed quality improvement in respect of various tree species of arid and semi-arid areas. (AFRI-35/Sil-7/2002-07) Principal Investigators: Dr. D.K. Mishra**

**Status:**

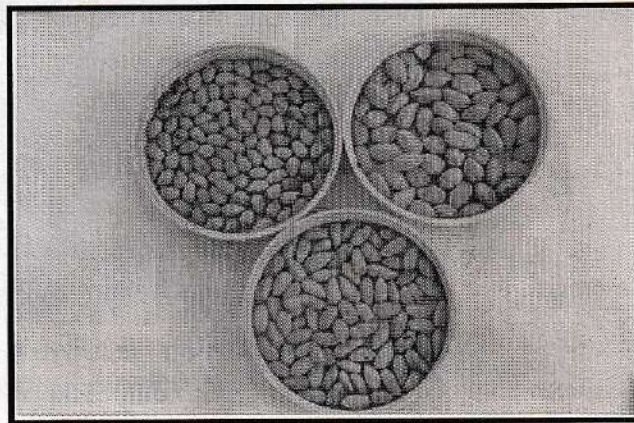
Agro-climatic zones together with seed zones and districts falling under each zone have been tabulated for the selection of trees of target species. Seeds of *Dalbergia sissoo* have been collected from all the agroclimatic zones of Rajasthan. Cleaning and upgrading of seed lots is in progress.

Seeds of neem were collected from trees of various age groups and germination and storability studies were performed. Physiologically mature green, greenish yellow and yellow fruits of neem showed more than 90% germination. However, in storage, seeds from yellow green fruits performed better. Sun, Shade and electrical heat drying do not affect seed germinability initially, however, shade dried seeds performed best in storability. Neem seeds sown horizontally and down ward in the germinating media gave better percent germination than upward orientation.

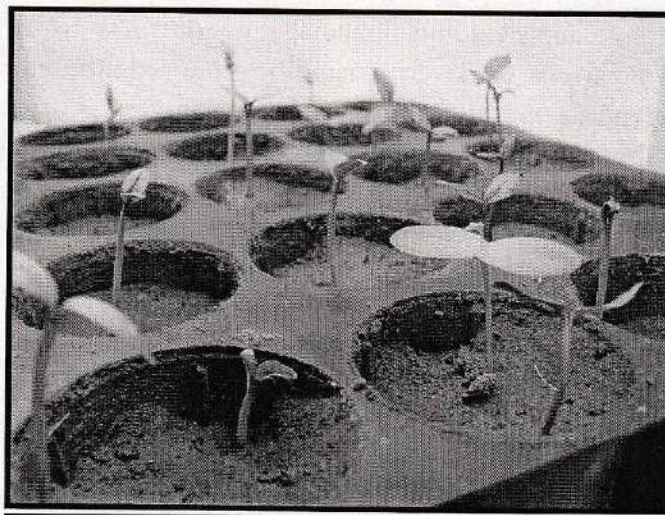
Seeds of *Capparis decidua* have been collected and extracted. Seeds were found extremely dormant probably due to physical reasons. Untreated seeds showed less than 10 percent germination. However, scarified seeds gave above 70 percent germination. Seeds collected in summer season showed above 95% viability, while seeds collected in winter season gave only 40 percent viability. Around 60% seeds were found infected/defunct due to insect attack.



**Neem fruits:** collected at yellow according to size



**Neem seeds:** graded into three groups stage of maturity



*Capparis decidua* : Germination of seeds after mechanical scarification pre-treatment

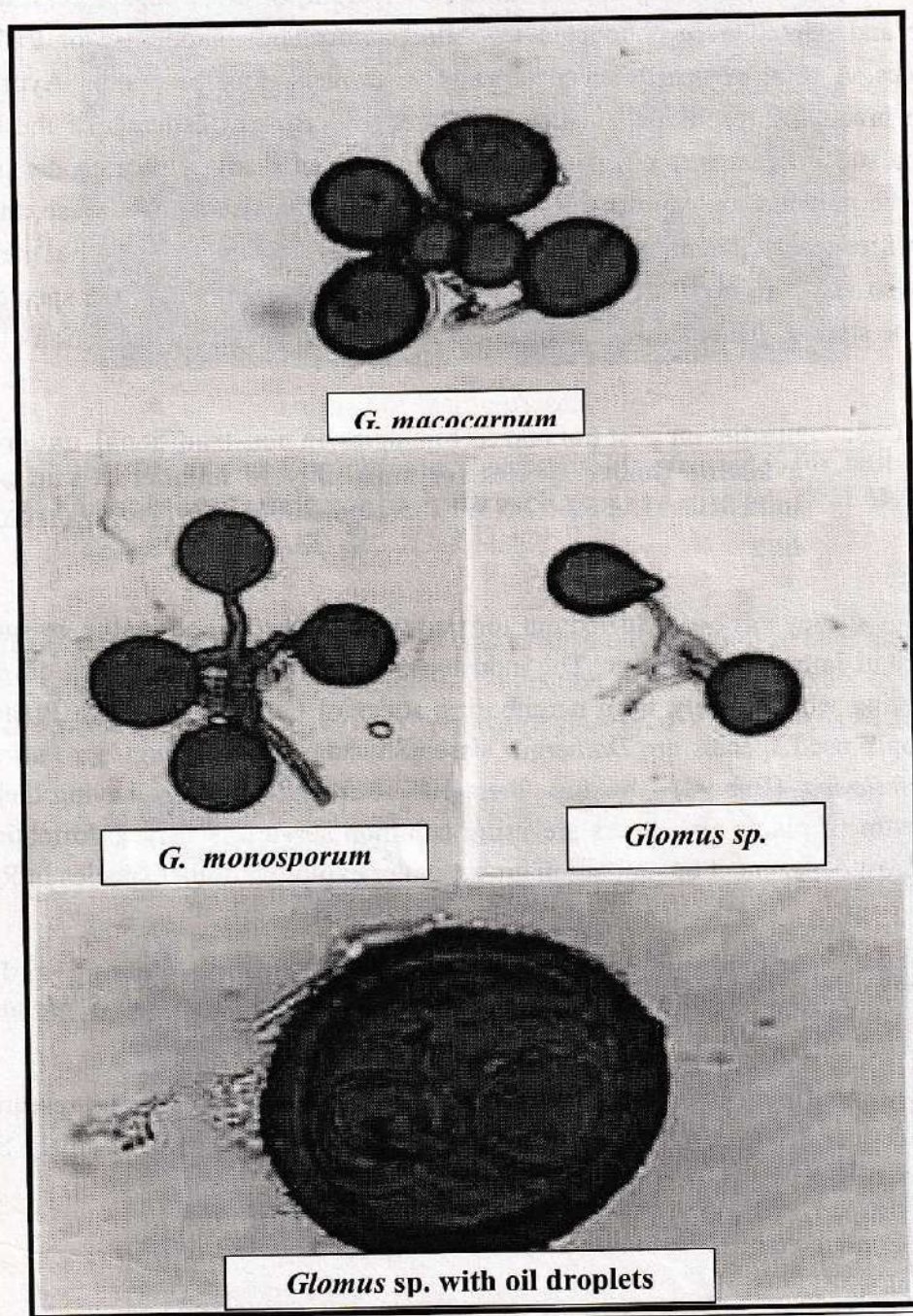
**Project 21:** Studies on improving tree productivity of *P.cineraria* through VAM/Biofertilizers. (AFRI-36/Silvi-8/2002-06) Principal Investigator: Dr.K.K. Srivastava.

