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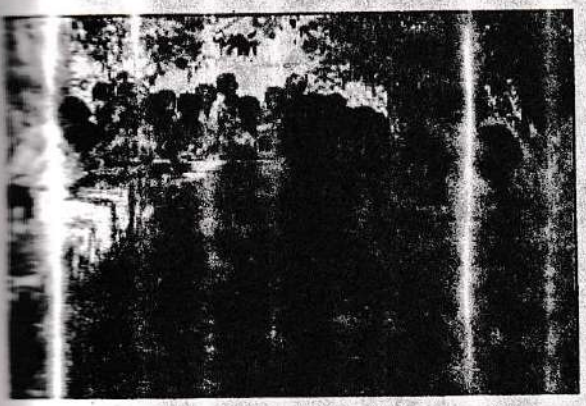
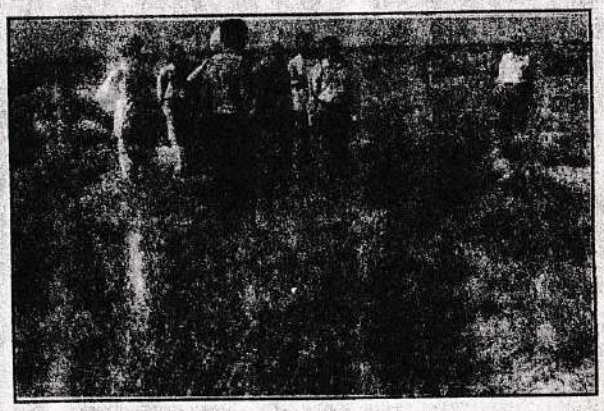
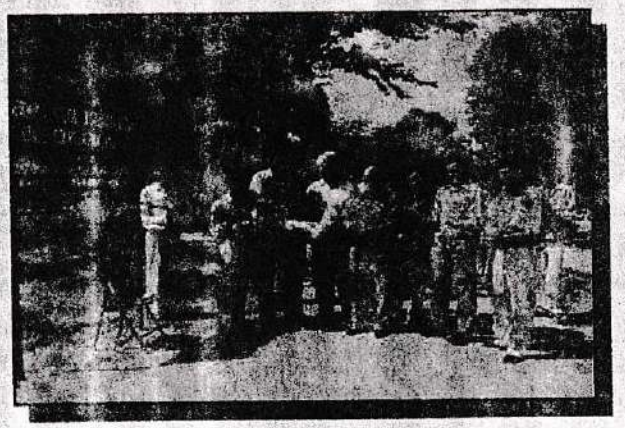
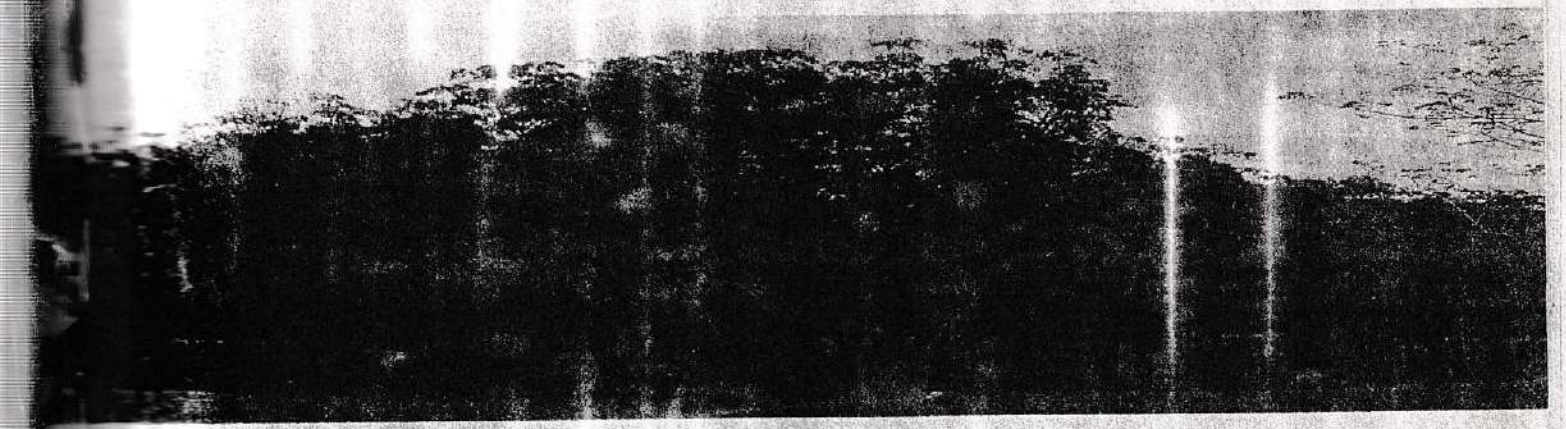
ANNUAL REPORT 2003-2004









ARID FOREST RESEARCH INSTITUTE, JODHPUR

(Indian Council of Forestry Research & Education, Dehradun)

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

CONTENTS

ARID FOREST RESEARCH INSTITUTE, JODHPUR

AFRI - 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 enhance bioproductivity to increase the vegetative cover and to conserve the biodiversity in the hot arid and semi arid region of Rajasthan, Gujarat and Dadra & Nagar Haveli.

Thirty research projects were executed during the year. The Institute has taken up a task for development of Silvipasture model under "***Maru Gauchar Project***" for its replication by concerned State departments and implementing agencies.

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, medicinal plants cultivation 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 2003-2004

Project 1. Agro forestry research for sustainable production in arid and semi arid regions of Rajasthan (AFRI-2/FEDD-2/1999-2003).

Principal Investigator-Dr. G. Singh

OBJECTIVES

- To find out optimum stand density of trees on agriculture farms
- To find out best tree crop combination for maximum benefits
- To find out ecological and economic benefits of different agroforestry system
- To study changes in soil properties under agroforestry systems
- To suggest ideal agroforestry models

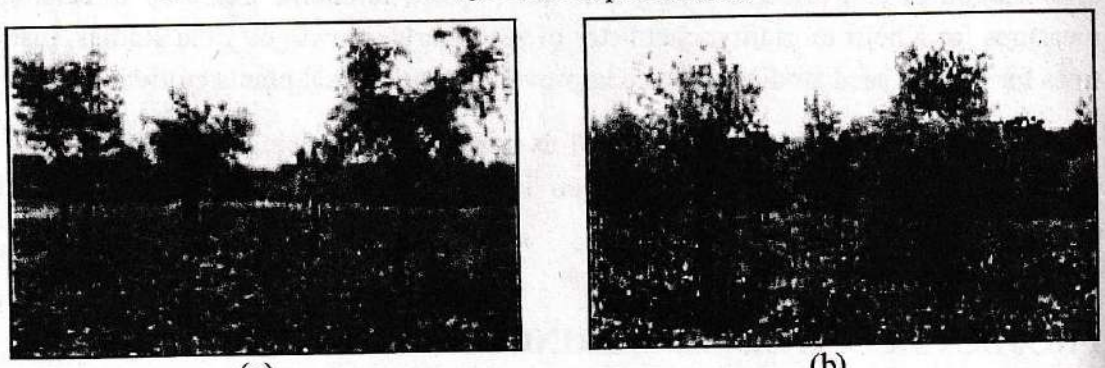
Significant Achievements:

Experiment 1. Effect of tree density on crop yields and plant growth in agroforestry systems :

Experiment was redesigned in different years by reducing tree densities from 1666, 833 and 417 trees per ha in 1991 to 417, 278 and 208 trees per ha in 1995 and further to 208, 138 and 104 trees per ha in June 2002. *Vigna radiata* was the agricultural crops in 2003 (Fig 1).

Findings:

- Crop yield reduction both at high and low tree density than the optimum one based on crop yield and resource depletion. Crop reduction varied from zero to 50% depending upon rainfall and tree density.
- Optimum density was 208 trees per ha at 9-12 years of tree age. Fruit yield of *P. cineraria* ranges from 350 –1040 g per tree at the age of 7 and 8 years. Utilizable biomass was 19.96 tones per ha including leaf fodder of 0.85 tones per ha at 12-year age. Therefore, *P. cineraria* and *T. undulata* could be grown at 208 trees per ha up to 12 years without significant reduction in agricultural production.



(a) (b)

Figure 1. Stand of (a) *P. cineraria* and (b) *T. undulata* at varying tree density with *Vigna radiata* as the intercrop in the Year 2003.

Experiment 2. Effect of different intercrops on yield and productivity of agroforestry systems

Various intercrops were *Vigna radiata* (mungbean), *Sesamum indicum* (sesame), *Cymopsis tetragonoloba* (guar) and *Cassia angustifolia* (senna). Different crop sequences adopted as the treatments were no crops (T_1), mungbean- mungbean (T_2), sesame- sesame (T_3), Mungbean – sesame (T_4), Senna- senna (T_5), Guar - Guar (T_6) and Mung + Sesame combined (T_7). Two blocks of tree species were for *Prosopis cineraria* and *Tecomella undulata*.