**Status:**

- Rhizosphere soil and root sample were collected to identify different VAMfungi associated with *P.cineraria* plantations from four districts of western Rajasthan viz., Nagaur, Sikar, Jhunjhunu and Churu. Rhizosphere soil sample were found rich in VAM fungi but spore density ranged between 70-346 spores / 100 gm soil. The rhizosphere soil collected from agroforestry site were found rich in spore population as compare to soil collected from disturbed area or road side plantation. The *Glomus fasciculatum* was found dominant genera and isolated from all sites. The associated VAMF genera were namely, *Glomus*, *Gigaspora*, *Scutellospora* and *Sclerocystis*. The major species were isolated and identified as, *Glomus fasciculatum*, *G aggregatum*, *G. macrocarpum*, *G. microcarpum*, *G. monosporum*, *G. constrictum*, *Gigaspora margarita*, *Sclerocystis indica* and *Scutellospora bionarta*.
- The stock culture *Sinorhizobium meliloti*, *Rhizobium trifolii*, *Azospirillum brasilense*, *Azospirillum lipoferum*, *Azotobacter chroococum*, *Paenibacillus polymyxa*, *Bacillus licheniformis* and indigenous strains of *Rhizobium* from *Albizzia lebbeck* and *Dalbergia sissoo* were maintained in suitable media for further experimental purpose.
- VAM production facility was developed at TRC, Gandhinagar, State Forest Department, Gujarat. The forty pots of VAM inoculum containing five different combinations of species of VAM fungi Viz., *G. fasciculatum*, *G. microcarpum* and *G. aggregatum* including Consortium inoculum.



- Mass inoculum production of VAM containing different species of VAM fungi by using Vermiculite as basal media are being maintained at AFRI, Model nursery, Jodhpur.
- Training of VAM technology imparted to the progressive farmers, NGO,s and forest officials.



VAM fungi isolated from *P. cineraria* plantations

**Project 22: Quantitative estimation of biologically active secondary metabolites in some of the arid zone medicinal plants to ascertain correct harvesting time. (AFRI-15/NWFP-4/ 2002-2005). Principal Investigator: Dr. Mala Rathore**

**Status:**

Surveys in the Districts of Udaipur, Dungarpur, Sirohi, Pali, Jalore, Rajsamand, Jodhpur, Jaipur and Ajmer were conducted to collect information about use of traditional medicinal practices. A total of nearly seven large scale farmers, four practicing Ayurvedic Physicians, fifteen practicing traditional medical practitioners, eighteen officials of the forest department who pursue interest in medicinal plants were contacted and elaborate discussions were held about the potential of various trees/plants for the study. Apart from these, three markets, four universities/research stations, three NGOs and eight forest nurseries/herbal gardens/krishi farms were also visited. The results of the survey are being compiled and the species on which work has to be started will be decided soon and trees will be marked for collection of samples.

**Project 23: Studies on post harvest technologies on non-traditional, under-exploited locally available timber species for suitability to handicraft and other small scale Industries (AFRI-37/NWFP-5/2002-2006). Principal Investigator: Shri S.H. Jain**

**Status:**

A survey has been carried out for traditionally used wood by the artisans and handicraft industry in Jaipur and Jodhpur. The industry is consuming about 36-lakh cft of wood annually and getting wood mainly from neighboring states of Gujarath, Madhya Pradesh, Punjab. The commonly used species are *Dalbergia sisso* (Shisham) 60%, *Mangifera indica* (Mango) 20%, *Acacia nilotica* (Babool) 10% and others 10%. Few industries are having their own seasoning and treatment plants and others are using common service facility. Information also collected from forest department on plantation grown under exploited timber species in Rajasthan state.

**Project 24: Transfer of technology on forestry through training and demonstration (AFRI-38/SF-1/2002-2006) Principal Investigator: Dr. S. Mohan**

**Status:**

- Lay out plan of Interpretation centre prepared. Visited various research institutes and conceived ideas for the development of interpretation centre at AFRI. Some of the civil works have been completed.
- Conducted training to army troops and cluster members of DDP.
- A stall depicting activities of AFRI was put up and took active participation in *Swadeshi mela* and *Hasta Shilp Utsav* held at, Jodhpur.



Display of Institute's activities

**Project 25: Identification of key indicators and suitable strategies for sustainable Joint Forest Management in Gujarat and Rajasthan. (AFRI-39/JFM-1/2002-2006)**  
*Principal Investigator: Dr. Sunil Kumar.*

**Status:**

Statistical method of sampling surveys was used in the selection of sites and carrying out various studies related to JFM. Questionnaire of selection of sites and details of questionnaire related to socio-economic study have been prepared. Surveyed JFM areas in Rajasthan and Gujarat.



Interaction with JFM committee members during survey

- Ten Sites have been selected for detailed survey in Gujarat
- Four district viz Jaipur, Kota, Bundi, Jodhpur have been selected in Rajasthan

## EXTERNALLY AIDED PROJECTS

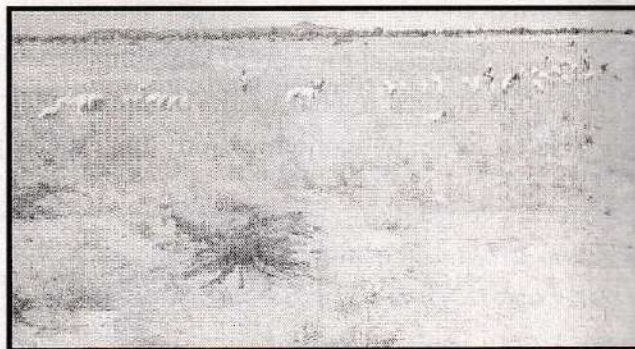
**Project 26: Comprehensive Community Drought Preparedness Programme to Improve Quality of Life of Women and Children In Jodhpur District**  
*Principal Investigator: Sh. H.C. Choudhary*

### Significant Achievements

- Comprehensive survey covering various aspects like administrative & physical location, present vegetation & legal status, type and extent of encroachment, resource availability & details of past intervention in respect of all the 3,287 community forests called *Oran, Gauchars, Parat, Agor etc. and* village ponds located in the entire Jodhpur District have been completed.
- Detailed physico-chemical analysis and nutrient availability assessment of about 700 soil samples collected from representative community forests during their survey have been partially completed.
- Two days workshop attended by senior level officials of the developmental departments, representatives from the research institutes and reputed NGO on 'Development of suitable strategy for rehabilitation of Oran and Gauchars in Rajasthan' have been organised during the year.



Inaugural session of two days workshop organised under the project



A typical view of community forests available in Western Rajasthan



A typical view of village pond located in community forests available in western Rajasthan

- Three clusters of villages, each cluster consisting of five villages have been selected in consultation with the district authorities for Participatory Learning & Action (PLA) based micro planning.
- One week training on PLA for 21 participants including 15 AFRI employees has been organised.
- Detailed PLA exercise in 15 villages comprising selected cluster of villages have been undertaken during the year.
- PLA based micro-plan for one of the villages where PLA exercise has been conducted and have been prepared and submitted to the UNICEF for providing necessary funding for its implementation. Preparation of the PLA based micro-plans for the remaining 14 villages are at the final stage of completion.
- Data collected during the survey have been utilised in formulation of a special project for rehabilitation of community forests located in Jodhpur district in association with the District Rural Development Agency (DRDA), Jodhpur. Consideration of the above project formed the basis for the launching of the 'Maru Gauchar Project' having a total financial outlay of Rs. 100 crores as announced by the Hon'ble Union Finance Minister in his budget speech for the financial year 2003-04.

**Project 27: Development of Suitable Models for Urban Aesthetic Forestry suitable for Arid & Semi Arid Region of Rajasthan (AFRI-28 / Silvi-4 / UIT / 2001-06).  
Principal Investigator- H.C. Chaudhary**

**Status:**

- 2.23 kilometre long experimental avenue plantation raised during the year 2001-02 on funding from UIT Jodhpur has been maintained during the year.
- 1.04 kilometre long experimental avenue plantation on funding from the Jodhpur Pardushan Nivaran trust, Jodhpur has been raised and maintained during the year.
- Advance work for raising 3.50 kilometre long experimental avenue plantations on funding from the Asian Development bank (ADB) funded Rajasthan Urban Infrastructure Development Project (RUIDP) have been initiated.
- Growth and survival data in respect of the plants raised under the experimental plantations have been recorded. Average height and diameter growth of various ornamental tree species raised under the experimental plantations have been observed in the order of *Dalbergia sissoo* > *Azadirachta indica* > *Cassia siamia* > *Tecomela undulata* > *Pongamia pinnata* > *Alistonia scholaris* > *Casia fistula* > *Delonix regia*.
- In respect of *D. regia* even under the liberal irrigation condition, severe die back have been observed during the winter season making the species less suitable for urban aesthetic forestry in arid region.

- Under the liberal watering of sewage water exceptionally high average top height have been observed in respect of *D. sissoo*, *C. siamia* and *A. indica* etc.
- Foliar spray of dilute monocrotophos solution at an average interval of 15 days has been found very cost-effective solution for controlling browsing of *A. indica* by blue bulls.



Sri S.R. Deora-RA-II being felicitated by Hon'ble Minister, Roadside Industries etc. Departments, Govt. of Rajasthan



18 Months old Plants at the experimental Plantation

- Recognizing the sincere and hard work undertaken in raising and maintenance of the experimental plantations raised under the project, AFRI employee associated in the implementation of the Project Sri Sadul Ram Deora, Research Assistant-II have been publicly felicitated by the local district administration during the independence day ceremony.

**Project 28: Standardization of nursery practices in respect of selected species suitable for arid & semi arid region (AFRI-33/ Silvi-5 / DRDA/2002-06) Principal Investigator- H.C. Choudhary**

**Status:**

- On funding from the DRDA, Jodhpur under the Member of Parliament's Local Area Development Scheme about 40,000 superior quality seedlings have been raised and supplied to various government departments, farmers, NGOs etc.
- Oxfam India Trust sponsored two days training on nursery technology have been organised for the representatives of various NGOs obtaining getting project funds from the Oxfam India Trust.
- Planting stock required by various research divisions for undertaking various experimental trials during the year have been successfully raised and supplied.

- Various aspects of nursery technology suitable for raising planting stock in arid and semi-arid region have been explained to IFS & SFS probationers, farmers, trainee forest rangers/ foresters/ forest guards, members of various watershed development committees who visited the nursery during the year.



AFRI Model Nursery

**Project 29: Survey and silvicultural management practices for commercially exploitable medicinal plants of arid and semi-arid areas of Rajasthan**  
(AFRI 35/Silvi 8/MPB/2002-05) *Principal Investigator: Sh. K.K. Chaudhuri*

**Status:**

The Medicinal Plants Board, Ministry of Health and Welfare, Government of India approved this project as externally funded project for three years. The fund was received in June 2002.

- Market survey of important medicinal plants traded in Rajasthan has been initiated.
- A Germplasm of 85 medicinal plants has been arranged for establishing herbal garden at AFRI.

- Initiated germination studies on seeds of *Commiphora wightii*. The germination is very poor mainly due to empty seeds. However, these can be removed by soaking seeds in water and subsequently germination can be improved.
- Initiated germination studies on *Cassia angustifolia*. The seeds are dormant and germination can be enhanced by mechanical scarification, hot water and acid pre-treatment. Green seeds in the lot showed poor germination as compared to yellow seeds.

Strategy and proforma for market survey has been finalized. List of 460 Ayurvedic drug manufacturing units and firms/persons involved in trading of medicinal plants in Rajasthan has been obtained from Drug Controller, Government of Rajasthan. Market survey work has been initiated and survey work of Ajmer (21 units), Barmer (2), Banswara (1), Chitorgarh (2), Jodhpur (28), Pali (3), Sirohi (8), and Udaipur (48) has been completed. In all 140 units so far have been surveyed.