Findings :

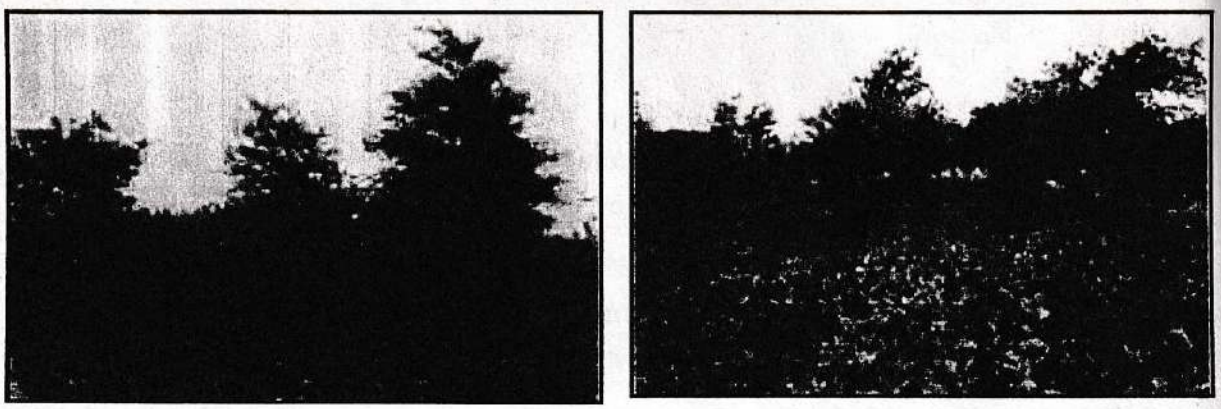
- *P. cineraria* was found less competitive than *T. undulata* in which agricultural production was 7-15% less. However, it is over compensated by values & usufructs if a farmer integrates *T. undulata* than *P. cineraia.*
- Pearlmillet was found more competitive with tree than mungbean as evidenced by reduction in tree incremental growth.
- Association of *Cassia angustifolia* with *T. undulata* was better in terms of yield of leaf than those in *P. cineraria.*
- Production of utilizable biomass was 21-32 tones per ha for *P. cineraria* and 17-30 tones per ha for *T. undulata* at 8 year of age

Experiment 3. Maximising food, fodder and fruit yield in Agroforestry in arid region

Experiment was laid out in a split plot design with three replications in 1994. There were three tree species viz. *Colophospermum mopane, Hardwickia. binata* and *Emblica. officinalis* with two treatments viz. (i) trees intercropped with agricultural crops in rotation; (ii) trees intercropped under a fixed intercrop (FC) with leguminous species (*Vigna radiata*). In addition to these, control plots of agricultural crops without tree were also laid.

Findings:

- *C. mopane* produced 3.0-4.0 kg dry fodder/ fuel wood per tree per year at 7-8 year age whereas fruit production ranges from 0.5 kg/tree at 5 to 1.25 kg/tree at 9 year age. Fruit yield was less when bajra (*Pennisetum glaucum*) or guar (*Cymopsis tetragonoloba*) was the intercrop. *C. mopane* extracts more soil water compared to *H. binata* and *E. officinalis*. A slightly less biomass was harvested from *H. binata.*
- Soil conditions indicated a Loss in SOC is less (3.2 to 35%) in agroforestry plots compared to that in control plot (56%) indicating benefits of tree integration in terms of carbon sequestration. *C. mopane* is more suitable for rehabilitation of degraded lands than its integration with agricultural crops under block plantation.
- *H. binata* and *C. mopane* are hardy to arid climate with deep penetrating root systems but *C. mopane* can be raised under site preparation and direct seeding with better survival. Facilitative effects of trees were more during dry period than in the good rainfall year.



(a) (b)

Figure 2. (a) *Vigna radiata* with *Hardwickia binata* and (b) *Colophospermum mopane* (right) in 2003 cropping season.

Project 2: Comprehensive Community Drought Preparedness Programme to Improve Quality of Life of Women and Children In Jodhpur District (AFRI-27/Silvi-3/UNICEF/2001-03) *Principal Investigator: H.C. Chaudhary IFS.*

Significant Achievements :

- Comprehensive survey of all the 3,278 community forests called *Oran, Gauchars, Parat, Agor etc. and* the village ponds located in Jodhpur District have been completed. Detailed physico-chemical analysis and nutrient availability assessment of the 700 soil samples collected from the representative community forests have been undertaken.
- Two days workshop on 'Development of suitable strategy for rehabilitation of Oran and gauchars in Rajasthan' have been organised during the year. Officials of the various developmental departments, research institutes at Jodhpur and NGOs gave deliberations in the workshop.
- One week training programme on PLA and micro-planning was organized for AFRI personnel, NGOs and cluster co-ordinators
- Micro plans for 15 villages located in three clusters of 5 villages each, were prepared in consultation with the local district administration which have been submitted to the UNICEF for funding

Data collected during the survey have been utilised in formulation of a special project on rehabilitation of community forests located in Jodhpur district in association DRDA which led to the launching of the '*Maru Gauchar Project'* with outlay of Rs. 100 crores, in the western Rajasthan from 2003-04.

Project 3: 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- Dr. Seema Kumar

OBJECTIVES:

1. To study outbreak if any, to survey, collect and identify pests of economic forestry importance and develop a reference collection of the same
2. To study the eco-biology and host range of important pests, to evolve eco-friendly integrated pest management strategies

Findings :

- Out of 53 tree species screened in different forest nurseries only 19 tree species exhibited insect -pest infestation whereas light to severe insect and non-insect pest infestation from was found in other tree species
- The important potential insect nursery pests include : one species of white grub, one species of cutworm, two species of sap suckers, twenty three species of defoliators, one species of shoot borer, three species of leaf miners and one species of gall producers
- *Microtermes* species was initially found, damaging the tree saplings but later on proved to be beneficial in breaking down the dead and decaying material, enhancing the soil nutrients
- The non-insect pests reported were two species of molluscs, one species of nematode, one species of mites and one species of rodents. Besides, outbreak of two non-insect pests and five insect pests were also recorded in different years
- Forest nurseries harbour a rich faunal diversity, cultural strategies of pest management is better alternative than to frequent use of pesticides

PROJECTS CONTINUED DURING 2003-2004

Project 1: Studies on the role of trees in reclamation of water logged area and their impact on soil [AFRI-29/FEDD-6/2002-2006].

Principal Investigator -Dr. N. Bala

Status: Two experiments have been undertaken under this project.

Experiment 1.: Transpirational capabilities of different species and their impact on soil at different age.

Eight study plots have been marked in plantations raised by the State Forest Department. Tree height and DBH recorded. Soil samples have been collected. Analysis of soil samples is in progress.

Experiment 2: **Performance of some *Eucalyptus* and *Casuarina* species under waterlogged condition**

The experimental area at 1357 RD, IGNP has been fenced. Raised bunds were prepared in the waterlogged area to enhance aeration and evaporation losses. Planting of eight species (*Eucalyptus rudis, E. camaldulensis, fastigata, saligna, grandis, Corymbia tesselaris, Casuarina glauca and C. cunninghamiana*) was done on the raised bunds. To avoid termite attack termiticide was applied (0.2 % Chloropyrophos). Initial watering was done for better soil root contact. Growth and survival data recorded in the month of December 2003. Survival was better in *Casuarina* species. However, Growth was better in *Eucalyptus salignaa* and was followed by *E. fastigata, E. camaldulensis, E. rudis, E. grandis, Corymbia tesselaris, Casuarina cunninghamiana* and *C. glauca.*

(a) **(b)**

Figure 3. (a) Raised bund and (b) planted seedlings of *Eucalyptus rudis* in a water logged area of IGNP

Project 2 : **Litter dynamics and soil changes during stand development in plantation forest. (AFRI-30/FEDD-5/2002-2006)** *Principal Investigator- Dr. N Bala*

Status

Litter plots have been laid at 76 places covering different species and age classes. Tree height and DBH have been recorded. Litterbags have been placed in the plots for decomposition study. Soil samples have been collected. Litter samples are being collected monthly. Analysis of litter and soil samples is in progress.

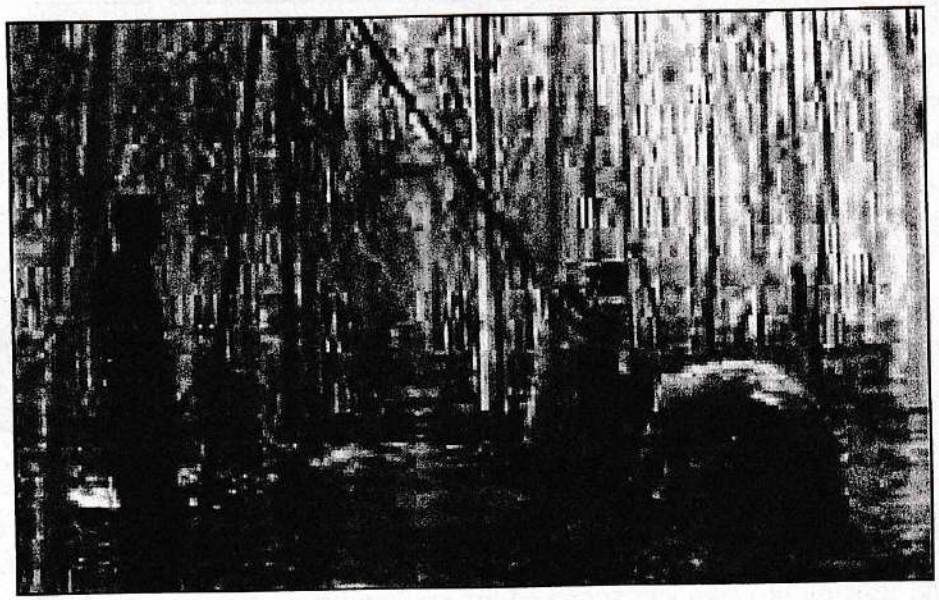


Figure 4. Collection of litter in *E. camaldulensis* plantation in IGNP area for nutrient dynamics studies.