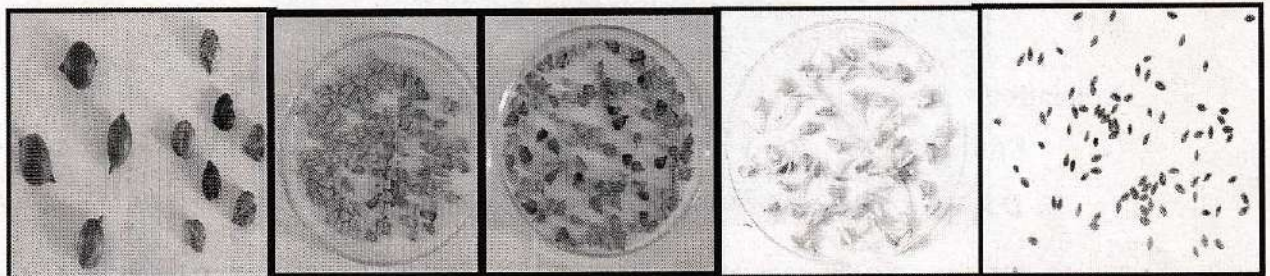
About 2 ha of area for the establishment of germ-plasm/herbal garden and 10ha. area for experimental trial have been selected. The area has been cleared, ploughed and leveled. So far seedlings of more than 85 medicinal plants species have been collected for the establishment of herbal garden and plantation activity is under progress. Several useful books on medicinal plants required for consultation, methodology and extension activity has been procured.

Seeds of *Commiphora wightii* were collected from Jaisalmer. Seeding was very poor due to drought period and only a small amount of seed was collected. Only dark brown/black seeds were found viable. The germination was found very poor (10 %) mainly due to empty seeds. However, these can be removed by soaking in water and subsequently germination can be improved. The seeds were non dormant and germinated readily without any pre-treatment.

Seeds of *Cassia angustifolia* were procured from locally grown variety (Sonma) and Thirunelveli Senna (*C. angustifolia*) from Coimbatore. Procurement of seeds of high sennoside content variety from CIMAP, Lucknow is underway. There are around 40,000 seeds/kg. The seeds from Coimbatore contain 10-15% shriveled dark brown seeds, while local lot contains no such seeds. Initial germination studies were performed on local seeds. The seeds were found dormant due to physical reasons and gave only 25% germination without any pre-treatment. The germination can be enhanced (>90%) by mechanical scarification, hot water and acid pre-treatments. Green seeds in the lot showed slightly poor germination as compared to yellow seeds.



A view of field trial of  
*Plantago ovata*



A

B

C

D

E

- A:** Fruits and seed of *Commiphora wightii*  
**B:** Seeds of local variety of *Cassia angustifolia*  
**C:** Seeds of Thirunelveli Senna *Cassia angustifolia*. Few dark brown/ black shrivel seeds are visible.  
**D:** Germinating seeds of *C. angustifolia*  
**E:** Seeds of *Plantago ovata*

## Research Achievements State wise under Institutes jurisdiction

Name of State	No. of Projects completed in 2001-02	No. of Ongoing Projects in 2001-02	No. of Projects initiated in 2001-02
Rajasthan	Twelve	Ten	Three
Gujarat	Two	Two	One

### Technology Assessed and Transferred

- Preparation of AFRI paste and its application to the affected Khejri trees has been demonstrated through training programmes of the farmers and through imparting training to the agricultural officers.
- The scientific documentary film ("*Khejri Ek Jeevan Rekha- Astitva Ka Sankat*") developed by Arid Forest Research Institute, Jodhpur in collaboration with Electronic Media Research Centre, Jodhpur on the mortality of Khejri (*Prosopis cineraria*) in north-western districts of Rajasthan, has been telecasted on 22<sup>nd</sup> Jan 2003 on the National TV channel of Doordarshan at 05.30 hours under UGC programme.

### Education & Training

#### (a) Education

##### *Ph. D Thesis Awarded by FRI, Deemed University on*

1. Clonal propagation of *Acacia nilotica* sub species *indica*. Brenan and *Azadirachta indica*. A. Juss. to Ms. Usha Negi, under supervision of Dr. U.K. Tomar.

#### (b) Trainings attended by AFRI Officials

##### I. International

Dr. V.P. Tewari, Scientist-D attended two months short-term study and research visit (from 1<sup>st</sup> Aug. 2002 to 30<sup>th</sup> Sept. 2002) under DAAD fellowship at the Institute of Forest Management, University of Goettingen (Germany) and worked on "Modelling tree growth in multi-species uneven-aged forests".

##### II. National

1. One day training on the cultivation of medicinal plants by Rajasthan Agroforestry Corporation has been provided to Dr. MMS Rawat Scientist-C, Sh. Prithvi Raj, Field supervisor, Sh. Anada Ram, Field supervisor and Sh. Sadul Ram Deora, RA-II, Nursery.

2. One week UNICEF sponsored training programme on Participatory Learning & Action (PLA) and Micro Planning organised by Trainers of UNICEF at Institute from 01.04.2002 to 06.04.2002, was attended by 21 AFRI, officers/Scientist/Research Staff.



Training programme on Participatory Learning & Action (PLA) and Micro planning

**(b) Trainings Imparted by Institute:**

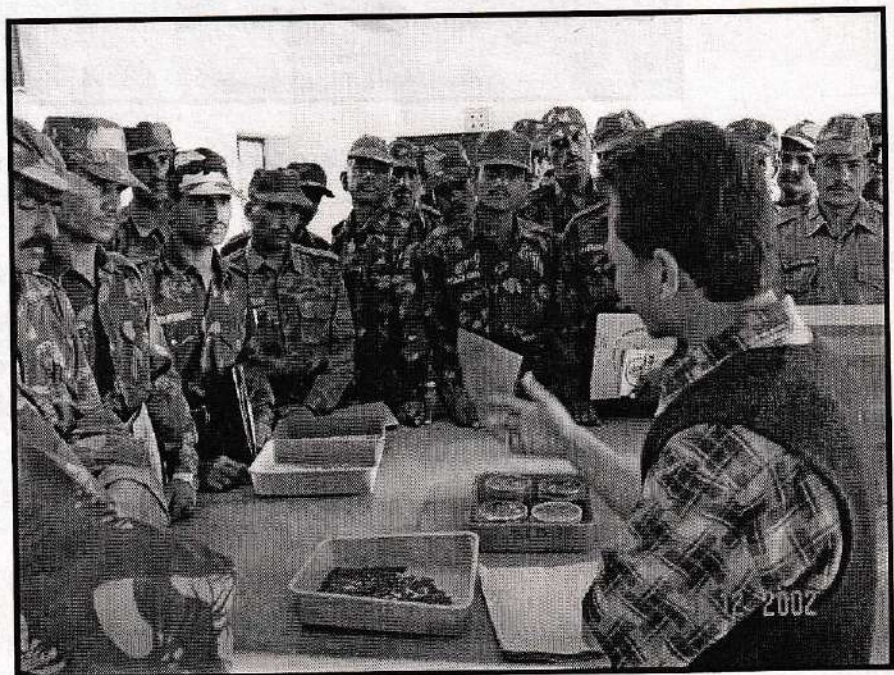
1. Two farmers training on "*Kisano Ke Liye Neem Vraksharopan Tatha Iske Bahu Upyogita Par Prashikashan*" were organized from 24 - 26 September' 2002 under NOVOD Board Project entitled "Integrated Development of Neem In Different Agro-climatic Zones of Gujarat.

Participants: 100 (50 Farmers/ SFD officials in each training)



Farmers training under NOVOD at Himmatnagar (Gujarat)

2. A training programme on “Eco- Sensitization on Arid Ecology Environment” for Army troops (Eco- Task Force)” was organized from 9<sup>th</sup> - 13<sup>th</sup> Dec. 2002. Inputs on various aspects of forestry viz. techniques on collection & storage of seed, raising of nursery, VAM, Clonal multiplication, vegetative propagation, reclamation of saline lands, management of local tree species for optimal productivity.



Demonstration of seed technology

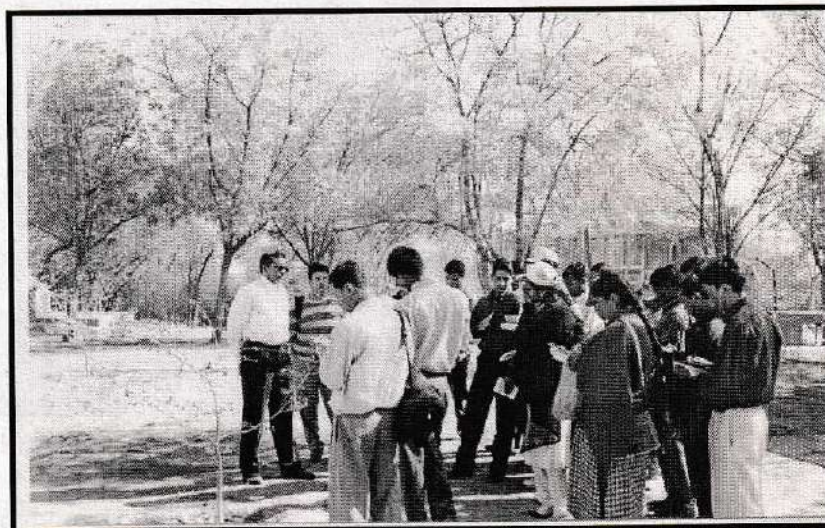
3. Two days training to Non Government Organizations on "Nursery Technologies" from 31 January'03 to 1 February'03.
4. Five days training programme on "Eco-Sensitization of Cluster Members on Integrated Watershed Management" in four batches, under DDP Jaisalmer, Rajasthan was organized at the Institute from 24<sup>th</sup> -28<sup>th</sup> Feb., 03<sup>th</sup> -07<sup>th</sup> , 10<sup>th</sup> -14<sup>th</sup> & 21<sup>st</sup> -25<sup>th</sup> March, 2003. To take the Research findings to the stake holders and application in the field, resource persons from the Institute gave deliberations on various techniques on collection & storage of seed, raising of nursery, VAM, clonal multiplication, vegetative propagation, management of local tree species for optimal production of timber, fodder & fuel wood. For multidisciplinary approach of watershed management, in puts on animal husbandry, pasture management were also given by the resource persons from outside.



Inaugural session: Training to cluster members

#### **Educational Visits:**

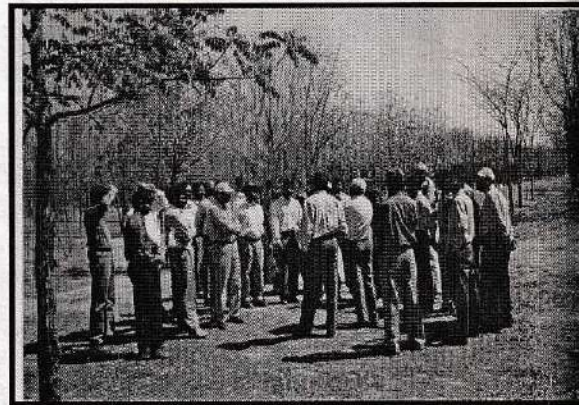
1. State Forest Service trainees of 2002-04 batch from Dehradun on 28 December' 02.



2. Indian Forest Service (probationers) from IGNF, Dehradun on 12<sup>th</sup> March 2003.



Vegetative propagation in Poly mist house



National Neem Provenance trail

3. Range Forest Officers from SFRC, Coimbatore on 15 -17<sup>th</sup> March 2003



National Neem Provenance trail



Gangani experimental area.

3. Forester trainees from "Education & Training Centre, Alwar" on 16 February '03.



Visit to National Neem Provenance trail

5. Students of M.Sc. (Forestry) from deemed university, Dehradun on 24 - 26 February '03.

## Linkages and Collaboration

### National:

1. National Bureau of Plant Genetic Resources, New Delhi.
2. Tata Energy Research Institute, New Delhi
3. Indian Institute of Technology, New Delhi
4. Central Arid Zone Research Institute, Jodhpur
5. National Botanical Research Institute, Lucknow
6. Chaudhary Charan Singh Haryana Agricultural University, Hissar
7. Neem Foundation, Mumbai

### International:

1. DANAIDA Forest Seed Centre, Humlebaek, Denmark
2. International Neem Network, FAO, Rome.
3. CSIRO, Australia

## Publications

### A) Chapters in Books:

1. Kumar Shivesh and Ahmed S.I. (2002). Natural enemy complex of insect pest spectrum and mites of *Prosopis cineraria* Linn and *P. juliflora* Swartz., DC in Indian Thar Desert. *In Recent Trends in insect pest control to enhance productivity*. (Ed by P.K.Shukla and K.C. Joshi) Tropical Forest Research Institute, Jabalpur:pp 218-230.
2. Sharma Meeta and Ahmed S.I. (2002). Integrated pest management of marwar teak defoliator, *Patialus tecomella*, Pajni, Kumar and Rose (Coleoptera: Curculionidae), in arid and semi arid areas. *In Recent trends in insect pest control to enhance forest productivity*. (Ed by P.K.Shukla and K.C.Joshi) Tropical Forest Research Intitute ,Jabalpur:pp. 199-211.
3. Ahmed, S.I. and Kumar Shivesh (2002). Role of Environmentally Acceptable Entomopathogens in *Forest Insect Pest Management*. *In Modern Trends in Environmental Biology*. CBS Publishers New Delhi.
4. Mohan S., Meena R.L. and Singh Balbir (2002) "Agroforestry models for arid region of India" was sent to ICFRE for publication of a book on Agroforestry models developed for India

### B) Research Papers in Scientific Journals:

1. Singh G. and Rathod T.R. (2002). Plant growth, biomass production and soil water dynamics in a shifting dune of Indian desert. *Forest Ecology and Management*, 171: 309-320.
2. Singh G. and Singh Bilas (2002) Changes in soil properties and foliage nutrient composition in different age *E.camaldulensis* plantation . *J. Tropical Forest Science* 14 (3) 1-11.