Project 3 : Provenance trial on Arid Zone species (AFRI-16/FGTB-3/1992-2005)

Principal Investigator: Dr. C.J.S.K. Emmanuel.

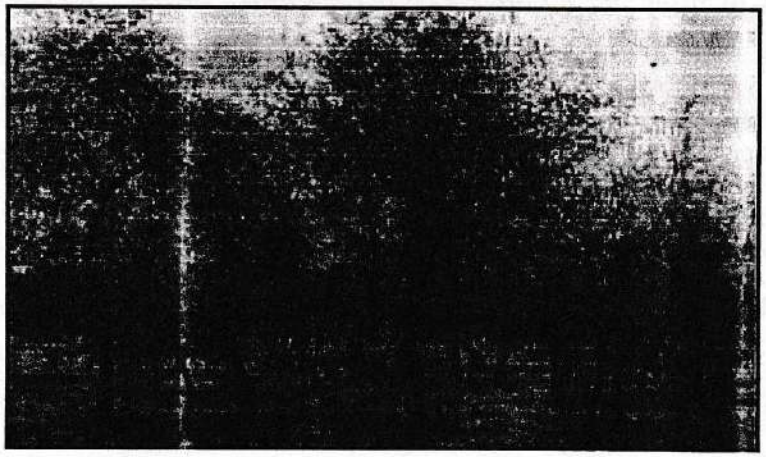
Status:

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 noticed after 36 hours at 2.00 pm in opened flower. Duration of stigma receptivity goes from 1 pm to 2.30 am.

National Provenance Trial of Neem

The data has also been recorded on the oil and azadiractin content of all the provenances. The promising provenances screened for azadiractin are Palanpur 0.93, 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 37.07 percent. The growth data recorded during 2003 shows that the promising provenances for height are Rewa (M.P.) - 6.62 meters, Palanpur (Gujarat) - 6.27 meters and Jaiselmaer (Rajasthan) - 5.59 meters. For girth Palanpur with 69 cms followed by Gurgaon with 53.12 meters and Kota with 52.60 cms.

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.



Provenance Trial of *Tecomella undulata*

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

[illegible] 4 : **International Neem Network Provenance trial. [AFRI-17/FGTB-2/1995-2005].** *Principal Investigator: Dr.C.J.S.K. Emmanuel*

[illegible]:

The International provenance trial on neem was initiated by the FAO Neem Network and [illegible] seeds were exchanged between the participating countries during 1995. The field trials have [illegible] laid out during the July - August 1996 at Jodhpur, Jaipur, Palanpur, Jabalpur, and [illegible]imbatore, with 18 provenances including control. At present the trial is continuing only at [illegible]odhpur, Jaipur and Coimbatore. The performance of the International Neem Provenance Trial [illegible] Jodhpur is good, though lot of mortality has been observed during this year due to severe [illegible]rought and low humidity in the atmosphere. The best performing provenances in the trial I for [illegible]eight are Annur (IND) 2.88m followed by Balharshah (IND) 2.79m, Ghatti Subramaniya [illegible]ND) 2.66m, The best performing provenances for girth are Annur (IND) 20.94cms followed [illegible]y Balharshah (IND) 19.82cms, Ghatti Subramaniya (IND) 17.01cms. In the Trial II also some [illegible]f the plants have died due to drought but the general condition is good and the best performing [illegible]rovenances for height are Sunyani (GHA) 5.26m followed by Myne(MYN) 4.74m, [illegible]ultan(PAK) 4.58m, Tibbi Laran (PAK) 4.53m and Chittagon (BAN) 4.74m. The best [illegible]erforming provenances for girth are Sunyani (GHA) 41.42cms followed by Myne(MYN) [illegible]7.38cms, Multan (PAK) 35.14cms, Tibbi Laran (PAK) 31.11cms and Chittagon (BAN) [illegible]4.25cms. At Jaipur the best performing provenances are Ramanaguda (IND) 2.92 m followed [illegible]y Mandore (IND) 2.66m and Jaipur (Control) 2.61 m.

[illegible]roject 5 : **Provenance trials on *Acacia nilotica* and *Ailanthus excelsa* [AFRI-18/FGTB-3/WB/1995-2005].** *Principal Investigator: Dr.C.J.S.K. Emmanuel*

[illegible]tatus:

ACACIA NILOTICA: provenance trial was laid out in the year 1992 with 28 provenances [illegible]ollected from major states of India. The trial has also been affected due to the prolonged [illegible]rought conditions in the state, some mortality has been observed in the trial. The data on [illegible]rowth parameter have been recorded and best performing provenances for height are [illegible]arlekhmundi 4.10m followed by Hastinapur 3.60m, Shivpuri 3.39m, and the lowest height was [illegible]ecorded in Akola 2.62m. The best performin provenances for girth are Parlekhmundi 30.15 [illegible]ms followed by Shivpuri 30.10cms, Solapur 29.42cms, Gurgaon 29.37cms and the lowest girth [illegible]as recorded from Manikpur 24.09cms. The studies on fodder value has also been conducted on [illegible]l the 28 provenances.

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 shows that the Control Jaipur (5.55m) was the best followed by Sonbhadra (5.16m), Mirzapur (4.44m) and lowest in height was Varanasi with 3.82m. The best performing provenances for girth are Control Jaipur 69.0cms followed by Mirzapur 58.5cms, Sonbhadra 55.62cms and lowest in girth is Varanasi 40.60 cms.

Project 6 : Multilocational trials of *Eucalyptus* and Dalbergia clones. (AFRI-31/FGTB-7/2002-2006).

Principal Investigator: Dr. U.K. Tomar

Status:

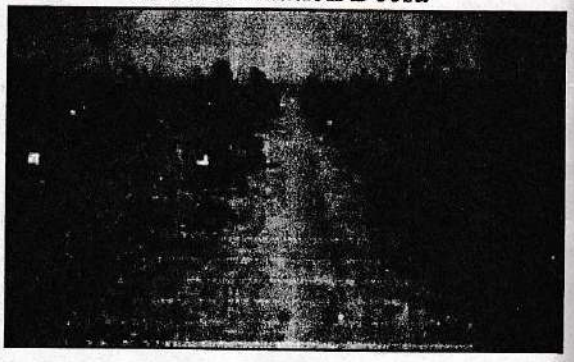
Multilocational clonal trial of *Eucalyptus camaldulensis* and *Dalbergia sissoo* is established in August 2003 at four different locations namely Deesa, Kheralu, Gandhinagar, Rajpipala in Gujarat state. These clones are superior germplasm selected under WB project and other sources. Number of clones, replications, spacing and design for both species is summarized in following table:

Species →	*Eucalyptus camaldulensis*				*Dalbergia sissoo*			
Locations ↓	Clones	Rep	Spacing	design	Clones	Rep	Spacing	design
Deesa	35	4	2x3 m	RBD	30	4	4x5 m	RBD
Kheralu	35	4	2x3 m	RBD	30	4	4x5 m	RBD
Gandhinagar	35	4	2x3 m	RBD	30	4	4x5 m	RBD
Rajpaipala	35	4	2x3 m	RBD	30	4	4x5 m	RBD

***E. camaldulensis* clonal trial**:

Research station Gandhinagar

Research station Deesa



Initial data recorded at the time of establishment (August 2003) and after six months (Feb, 2004). The survival % is good at Deesa and Gandhinagar. However, survival % is relatively poor at Kheralu and Rajpipala due to some biotic and abiotic factors. Remedial measures have been suggested to concern officers and field staff.

Preliminary observations recorded (height and girth) after six months on *E. camaldulensis* clonal trials indicate that clone no 6,7,71.72,93,271 and 1002 are performing better on the basis of height and girth taken into account. However, *D. sissoo* is relatively slow growing species is not worth ranking them on six months data. Work is in progress to establish Multilocational trial of both species in Rajasthan state this year (1994-1995).

Project 7 : Micropropagation of an Important Medicinal Plant of the Arid and Semi-arid regions–*Commiphora*". (AFRI-32/FGTB-8/2002-2006).

Principal Investigator : Dr. Tarun Kant

Status:

Experiments involving two kinds of pathways are underway with the final aim of in vitro mass multiplication of *Commiphora wightii*. The first pathway involves callus induction followed by organogenesis and/or somatic embryogenesis while the second one involves direct micropropagation from either apical or lateral bud break from stem segments.

Good callus induction from many explants namely leaf, stem segments, cotyledons, apical-bud have been achieved. Callus induction has been achieved on MS medium supplemented with different auxins out of which 2,4-D and NAA have given best response. Though the problem of browning up of callus after two weeks of culturing has been encountered. This seems primarily due to the leaching of phenolics from the cultured tissue. Experiments to curb these problems are underway and some encouraging preliminary results have been achieved using chilling anti-oxidant treatment of explants and with the use of activated charcoal in the medium. Experiments using combinations of auxins and cytokinins to trigger organogenesis (shoot morphogenesis) are underway.

Apical buds and *in vitro* raised cotyledonary nodes have given the good response in terms of bud break. A maximum of up to six micro-shoot regeneration from single cotyledonary node has been achieved and further experiments are underway to further increase the efficiency of the same. Preliminary round of rooting experiments has been initiated.