3. Singh G., Singh Bilas, Kuppusamy V. and N. Bala (2002). Variations in foliage and soil nutrient composition in different age classes *Acacia tortilis* plantation. *Indian Forester*, 128: 514-522.
4. Singh G. and Bhati M. (2003). Mineral accumulation and physiological functions in tree seedlings irrigated with effluents of varying chemistry in sandy soil of dry region. *J. Environ. Sci. Health Part C*, C21: 45-63.
5. Kumar Pramod, Singh G., Chaukiya S.P. and Bohra N.K. (2002). A study: Kuchh Aur Pani- Sunel Jal Grahan Pariyojana (Hindi). *Parti Bhumi Samachar*, Oct-Dec: 31-32.
6. Paunikar, S. and Ahmed, S.I. (2003) Observation on infestation of five-striped squirrel *Funambulus pennanti* Wroughton, in the forest nurseries of arid and semi-arid zone. *Rodent Newsletter*, 26(3): 9-10.
7. Sundararaj R., Sharma Meeta and Ahmed S.I. (2003) Aleyrodids infesting rose (*Rosa Chinensis*) in Indian arid zone. *Hexapoda* 12 (1& 2): 19-24.
8. Ahmed, S.I and Khan Ameen Ullah (2002). A New host record of *Achmaeodera aurifera* Laporte and Gory (Coleoptera:Buprestidae) on freshly felled timber of *Prosopis cineraria* (Linn) and *Albizia lebbek* in Rajasthan. *Indian Forester*, 128: 103-104.
9. Tewari V.P. and V.S. Kishan Kumar (2003), Volume equations and their validation for irrigated plantations of *Eucalyptus camaldulensis* in the hot desert of India. *Journal of Tropical Forest Science*, 15(1), 136-146.
10. Arya Ranjana (2003), Yield of *Cassia angustifolia* in combination to different tree species in a silvi-herbal trial under hot arid conditions in India, , *Bioresource technology*, 86(2), 165-169.
11. Tewari, V.P., Verma Amit and V.S. Kishan Kumar (2002), Growth and yield functions for irrigated plantations of *Eucalyptus camaldulensis* in hot desert of India. *Bioresource Technology*, 85(2), 137-146.
12. Tewari, V.P. and V.S. Kishan Kumar (2002), Development of top height model and site index curves for *Azadirachta indica* A. juss, , *Forest Ecology and Management*, 165(1-3), 67-73.

**C) Scientific Reports Prepared and Submitted:**

1. Ahmed, S.I. Srivastava, K.K. (2003). A scientific approach to study the causes of mortality of *Prosopis cineraria* (L) Druce (Khejri) in Western Rajasthan. *Paryavaran*.

**D) Technical Bulletin:**

1. Brief writ-up on the importance and distribution & production potential of Khejri, Kair and Kumat in arid zone of Rajasthan.



**E) Scientific Brochures:**

1. Ahmed, S.I. (2002), Brochure on " Know your nursery pests and their control" *Published by the Director, AFRI, Jodhpur.*
2. Ahmed, S.I. and K. K. Srivastava (2001) Preliminary report on Khejri (*P.cineraria*) mortality. Submitted to the Director, AFRI & authorities of SFD's.
3. Srivastava, K.K. and Neelam Verma (2002) "Know your nursery diseases and their management".
4. Ahmed, S.I. (2002), Brochure on " Know your nursery pests and their control".

**F) Scientific Films/Documentary: NIL**

**G) Research Papers Presented in Seminars/Symposiums/Workshops:**

1. Drought preparedness: Planning, policy and management in arid areas, V.P. Tewari. Paper presented in the workshop on *Development of suitable strategies for rehabilitation of Orans and Gochers in Rajasthan* at AFRI on 16<sup>th</sup>-17<sup>th</sup> April 2002.
2. Performance of some important tree species in silvipastoral system in arid Rajasthan, Ranjana Arya. Paper presented in the workshop on *Development of suitable strategies for rehabilitation of Orans and Gochers in Rajasthan* at AFRI on 16<sup>th</sup>-17<sup>th</sup> April 2002.
3. Emmanuel, C.J.S.K. and Tomar, U.K., (2002) Neem Improvement Work at Arid Forest Research Institute, Jodhpur, Paper presented in the World Neem Conference NEEM 2002, Organised by the Neem Foundation Mumbai 27-30 November 2002.
4. Emmanuel, C.J.S.K., (2003) Role of genetic selection, gene conservation, provenance trials and hybridization with special reference to *Gmelina arborea.*, Invited paper presented at the Round table conference on *Gmelina* at Rain Forest Research Institute, Jorhat, 4-6 March 2003.
5. Kumar Sunil, Singh Balbir, Meena R.L and Baloch M.R. Criteria and Key Indicators for sustainable Joint Forest Management at FORSPA - Bangkok sponsored National Workshop on "Technological Innovation and Research Advancements for Application in Joint Forest Management" on 3 – 4 February 2003 at Dehradun.
6. Chaukiyal, S.P., Singh G., Bala N. and Kumar P. (2002). Floral diversity and carbon stock in common property land resources in some villages of Rajasthan and Gujarat. Presented in workshop on 'Development of suitable strategies for rehabilitation of oran and gauchar in Rajasthan' on 16-17 April 2002.
7. Kumar P., Bala N., Singh G. and Chaukiyal S.P. (2002). Status of common access resources (CARs) and socio economic conditions in some villages of Rajasthan and Gujarat. Presented in workshop on 'Development of suitable strategies for reghabilitation of oran and gauchar in Rajasthan' on 16-17 April 2002.

8. Singh G., Meena R.L. and Chaudhuri K.K. (2002). Agroforestry for sustainable production in dry region of Rajasthan and their role in socioeconomic benefits. Presented in national Seminar on "Agroforestry" held at IFGTB, Coimbatore on 22<sup>nd</sup> November 2002.
9. Singh G., Bala N., Mutha Sarita, Limba N.K. and Rathod T.R. (2002). Effect of varying spacing regimes of *Prosopis cineraria* on plant growth and associated crops in the arid zone of India. Presented in national Seminar on "Agroforestry" held at IFGTB, Coimbatore on 22<sup>nd</sup> November 2002.
10. Singh G., Bala N. and Chaudhuri K.K (2002). Strategies for rehabilitation and productivity enhancement of degraded land in dry regions of western India. Presented in National Seminar on "Management of degraded forest for productivity enhancement and carbon sink expansion" held at TFRI, Jabalpur on 15-16 January, 2003.

#### H) Research Papers Communicated/Accepted in Press:

1. Bhati M. and Singh G. (2003). Growth and mineral accumulation in *Eucalyptus camaldulensis* seedlings irrigated with mixed industrial effluents. *Bio Resource Technology*. (In press)
2. Singh G. and Bhati M. (2003). Mineral element composition, growth and physiological functions in *Dalbergia sissoo* seedlings irrigated with different effluents. *J. Environ.Sci. Health Part A* , A38(10): (in press).
3. Singh G. and Bhati M. (2003). Growth, biomass production and nutrient composition of *Eucalyptus camaldulensis* seedlings irrigated with municipal effluent in loamy sand soil of Indian desert. *J. Plant Nutrition*. (Accepted)
4. Bala N., Singh G. and Bohra N.K. (2002). Effect of irrigation on growth and performance of three different tree species in Indian arid zone. *Annals of Arid Zone*. (Accepted).
5. Kumar P., Singh G., Bala N. and Bohra N.K. (2002). Ethnobotanical studies of forest of Banaskantha and Sabarkantha districts of Gujarat: A case study of some tribal villages. *Indian J. Ecoplanning* (Accepted)
6. Singh B. and Singh G. (2003). Effect of water availability and phosphorus application on biomass accumulation and micronutrients concentration in *Dalbergia sissoo* seedlings. *J.Indian Soc. Soil Science*. (Revised).
7. Singh G., Bala N., Rathod T.R. and Chouhan Sahadev (2003). Effect of adult neighbours on regeneration and performance of surface vegetation in shifting dune of Indian desert for the control of sand drift. *Environmental Conservation*. (Revised).
8. Singh G., Rathod T.R. and Chouhan Sahadeo (2003). Growth, biomass production and the associated changes in soil properties in *Acacia tortilis* plantation in relation to stand density in indian arid zone. *Indian Forester*. (Revised).
9. Singh G., Bala N., Kuppusamy V. and Rathod T.R. (2003). Adaptability and productivity of *Cassia angustifolia* in sandy soil of Indian Desert. *Indian Forester* (Revised).

10. Kumar Pramod, Bala N., Singh G., Mutha S., Limba N.K. and Bohra N.K. (2003). Socioeconomic conditions with special reference to common access resources: A case study from Gujarat and Rajasthan. *Indian Forester* (Revised)
11. Singh G. and Rathod T.R. (2002). Rehabilitation of degraded drylands of Indian arid Zone through direct seeding. *Indian Forester*.
12. Bhati M. and Singh G. (2003). Growth, biomass production and mineral accumulation in *A. nilotica* seedlings irrigated with effluents of varying chemistry. *J. Plant Nutrition*
13. Singh B. and Singh G. (2003). Growth, biomass production and nutrient uptake of *Dalbergia sissoo* seedlings under water deficit and phosphorus nutrition. *J. Plant Nutrition*.
14. Singh G. and Bhati M. (2003). Soil properties and seedling performance in artificially contaminated soil through effluent irrigation of varying chemistry. *Environmental Pollution*.
15. Singh G. and Bhati M. (2003). Effect of municipal effluent irrigation on plant mineral status and biomass productivity in *Acacia nilotica* seedlings and soil chemical changes. *Agriculture, Ecosystem and Environment*.
16. Singh G. and Bhati M. (2003). Growing *Dalbergia sissoo* in Desert regions of western India using municipal effluent and the consequent changes in soil and plant chemistry. *Bio-resource Technology*.
17. Tripathi, Y.C. Tiwari, V.K., Srivastava, K.K., Ahmed, S.I. (2002). Biopesticides as an effective tool for integrated pest management. In *Forest conservation and management-challenges of the millennium* (Ed. P.Rethy, P.P.Dabral, Vinay Singh and K.K.Sood) 113.
18. Preliminary growth models for *Prosopis cineraria* (L.) Druce plantations in the hot arid region of India, V.P. Tewari and K.v. Gadow, *Forests, Trees and Livelihoods* (accepted).
19. Tewari V.P. and Kishan Kumar V.S., Spacing effect on the growth of irrigated plantations in hot desert, *Indian Forester* (accepted).
20. Tewari V.P., Verma Amit and V.S. Kishan Kumar, Growth and yield functions for *Dalbergia sissoo* plantations in hot desert of India grown under irrigated, *Journal of Tropical Forest Science* (accepted).
21. Arya Ranjana and Chaudhary K.R., Studies on morphological status of *Acacia nilotica* for gum production *Current Agriculture* (accepted).
22. Tewari V.P. and Arya Ranjana, Overgrazing and degradation in arid rangelands and their management with reference to Thar Desert In India: An overview, *Forests, Trees and Livelihood* (communicated).
23. Tewari V.P., Generalised diameter-height equations for even-aged stands of *Azadirachta indica* in Gujarat State of India, *Journal of Arid Environments* (communicated.)
24. Tewari V.P., Stem number development and potential stand density in the unthinned even-aged *Azadirachta indica* plantations in the Gujarat State of India, *International Forestry Review* (communicated).

25. Tewari V.P. and Gadaw K.V., Basal area growth of even-aged *Azadirachta indica* stands in the Gujarat State of India, *Forest Ecology and Management* (communicated).
26. Arya Ranjana and Chaudhary K.R., Effect of Nitrogen and gypsum on establishment and early growth of *Salvadora persica* (L.) in a salt affected soil in hot arid zone, *J. Arid Environment* (Communicated).
27. Arya Ranjana, Studies on growth and biomass production of different fodder tree species in a silvi-pastoral trial under hot arid conditions in India, *Forest Ecology and Management* (Communicated).
28. Mishra D.K. and Singh Ved Pal (2002): Standardization of seed weight replications of tree species growing in arid and semi-arid zone. *My Forest*.
29. Mishra D.K. (2002): Germplasm variability in neem (*Azadirachta indica* A Juss). *Jour. Tropical Forest science*

### Consultancy

Ministry of Rural Development, Department of Land Resources, Government of India and Department of Rural Development, Land development cell, Government of Rajasthan assigned the evaluation work of following projects.

1. Integrated Watershed Development Project in Sunel Watershed of Pirawa Panchayat Samiti, District Jhalawar, Rajasthan vide letter No. K-1301/2/2001-IWDP (D II) from MoRD, Governemnt of India. Evaluation of the project completed and report has been submitted.
2. Reclamation of wastelands of waterlogged area in Rawatsar, Hanumangarh District, Rajasthan" implemented by DRDA, Hanumangarh vide letter No.5-22/99-TE, Dated-19.06.2002 from Ministry of Rural Development, Govt. of India.
3. Reclamation of waterlogged area at Jetsar Farm, Rajasthan" implemented by State Farms Corporation of India Ltd., Delhi vide letter No.5-6/2000-TE, Dated-02.08.2002 from Ministry of Rural Development, Govt. of India Evaluation of the project completed and report has been submitted.
4. Interim/ final evaluation of watershed projects vide letter No. 8(10) RD/LR/2/2002, Dated-17.06.2002 of Department of Rural Development, Land development cell, Govt. of Rajasthan.