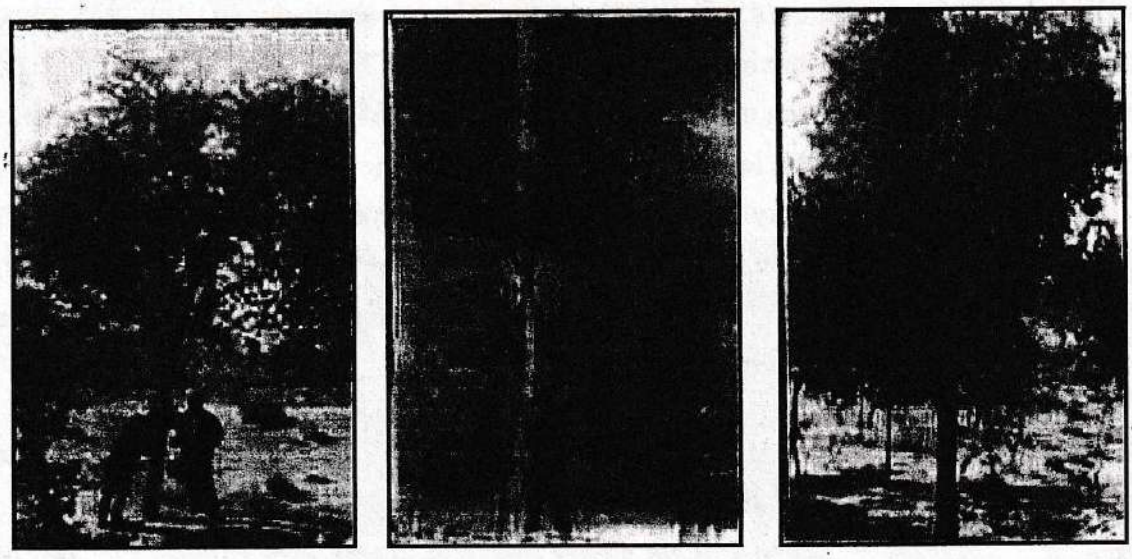
Project 8 : Genetic Improvement of T*ecomella undulata*.(AFRI- 33/FGTB-9/2002-05)

Principal Investigator: Dr. C.J.S.K. Emmanuel

Status:

Survey conducted for availability of candidate plus trees (CPTs) in different areas. Selected 30 CPTs in the irrigated tract of IGNP canal area from the plantation raised in 1987 and 35 CPTs in the unirrigated areas in the Farmers Field. The data has been recorded for the total height, clear bole d.b.h., and the colour of the flower. The tree bears yellow, deep red and orange colour of flowers. The clear bole percentage was calculated over the total height of the CPTs selected, the maximum clear bole over the total height was recorded 46.5 per cent and minimum 17.9 per cent. The number of trees in each range of the clear bole percentage over the total height is presented below:

S.No.	Range in percentage		No. of trees
	From	To	
1.	17.9	20	5
2.	21	25	3
3.	26	30	7
4.	31	35	6
5.	36	40	4
6.	41	45	2
7.	45	46.5	3



Photographs of the CPTs selected

Project 9: Screening of high oil and azadirachtin in Neem (AFRI-34/FGTB-10/2002-05)

Principal Investigator: Dr.C.J.S.K. Emmanuel

Status:

Clonal material from High oil and azadirachtin yielding CPTs (32 CPTs) has been raised and is ready for laying out field trial in the coming monsoon season. Twelve hectares of progeny trials of summer and winter flowering CPTs at AFRI, Jodhpur and high azadirachtin and high oil CPTs at Govindpura Jaipur are being maintained. Data on growth parameters of high Az and high oil CPT's progenies have been recorded.

Project 10 : "Identification of mortality factors of *Prosopis cineraria* and development of suitable management strategies" [AFRI-26/FP-3/2001-2005]

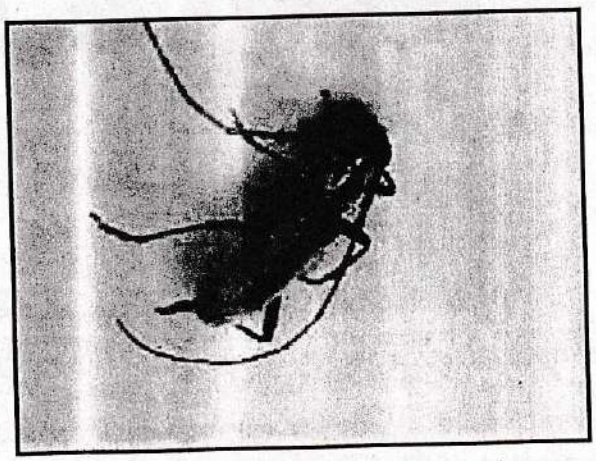
Principal Investigator: Dr. S.I. Ahmed

Status:

A. Entomological observations and findings:

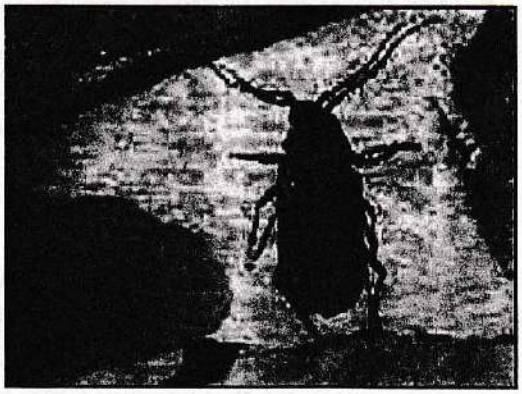
The extensive surveys on the Khejri mortality in North- west Rajasthan have been taken up and the observations on various biotic and abiotic aspects are being initiated during January 2003. Data on the following aspects have been collected in order of evolving possibilities of finding out the responsible causes for the mass scale mortality of *Prosopis cineraria* in northwestern districts of Rajasthan.

1. Biotic stresses: Data on Insect pest and disease problems.
2. Abiotic stresses: Data on lopping intensity and interval; water table depletion in study areas; surface water exploitation through tube wells; change in agricultural practices.



Derolus iranensis- Khejri shoot borer

Out of 859 total localities in four districts viz., Nagaur, Sikar, Churu, and Jhunjhunu, 140 localities have been selected for the 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, all the 16 sites have been surveyed and data have been collected.



Khejri root and shoot borer, *Aelesthes holosericea* Fab.

Several samples of The insect borers viz., *Aeolesthes holoserecea* Feb, *Derolus iranensis (discicollis)* Gahan and *Hypoeschrus indicus* Gahan alongwith infested materials of Khejri trees have been collected. The insect specimens got identified from Forest Research Institute, Dehradun. Studies on the bionomics of potential insect borers vis., *Derolus iranensis* and *Aeolesthes holoserecea* Feb, is in progress. Studies on the collection and identification of plant pathogens and preparation of a checklist of potential pathogens infecting *P.cineraria* is in progress.

Boring larvae of *Acanthophorus serraticornis*, infesting Khejri root and shoot system

Maximum percentage of Khejri mortality in the four northwestern districts of Rajasthan *viz.*, Nagaur, Sikar, Jhunjhunu and Churu has been recorded as being 36.52, 38.87, 42.78 and 26.08 respectively. The mortality percentage is being correlated with the other biotic (pests and

Root treatment of infected khejri tree at Basuwa(Sikar)

Following studies have been initiated and in progress to study the impact of biotic and abiotic stresses on the Khejri mortality in Rajasthan:

- Studies on the bionomics of potential insect borers with particular reference to *Derolus iranensis (=descicollis)*.
- Studies on the collection, identification, augmentation and updating of checklist of insect pests of *P.cineraria* with particular reference to the insect borers.
- Studies on the collection and identification of plant pathogens and preparation of a check-list of potential pathogens infecting *P.cineraria.*
- Studies on the interaction of various abiotic factors with khejri mortality.
- Laboratory analysis of 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 Khejri mortality.
- Laboratory analysis of the physical and chemical quality of water samples are being collected from the various study areas.

3. Pathological observations and findings:

The high incidence of mortality in Khejri trees was noticed in agroforestry as compared to trees grown in undisturbed land *i.,e.*Oran and Gochar lands at Salasar Tahsil, Sikar District. Deep ploughing with tractor (adopting modern agricultural practices) resulting lateral roots injury and subsequently attacked by soil borne pathogens like,*Fusarium sp., Rhizoctonia solani* and root borers may be a causative factor of Khejri mortality in Sikar.

diseases) and abiotic (soil and water quality, water table depletion, lopping intensity and interval use of ploughing implements and status of hardpan etc.,) factors.

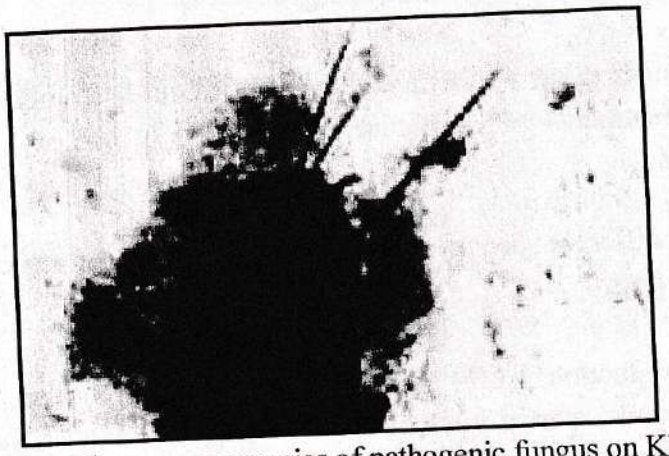
Hypoeschrus indicus Gahan, Khejri shoot borer

Collection of various relevant abiotic factors viz., soil, water and studies on their interaction with the khejri mortality is in progress. Studies on the 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.

Field experimental trial : A field experimental trial for the management of Khejri mortality has been laid out at Basuwa in Sikar district during January, 2004 in order to test the relative efficacy of different treatments for the management of infected Khejri trees.The experiment was laid out in randomized block design (RBD) with seven treatments. The treatments were taken with different combinations of fungicides, insecticides and growth regulators. The lopped branches were pasted with AFRI, paste (a modified chaubattia paste). The diseased samples were analysed in the laboratory and *Colletotrichum* sp, was isolated and identified.

Shoot treatment of infected khejri tree with AFRI paste

samples of Khejri (*P.cineraria* L.Druce.) were anaysed in the laboratory and two species of *Fusaium* and *Rhizoctonia solani* were isolated and identified. All the three pathogens are wilt and root rot causing pathogens which enters through roots damaged by mechanical insect injury.



Colletotrichum, a new species of pathogenic fungus on Khejri

3. The pathogen , *Colletotrichum* sp. was found associated with diseased branches of Khejri from Sikar.

4. The root samples of Khejri (*P.cineraria* L.Druce.) were anaysed in the laboratory and two species of *Fusaium* and *Rhizoctonia solani* were isolated and identified. All the three pathogens are wilt and root rot causing pathogens which enters through roots damaged by mechanical insect injury.

5. 37 Khejri infected wood samples collected from various localities were analysed in laboratory and nine various fungal species viz., Mucor sp,s Rhizoctonia stolonifer, Aspergillus flavus, Aspergillus niger,Aspergillus niveus,*Aspergillus ochraceus,Fusarium* sps white mycelium with slightly pinkish with exudation,*Fusarium* sps purplepinkish mycelia with black colour exudation, *Fomes species*.were isolated and identified.

Project 11 : Studies on improving tree productivity of *P.cineraria* through VAM/Biofertilizers. (AFRI-36/Silvi-8/2002-06)

Principal Investigator: Dr.K.K. Srivastava.

Status:

1. VAM population studies showed that maximum number of propagules were isolated from agro-forestry plantation of *P.cinearia* at Sikar and minimum from Churu.

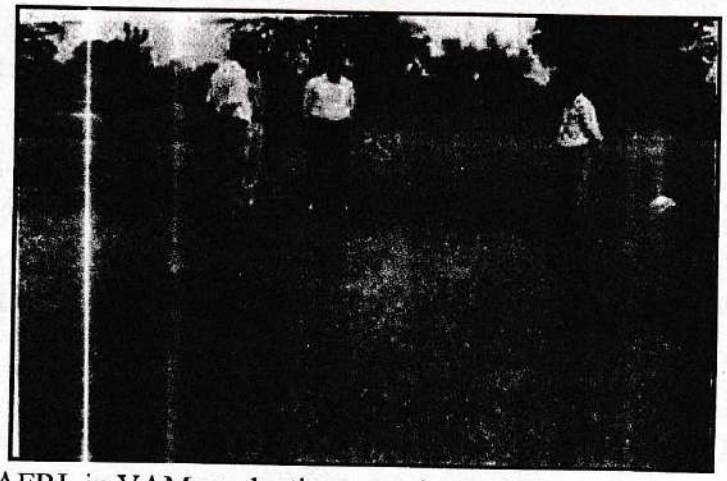
2. *Glomus fasciculatum* and *G.aggregatum* were found dominant genera. *Scutellospora* and *Sclerocystis* were less in number.

3. Maximum spore population was recorded 0-10 cm depth of soil and gradually decreasing in deeper layers.

4. Nursery experiment on biofertilizer *P.cineraria* has been laid out in Completely Randomised Design (CRD) with eight treatments with different combinations of bacterial biofertlizers and VAM. and three replications.

5. The inoculum containing different species of VAM fungi brought from IFGTB, CBE. were maintained in vermiculite in pots.

6. VAM inoculum production of five different species of VAM fungi (indigenous and non- indigenous) started in sterilized vermiculite at Model Nursery, Jodhpur and TRC, Gandhinagar (Gujarat).



Visit of Director, AFRI, in VAM production experimental site at TRC,Gandhinagar

7. The stock culture of five bacterial biofertilizers including *Rhizobium, Azospirillum* and *Bacillus* sp. were maintained in suitable media for further experimental purpose.

Project 12 : Studies on seed quality improvement in respect of various tree species of arid and semi-arid areas. (AFRI-35/Sil-7/2002-07)

Principal Investigator: Dr. D.K. Mishra

Status:

Neem seeds physiologically mature green, greenish yellow and yellow fruits showed more than 90% germination. However, in storage, seeds from yellow green fruits performed better.

Seeds of *Capparis decidua* 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.

Seeds of *Dalbergia sissoo* collected from various agro climatic regions were stored at four moisture levels (14.6%, 11.3%, 6.8% and 5.6%) at room temperature and low temperature.

Seeds of *Ailanthus excelsa* were tested and stored at two moisture levels and room and low temperature. Other seed testing work is continued.

Seeds of Cassia angustifolia were collected from three places (Bikaner, Jodhpur and Coimbatore) and were compared with respect to seed qualities.

Project 13 : Market survey on selected species AFRI-24/FRME-2/1994

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 14 : Stand dynamics of some important tree species of Gujarat. [AFRI-25/FRME-3/2001-2006].

Principal Investigator: Dr. V.P. Tewari

Status:

Annual measurements carried out in 30 sample plots of *E. hybrid* and 19 of *A. nilotica* laid out in Gujarat State during last year. Seven new plots (4 of *E. hybrid* and 3 of *A. nilotica*) have been laid out in Bharuch division. 169 sample trees of *E. hybrid* and 98 of *A. nilotica* felled for volume estimation. A database consisting of measurements of 167 logs collected from the felled sample trees of *E. hybrid* and *A. nilotica* was used to compare the predictive ability of Bruce's formula, Huber, Smalian, Newton, Sorenson, subneiloid and two-end conic methods for estimating butt log volumes. The MSE showed that Bruce formula performed better compared to other models as far as composite effect of accuracy and precision is concerned. Analysis of data indicated that there was a significant relationship between large end diameter and percent

error in estimating log volume. The error increased with increasing large end diameter for all the formulas. Data processing and plot computations have been completed which include information on stems/ha, BA/ha, Dominant height, average height and quadratic mean diameter of the trees in the plots, volume/ha etc.

Project 15 : 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 eight experimental trials exist at the salt affected area of Gangani in Jodhpur district laid out in different years (from 1997 to 2003) out of which Experiment-1 & 4 are concluded this year .

Experiment 1:

Trial on *Atriplex lentiformis* was laid in 1997 with three levels of gypsum: Control (G_0), Gypsum @ 100 % soil GR (G_1), and Gypsum @ 150 % soil GR (G_2) and six nitrogen levels: 0 (N_0), 20 (N_1), 40 (N_2), 60 (N_3), 80 (N_4), 100 (N_5) g of urea leading to 18-treatment combinations. This trial was concluded in August 03. The final survival was ranging from 44% to 83% in different treatments. Data analysis revealed that overall treatments were not influencing the survival but G_2 treated bushes recorded 11% more survival as compared to G_0 &G_1 levels. The green biomass yield was ranging from 1tha-1 to 3.2 t ha-1 in different treatment. In general G_1combinations recorded higher biomass but 36g N (80g urea) dose recorded maximum biomass in every gypsum level respectively

Experiment 2:

Trial of Salvadora persica was planted in 1997 with two levels of gypsum (control and 100 % soil GR) and four levels of nitrogen (0, 20, 40 and 60 g of urea). After 60 months Salvadora persica, maintained 85.2 to 66.7 % survival in different treatments despite deficient rainfall conditions. Treatments positively influenced the growth; T_6 (gypsum + 9g N) was the best treatment attaining 201 cm of height and 172 cm of crown diameter, which was 41 % and 35% more than the untreated plants. The above ground biomass study revealed that T_6 treatment produced 12.0 kg/tree of fresh biomass followed by 10.7 kg and 8.8 kg in T_8 (gyp + 27g N) and T_2 (9 g N) respectively which was 71%, 53% & 27% more than the control (untreated plants).

Crescent shaped drainage trenches for individual plants helped in plant establishment and growth as it served the dual purpose of leaching of salts and water harvesting as well. The site has shown substantial improvement in soil status (reduction in soil pH and electrical

conductivity and improvement in percent organic carbon content) during the study period. Protection and plantation activities promoted the natural regeneration and the number of plant species increased gradually. Weed evaluation in Aug 03 showed that Chloris virgata was the dominant grass species with 231 g m^{-2} dry biomass production.

Experiment 3:

Acacia ampliceps was planted with and without gypsum in Sept 1998 on highly degraded soil. After the worst drought in 02-03, species suffered with some casualties (more on shallow soil area) and now the overall percent survival was 58.4(-15%) for control and 69 (-9%) for gypsum treated trees on deeper soil as compared to 48 (-27%) for control and 51(-24 %) for gypsum treated trees on shallow soil area. This year there is almost no increase in height both on deep as well as shallow soil, in case of crown diameter there was increase of 10 % on deeper soil areas only. Soil depth influenced the biomass production also and the biomass estimation of 12 trees carried out in Nov 2003 showed that green biomass yield difference was more than two fold (12 kg/tree to 5.43 kg/tree for gypsum treated and 8.1kg to 3.9 for untreated trees). This year flowering initiated 20 days early (due to normal monsoon) in 65 and 27 % plants on deep and shallow areas but the seed setting was only in 7.5 % and 16% plants respectively.