**Patents Obtained/ filed:** Nil

**Commercialization of technology:** Nil

## Organized and Participation in conference, meetings, workshops, symposia, Exhibitions:

### (a) Organised

1. Workshop on 'Development of suitable strategy for rehabilitation of Oran and Gauchars in Rajasthan' organized on 16-17<sup>th</sup> April 2002 funded by UNICEF.
2. Organized *Liaison & RAG* meetings on 19<sup>th</sup> August' 2002.
3. A Brain storming session organized on the Importance and Distribution & Production potential of Sangri, Kumat, Kair and Loong at AFRI on 18 February'03". Various institutions i.e. CAZRI, Desert Medicine Research Centre (DMRC), Space Research centre, State Agriculture & Horticulture Departments, Agriculture University, NGOs, local Merchant & Farmers participated in the session
- 4-मानव संसाधन विकास मंत्रालय, भारत सरकार के वैज्ञानिक तथा तकनीकी शब्दावली आयोग के सहयोग से वानिकी प्रशासनिक एवं तकनीकी शब्दावली तीन दिवसीय कार्यशाला २०-२३ मई २००२ का आयोजन संस्थान द्वारा किया गया ।



### (b) Participation:

1. Workshop on "Regional workshop of the Principal Investigators" organized by MPB at Goa on 21.5.2002.  
I. Sh. K.K.Chaudhuri
2. Seminar on the eve of " World day to combat desertification" on 17 June 2002 at Van-  
chetna Gandhinagar  
I. Sh. R.L.Meena

3. Technical workshop on the formulation of field projects for the UNCCD NAP Implementation at N. Delhi from 11-13 December' 2002.
  - I. Sh. K.K. Chaudhuri
  - II. Dr. G. Singh
4. National seminar at TFRI, Jabalpur held on 15-16 December' 02.
  - I. Sh. K.K. Chaudhuri
  - II. Sh. N.Bala
5. Workshop on Traditional water harvesting technologies in Arid Zone, their status and prospects on 24 December' 02 organized by Gramin Vikas vigyan Samiti(GRAVIS) Jodhpur
  - I. Sh. R.L.Meena,
6. National workshop on "Technological Innovations and Research Advances for Application in Joint Forest Management" at FRI, Dehradun on 3-4 February' 03.
  - I. Sh. K.K. Chaudhuri
  - II. Sh. Balbir Singh
  - III. Dr. Sunil Kumar
7. National Seminar at RFRI, Jorhat on "Expert Consultation on *Gmelina arborea*" on 4-5 March' 03.
  - I. Sh. K.K. Chaudhuri
  - II. Sh. C.J.S.K. Emmanue.

**(c) Exhibition**

The activities and research findings of AFRI was exhibited in the Swadeshi Mela held in Polo ground, Jodhpur from 21<sup>st</sup> - 30<sup>th</sup> Dec 2002 and in the Paschimi Rajasthan Hasta Shilp Utsav held at Jodhpur from 2<sup>nd</sup> - 11<sup>th</sup> January 2003.

**Extension publications**

1- शुष्क वन अनुसंधान संस्थान (आफरी) जोधपुर

**News Articles:** कुछ और पानी . सुनेल जल ग्रहण परियोजना

**Awards**

Dr. S.I.Ahmed, Scientist E and Head, Division of Forest Protection. AFRI, has been awarded *Dr. Anand Prakash Award-2002*, for his outstanding contribution in the field of forest

entomological research work by the Applied Zoologist Research Association, Cuttack On 23<sup>rd</sup> Dec., 2002 in a conference held at Cuttack.

**Distinguished Visitors:**

1. Hon'ble Chief Minister, Rajasthan Sh. Ashok Gehlot Visited AFRI on 23<sup>rd</sup> June 2002.



Ceremonial plantation

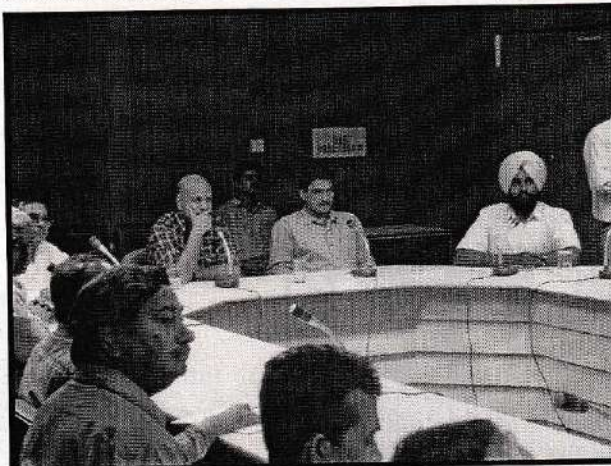


Briefing about AFRI activities

- 2- डॉ हरीश कुमार, अध्यक्ष, मानव संसाधन विकास मंत्रालय, भारत सरकार के वैज्ञानिक तथा तकनीकी शब्दावली आयोग 20 मई 2002.
3. Dr. D.N. Tewari, Hon'ble Member of Planning Commission on 14<sup>th</sup> Nov. 2002
4. Sh.R.P.S.Katwal, Director General, ICFRE, Dehradun reviewed the research works on 21 to 25 December' 02 and 31<sup>st</sup> March'03.



D.G.'s field visit to sand dune afforestation works at Tapu, Jodhpur



Review of research achievements at AFRI

5. Sh. M.K.Khanna, Principal Secretary, Rural Development, Govt. of Rajasthan on 22 January'03

#### Miscellaneous

1. Celebrated World Environment day, 5<sup>th</sup> June 2002, ceremonial plantation by chief guest Sh.D.K. Dhotawat, IAS, Executive Wool Development Board, Jodhpur.
2. Organized sports meets and cultural activities on 15<sup>th</sup> Aug., 2002 and on 26<sup>th</sup> Jan., 2003.
3. Observed "Vigilance Awareness Week 2002" from 31<sup>st</sup> October to 6<sup>th</sup> November 2002. On 31<sup>st</sup> October, the pledge was administered to all officers, scientists and staff by the director, followed by reading of the messages of dignitaries. An essay and poetry competition was organized
4. Launching of AFRI Website in Hindi by the D.G., ICFRE on 23 December' 02.