Experiment 4:

A trial of A. *lentiformis* was planted in August 1999 on double ridge mound with three levels of gypsum: control (G_0), half gypsum requirement (G_1) and full gypsum requirement (G_2). Three doses of nitrogen 9, 18, 27 g of N from two nitrogen sources, Urea and calcium ammonium nitrate (CAN) were applied in August 2000. Survival of *A. lentiformis* on double ridge mound ranged from 22% to 78 % in different treatments in August 03. Analysis of variance showed that there is no effect of either gypsum doses or nitrogen application on survival. Weed evaluation carried out in Sep 03. Due to normal rainfall salt tolerant grasses mainly *Sporobolus sp, Chloris virgata and Dactyloctenium spp* dominates. An average of 284.6 g m^{-2} dry biomass was available from the experimental area.

The trial is concluded in August 03 but the bushes are maintained as seed source.

Experiment 5:

An experimental trial of *A. amnicola* was laid out in August 2000 with three planting treatments (double ridge mound S_1, elevated slope planting S_2 and simple bund planting S_3) with full gypsum requirement G_1 and control G_0. Treatment combinations were T_1= S_1 Go, T_2 = S_2G_0, T_3 = S_3G_0, T_4 = S_1G_1, T_5 = S_2G_1, T_6 = S_3G_1. In spite of severe drought the survival varies from 80.6% to 61.4% in different treatments. Height and crown diameter (77 and 117 cm) was

maximum on Double Ridge Mound followed by bund planting and Single ridge mound for control and gypsum treated bushes. Treatments significantly influenced the height (p-0.03) and crown diameter (p0.05) but it was largely due to less growth on single ridge mound (SRM) indicating that on sandy soils this structure is not very suitable. Biomass was estimated in August 2003 and 2.2 to 2.4 t/ha green biomass was obtained on DRM and simple bund structures while it was 0.98-1.4 t/ha on SRM.

Experiment 6:

Trial was laid with 3 salt tolerant species namely *A. lentiformis, A. stocksii* and *Sueda nudiflora* and three planting techniques. *Sueda nudiflora* adapted well to the dry land stress& salt conditions. It was the best species recording nearly 100% survival, attaining max. growth and biomass in all the three planting treatments(Double ridge mound(DRM), Circular dished mound(CDM) and control) followed by *Atriplex lentiformis. Atriplex stocksii* was poorest performer.

S.nudiflora produced maximun total dry biomass on all the three structures (2.16 tha^{-1} on DRM, 2.25 tha^{-1} on CDM and 1.09 tha^{-1} on control followed by *A.lentiformis* (1.18 tha^{-1} on DRM, 1.30 tha^{-1} on CDM and 0.23 tha^{-1} on control). *Atriplex stocksii* produced minimum biomass (1.13 tha-1 on DRM, 0.72 tha-1 on CDM and 0.26 tha-1 on control) Overall DRM was the best planting practice producing maximum 1.49 tha^{-1} mean dry biomass, closely followed by CDM (1.42 tha^{-1}) while control was poor third with 0.53 tha^{-1}

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 (46%) and control (23.8%) after 24 months of planting surviving the worst drought. Species wise *Acacia colei* showed better survival than *Azadirachta indica*. Height of both the species and crown dia of *A.colie* was not significantly influenced by the structures, but crown dia of *A.indica* was significantly influenced by structures with CDM recording the maximum crown dia.

Experiment 8:

A new experimental trial was laid in August 2003 with two fodder species namely *Zizyphus mauritiana* and *Colophospermum mopane*. The trial was laid with two levels of gypsum (0 and 100% soil G.R.) and three doses of nitrogen (0, 9 and 18 g of N in the form of

two modes of planting (control and circular dished mound). Fertilizer treatments were in Dec 03. Survival of *Z. mauritiana* and *C. mopane* was 89 & 95% on CDM and 86 & % under control after six months of planting.

control measures: Experimental area suffered with serious rodent problem. Periodic control measures were applied.

Project 16 : 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:

On basis of literature and field survey two species have been selected for the study : *Calotropis procera* and *Boerhaavia diffusa.* It was proposed to work on flowers and roots of these species respectively. Flowers of *Calotropis procera* have been collected for two seasons. These have been extracted over Soxhlet with different solvents. The preliminary examination of these extracts has shown the presence of steroids and absence of flavonoids. Thin layer chromatography is in progress for determination of various components.

Project 17 : 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:Dr. S.H. Jain

Status:

Acacia nilotica (Babool), *Acacia tortilis* (Vilayathi babool), *Acacia senegal* (Kumta), *Azadiracta indica* (Neem), *Ailanthus excelsa* (Aradu), *Prosopis cineraria* (khejri), *Prosopis juliflora* (Vilayathi kikar), *Eucalyptus* (Safeda).have been identified as potential to under take study on post harvest technologies and value addition by chemical/ preservative treatment to make them suitable for use in the handicraft industry.

Wood logs of *Acacia tortilis* (Vilayathi babool), *Prosopis cineraria* (khejri), *Prosopis juliflora* (Vilayathi kikar) have been procured from experimental fields of AFRI for further seasoning and treatment.

IWST Bangalore is collaborating on this project.

Project 18 : Transfer of technology on forestry through training and demonstration (AFRI-38/SF-1/2002-2006) *Principal Investigator: Dr. S. Mohan*

Status:

An Extension and Interpretation Centre is being established. Civil works, display boards, backlight printing board, metallic folding photo album and laminated photographs, etc depicting the research activities of the institute are completed.

Project 19 : 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:

The detailed questionnaire for socio-economic status and present status of Joint Forest Management committee were prepared. 39 JFM committees (28-Rajasthan & 11 –Gujarat) villages have been covered and the sampling survey have been completed. The committee members & villagers were interviewed and information regarding JFM Committees were collected.

Project 20 : 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.

PROJECT INITIATED DURING THE YEAR 2003-2004

Project 1: Identification And Screening Of Some Suitable Nitrogen Fixing Species of Dry Region For Their Utilization In Improvement Of Soil Fertility And Biomass. (AFRI -41./ FEDD –6 /2003-2007) *Principal Investigator- Dr. S.P.Chaukiyal*

Status:

Alysicarpus longifolius, Crotalaria burhia, C. meticaginea, Indigofera ungentea, I. I.sessiliflora, Clitoria ternatea, Mucuna prurience, Mimosa hamata and *Rhynchosia* were selected for soil enzymes and soil nutrients estimation. Enzyme activity was ficantly higher near the root zone of these species as compared to that in control. Seeds of *ngifolius, C. burhia, I. ungentea, I.sessiliflora, C. ternatea, M. prurience, M. hamata* and *R.* were collected for sowing and further assessment. Analysis of collected soil samples for nutrient is in progress.

Project 2. Screening Different Phenotypes of *Dalbergia sissoo* and *Acacia nilotica* For Their Tolerance To Salinity and Sodicity (AFRI-42/FEDD-7/2003-07)

Principal Investioigator Dr. Pramod kumar

Status:

Site for the experiment has been selected in Tharad range of Banaskantha Forest Division, Gujarat. Plus trees of *Acacia nilotica* and *Dalbergia sissoo* have been identified from affected area. Seeds of D. sissoo have been collected and raising of seedlings is in progress.

Project 3: Survey of sandal population in Rajastan and Gujarat states and evaluation of heartwood content and oil content. (AFRI-44/NWFP-6/2003-2007).

Principal Investigator:Shri S.H. Jain

Status:

A survey has been carried out for sandal population in Udaipur, Rajasmand, Chittorgarh, Pratapgarh, Sirohi, Banswara, Dungarpur, Jhalwar, Ajmer, Jaipur and Karoli forest divisions. It is found that population is depleted, but some stands still exist, very good population of sandal found in Haldighati forest of Nathdwara range and Bhavarmatha block in Pratpghad range. Sandal is grown in association with other host species like *Acacia nilotica, Acacia catachu, Acacia senegal, Prosopis cineraria, Prosopis juliflora* etc. The regeneration is mainly through the dispersal of seeds by birds; farmers along the fencing of agricultural land normally protect seedlings germinated from bird-droppings. Artificial regeneration is also being done by dibbling seeds in the bushes and pits or sowing on mounds in trench or raising seedlings in nursery.

Trees of girth class above 30 cm are missing in the natural forests due to illicit felling, well-grown trees are found mainly in protected areas. The oil content of the heartwood varies from tree to tree and is higher in older trees. The oil content in trees of Rajasthan varies between 0.9 to 3.0 %.

Project 4: Development of Suitable Multi-Tier Farm Forestry Models In IGNP Command Area. (AFRI-40/SF-2/2003-2007).

Project Investigator: Dr. S. Mohan

Status:

On visiting of four available sites, the best suitable site at 155 RD CharanWala Branch was finalized. The status of land is forest land and temporary allotment of site has already been made by CCF (IGNP) Bikaner to carry out the project. The activities like collection and analysis of initial soil samples, raising of nursery of medicinal plants and other species are being taken up.

EXTERNALLY AIDED PROJECTS

Project 1 : Development of Silvipasture Model for *Maru Gaucher Project* suitable for Arid & Semi Arid Region of Rajasthan (AFRI-45 / Silvi-9 / MGP/ 2003-06).

Principal Investigator- H.C. Chaudhary

Status:

The silvi-pastoral rehabilitation of *orans* and *gauchars* at two sites (each having area of 16 ha) are being developed with the concerned gram panchayats at :

- Tulesar charnan
- Ostra

Planting of grasses with shrubs and trees yielding high quality fodder will enhance the fodder productivity of the area and will ensure the fodder availability during scarcity period. The grasses, shrubs and tree species planted in the models are:

Grasses: Sevan (*Lasiurus sindicus*) , Dhaman(*Cenchrus ciliaris*), Anjan (*Cenchrus setigerus*), Bhurat (*Cenchrus biflorus*).

Shrubs: Bar bor (*Zyzyphus mauritiana*), Jhar beri (*Zyzyphus numularia*)

Trees: Khejri (*Prosopis cineraria*), Mopane (*Colophospermum mopane*), Ardu (*Ailanthus excelsa*), Kumat (*Acacia Senegal*).

Project 2 : 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.
- 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 3 : Raising of Arboretum cum Botanical Garden for Native Flora of Rajasthan. (AFRI-34/Silvi-6/2002-06) *Principal Investigator: Shri K..K.. Chaudhuri*

Status:

- Pitting completed and planting of 230 native tree species of Rajasthan is in progress.
- Seedlings of 78 tree species have already been planted
- Seedlings for the another 20 species are being raised at nursery
- Work for the seed collection in respect of the remaining species in under progress
- Underground pipeline network and construction of mist chamber is in progress.

Project 4 : 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:

- 301 units/traders of 15 Districts associated with medicinal plants have been surveyed and information received from them have been entered and analysed.
- The annual requirement of medicinal plants of Jaipur was highest followed by Jodhpur and Ajmer and Banswara has lowest requirement.
- Emblica *officinalis* Gaertn. followed by *Cassia angustifolia* Vahl. and *Mangifera indica* Linn. were highly traded. Senna seed procured from Jodhpur, Bikaner and Coimbatore was intercompared for seed weight, number of seeds per kg and presence of green and yellow seeds. Silvicultural trial is in progress.
- Germplasm bank has been established with 150 medicinal plants and field trials on guggal are being executed.

Project 5 : Study of Characteristic Features Pertaining to Bio-drainage Potential of Some Selected Tree Species. *Principal Investigator- N. Bala*

Status

The Ministry of Water Resources, Govt. of India, has sanctioned the project for Rs.45.36 lakhs. Administrative approval and intimation regarding release of Rs. 19.19 lakhs has been received vide letter no. 21/73/2004-R&D/445-457 dated 4th March 2004. Funds are awaited.

Research Achievements State wise under Institutes jurisdiction

Name of State	No. of Projects completed in 2003-04	No. of Ongoing Projects in 2003-04	No. of Projects initiated in 2003-04
Rajasthan	3	19	3
Gujarat	-	1	1

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.

- Indeginous and exotic species *Atriplex lentiformis* and *Acacia amliceps* screen out with afforestation technology on salt affected lands. Seeds of these species with afforestation technology were supplied to State Forest Department Gujarat & Rajasthan.

- VAM production facility was developed at TRC, Gandhinagar, State Forest Department, Gujarat. Demonstration for preparation of VAM inoculum containing five different combinations of species of VAM fungi Viz., *G. fasiculatum*, *G. microcarpum* and *G. aggregatum* including Consortium inoculum was given to the field officers.

Education & Training

(a) **Education**

Ph. D Thesis Awarded by FRI, Deemed University on

1. Seed Source Variation And Reproductive Biology Of *Azadirachta indica* A. Juss." To Shri. Somendra Sharma Under the supervision of Sh. C.J.S.K. Emmanuel, Head, FGTB Division, AFRI Jodhpur.

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

I. International

Sh. K.K.Chaudhuri, IFS attended two months short-term study and research visit (from 15th Aug. 2003 to 14th Oct. 2003) under DAAD fellowship at the Institute of Forestry, University of Goettingen (Germany) and worked on " Nursery technology".

Research Achievements State wise under Institutes jurisdiction

Name of State	No. of Projects completed in 2003-04	No. of Ongoing Projects in 2003-04	No. of Projects initiated in 2003-04
Rajasthan	**One**	**Nineteen**	**Three**
Gujarat	-	**Five**	Two

Technology Assessed and Transferred

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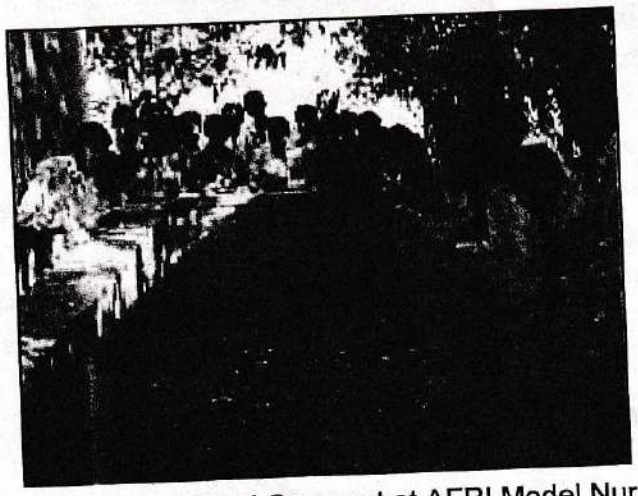
Sh. K.K.Chaudhuri, IFS attended two months short-term study and research visit (from 15th Aug. 2003 to 14th Oct. 2003) under DAAD fellowship at the Institute of Forestry, University of Goettingen (Germany) and worked on " Nursery technology".

II. National

Dr. Sunil Kumar attended an advance course on "Criteria and Indicators for sustainable forest management" from 13th -17th Oct.2003 at Bhopal organized by Indian Institute of Forest Management.

(c) Trainings Imparted by Institute:

Organised 5 days & 3 days training programme on Integrated Watershed Management to the cluster members, SHGs and farmers from Sangod & Kherabad Pnachayat samities (Kota), Phalodi (Jodhpur) and Indergarh (Bundi).
As a multidisciplinary approach of watershed management, in puts on Nursery & plantation techniques, biofertilzers, agroforestry models, moisture & soil conservation techniques, horticulture, on animal husbandry, pasture management, were also given by the resource persons from the institute and outside both.



Demonstration on Vermi Compost at AFRI Model Nursery

Participants during technical session

CEO Zila Prishad, Jodhpur addressing the participants

(d) **Educational Visits:**

1. Students of B. Sc. (Forestry) from Dr. Y.S. Parmar University of Forestry and Horticulture, Solan on their study tour on 2nd April 2003.

2. Study tour of *IFS Probationers* on 19th July'2003.

3. Study tour of Forester & Beat Guard class of Haryana State on 29.08.2003.
4. Range officer Trainees of SFRC Coimbatore on study tour to the institute from 8 - 10th October'2003 .

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. *Ahmed.S.I* and Shivesh Kumar (2002). Role of Environmentally Acceptable Entomopathogens in *Forest Insect Pest Management. In Modern Trends in* Environmental Biology. *CBS Publishers New Delhi*
2. 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.
3. K.K.Srivastava ,S.I.Ahmed and D. Thangamani for inclusion in Dr.K.Bagchee Submitted a chapter entitled "Biostresses on arid and semi-arid tree plantations and their possible management strategies" to be published by Forest Pathology Division ,FRI, Dehradun.
4. Srivastava,K.K.and Y.C.Tripathi (2004) Potential of phytochemical in controlling pathogenic mycobionts. Chapter submitted in book on "Forest conservation and Management in challenges of the millenium. (eds.D.Reddy,B.P.Dabral,Vinai Singh and K.K.Sood.)pp 594-612.

B} Research Papers in Scientific Journals

International

1. M. Bhati and G. Singh (2003). Growth and mineral accumulation in *Eucalyptus camaldulensis* seedlings irrigated with mixed industrial effluents. *Bio Resource Technology*, 88(3): 221-228.
2. Bilas Singh and G. Singh (2003). Biomass partitioning and gas exchange in *Dalbergia sissoo* seedlings under water stress. *Photosynthetica*, 41(3): 407-414.
3. G. Singh and M. Bhati (2003). Mineral element composition, growth and physiological functions in *Dalbergia sissoo* seedlings irrigated with different effluents. *J. Environ. Sci. Health Part* A 38: 2679-2695.
4. G. Singh and M. Bhati (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*, 26: 2469-2488.

5. G. Singh, N. Bala, T. R. Rathod and S. Chouhan (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*. 30(4): 353-363.

6. G. Singh (2004). Influence of soil moisture and nutrient gradient on growth and biomass production of *Calligonum polygonoides* in Indian desert affected by surface vegetation. *J. Arid Environment* 56(3): 541-558.

National

1. G. Singh, N. Bala, V. Kuppusamy and T.R. Rathod (2003). Adaptability and productivity of *Cassia angustifolia* in sandy soil of Indian Desert. *Indian Forester*, 129(2): 213-223.

2. N. Bala, G. Singh, P. Kumar and A.K. Sinha (2003). Role of forest in carbon sequestration. *Indian Forester*, 129: 799-806.

3. G. Singh, N.Bala, K.K. Chaudhuri and R.L. Meena (2003). Carbon sequestration potential of common access resources in arid and semi-arid regions of northwestern India. *Indian Forester*, 129: 859-864.

4. P. Kumar, G. Singh and N.K. Bohra (2003). Socio-economic status-A tool to assess the impact of forestry programmes. *Wasteland News*, 18(4): 31-33.

5. G. Singh (2003). Sowing seeds: Seed germination and growth of *Colophospermum mopane* during drought. *Wasteland News*, 19 (1): 48-50

6. P. Kumar, G. Singh, N.Bala and N.K. Bohra (2003). Ethnobaotanical studies of forest of Banaskantha & Sabarkantha districts of Gujarat: A case study of some tribal villages. *Indian J. Ecoplanning* 7(2): 303-306.

7. N. Bala, G. Singh and N.K. Bohra (2003). Effect of irrigation on growth and performance of three different tree species in Indian arid zone. *Annals of Arid Zone* 42: 61-67.

8. G. Singh (2003). Windblown wonders: bio-productivity and economic returns from sand dune stabilization. *Wasteland News*, 19(2): 32-35.

9. B.Singh and G. Singh (2003). Effect of water availability and phosphorus application on biomass accumulation and micronutrients concentration in *Dalbergia sissoo* seedlings. *J. Indian Soc. Soil Science*, 51(3): 316-319.

10. Sharma Meeta and Ahmed, S.I. (2003). Relative toxicity of different insecticides against marwar teak defoliator, *Patialus tecomella* Pajni, Kumar and Rose (Coleoptera: Curculionidae). *Ann. For,* 11 (1): 127-132.

11. D.K. Mishra and Ved Pal Singh (2003): Standardization of seed weight replications of tree species growing in arid and semi-arid zone. My Forest 39: 287-289.

12. 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*, **13**(4), 2003, 361-373.

13. Spacing effect on the growth of irrigated plantations in hot desert, V.P. Tewari & V.S. Kishan Kumar, *Indian Forester*, 129(3), 2003, 349-356.

C) Scientific Reports Prepared:

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

1. **Proceeding of Workshops on :**

"Development of suitable strategy for rehabilitation of Orans and Gauchars in Rajasthan" sponsored by UNICEF, Jaipur.

"Data Analysis of the International Neem Network" sponsored by the FAO, Rome.

D) **Technical Bulletin**: NIL

E) **Scientific Brochures**: NIL

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

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

1. V.P. Tewari, "Some important wild plants yielding alternative foods for nutritional security in arid region of Rajasthan" for the National Symposium on "Food and Nutritional Security: Technological innovations and Genetical options" held at CSKHP Krishi Vishvavidyalaya, Palampur on Sept. 18-19, 2003.

2. D. Thangamani, Neelam verma K.K. Srivastava.(2003) Purification of antifungal proteins from Trigonella foenum graceum against charcoal rot causing organisms Macrophomina phaseolina Paper presented and abstract published in 25th Annual conference and Symposium conducted in Indian society of mycology and Plant Pathology at Rajasthan college of Agriculture, Jaipur on October,8-10.

3. D.Thangamani, K.K. Srivastava and Neelam verma (2003). Charcoal Root Rot - a serious Disease of Neem. Paper presented and abstract published in 25th Annual conference and Symposium conducted in Indian society of mycology and Plant Pathology at Rajasthan college of Agriculture, Jaipur. on October 8-10.

4. D. Thangamani, K. K. Srivastava and Neelam Verma (2004). Noval antifungal protein from *Staphylococcus aureus* against *Macrophomina phaseolina*. Paper presented and abstract published in National conference on "Microbes for Mankind' conducted by Dept. pf Microbiology, Karpagam Arts and Science college, Coimbatore on January 9-10.

5. D. Thangamani, K. K. Srivastava and Neelam Verma (2004). Identification and Purification of antifungal proteins from *Trigonella foenum graceum* against the charcoal rot causing organism Macrophomina phaseolina. Paper presented and abstract published in National conference on "Microbes for Mankind' conducted by Dept. of Microbiology, Karpagam Arts and Science college, Coimbatore on January 9-10.

6. K.K. Srivastava, D. Thangamani and Neelam verma (2004). Antagonistic activity of AM-fungi against *fusarium* wilt disease of Rhoida (*Tecomellaa undulata* Sm. Seem.) Paper presented and abstract published in National conference on "Microbes for Mankind' conducted by Dept. of Microbiology, Karpagam Arts and Science college, Coimbatore on January 9-10.

7. S.H.Jain, Ranjana Arya and K.K.Chaudhuri, "Wood craft industry in Rajasthan" in workshop of " wood preservation in India : Challenges, opportunities and strategies" at Banglore on 20-21st October'03.

8. V.P.tiwari, Desertification and its control through afforestation activities for increasing productivity" in Seventh International conference on " Desert Technology" from 9-14 November'03 at Jodhpur.

9. R.L. Meena and G. Singh, " Integrated ecosystem approach for management of degraded arid and semi-arid areas of northwestern India" in Seventh International conference on " Desert Technology" from 9-14 November'03 at Jodhpur.

10. S.H.Jain, Hemant Kumar, Ranjana Arya and K.K.Chaudhuri,(2003) Woodcraft industry in Rajasthan – A challenging opportunity for Wood Preservation presented at National workshop on" Wood preservation in India: Challenges, opportunities and Strategies" 2oth to 21st October 2003 at IWST, Bangalore

11. S.H.Jain, Ranjana Arya, Hemant Kumar and K.K.Chaudhuri,(2004) Rational utilization of plantation grown lesser known timber species in arid region. Sent to National workshop on "Conservation and Sustainable utilisation of lesser known tree species". 8th to 10th March 2004 at FRI, Dehradun

12. Mala Rathore, R. Arya, Rajendra Meena, K.K.Chaudhuri(2004) Potential of some lesser known oilseed tree species from Indian Arid Zone, Sent to National workshop on "Conservation and Sustainable utilisation of lesser known tree species". 8th to 10th March 2004 at FRI, Dehradun.

H) Research Papers Communicated/Accepted in Press:

1. K.K. Chaudhuri*, D.K. Mishra, Vedpal Singh and J.K. Shukla (2004). Harnessing Thar biodiversity for medicinal uses. In National Workshop on 'Conservation & Sustainable Utilization of Lesser-Known Tree Species", FRI Dehradun March 8-10, 2004.

2. K.K. Chaudhuri, G. Singh and N. Bala (2003). Traditional knowledge and technological innovations for productivity enhancement of degraded land of arid region. Presented in Desert Technology-7 Seminar held at Jodhpur from 9-14, November, 2003.

3. R.L. Meena and G. Singh (2003). Integrated ecosystem approach for management of degraded arid and semi-arid areas of northwestern India. Presented in Desert Technology-7 Seminar held at Jodhpur from 9-14, November, 2003.

4. Ranjana Arya and R.R.Lohara Utilization of degraded arid salt lands with different management practices, presented in National Seminar on "Rehabilitation of Lands under Anthropogenic Stress & Degradation at IFP Ranchi on 20th January 04.

5. D.K. Mishra and Ved Pal Singh (2002): Effect of pretreatments and seed grading on germination pattern of *Prosopis cineraria* (L) Druce. Seed Research

6. D.K. Mishra and Ved Pal Singh (2002): Effect of pretreatments and seed grading on germination pattern of *Acacia nilotica*. Advances in Plant Sciences

7. D.K. Mishra (2002): Germplasm variability in neem (Azadirachta indica A Juss). Jour. Tropical Forest science

8. G. Singh (2004). Growth, biomass production and soil water dynamics in relation to habitat and surface vegetation in hot arid region of Indian desert. *Arid Land Research and Management*

9. G. Singh, N. Bala, Sarita Mutha, T.R. Rathod and N.K. Limba (2004). Biomass production of *Tecomella undulata* agroforestry in arid India. *Biological Agriculture & Horticulture*

10. B. Singh and G. Singh (2004). Growth, biomass production and nutrient uptake of *Dalbergia sissoo* seedlings under water deficit and phosphorus nutrition. *J Plant Nutrition and Soil Science*

11. G. Singh and M. Bhati (2004). Growth of *Dalbergia sissoo* in Desert regions of western India using municipal effluent and the consequent changes in soil and plant chemistry. *Bio-Resource Technology*

12. G. Singh, Sarita Mutha, N.Bala, T.R. Rathod, N.K. Bohra and G.R. Kuchhawaha (2004). Growth and productivity of *Tecomella undulata* based agroforestry system in Indian desert. Forests, Trees and Livelihood

13. B. Singh and G. Singh (2004) Influence of soil water regime on nutrient mobilization and uptake by *Dalbergia sissoo* seedlings. *Tropical Ecology*

14. B. Singh and G. Singh (2004). Influence of water deficit on biochemical activities in *D. sissoo* in dry environment. *J. Environment and Experimental Botany*

15. G. Singh, M. Bhati, T.R. Rathod and U.K. Tomer (2004). Mineral accumulation and physiological response in trees seedlings irrigated with municipal effluent. *Photosynthetica*

16. Pramod Kumar, N. Bala, G. Singh, S. Mutha, N.K. Limba and N.K. Bohra (2003). Socioeconomic conditions with special reference to common access resources: A case study from Gujarat and Rajasthan. *Indian Forester*

17. G. Singh, Bilas Singh and T.R. Rathod (2003). The impact of soil water availability on carbon sequestration in biomass and soil in northwestern India. *Indian Forester*

18. G. Singh (2003). Tree influenced carbon sequestration in the degraded land of arid region under different agroforestry systems. *Indian Forester*

19. G. Singh and M. Bhati (2003). Soil properties and seedling performance in artificially contaminated soil through effluent irrigation of varying chemistry. *J. Indian Soc. Soil Science*

20. Ranjana Arya (2003) Silvi-pastoral studies using Cenchrus ciliaris in combination to different tree species in a frost prone hot arid tracts in India, Forest Ecology and Management

21. Ranjana Arya, K.R.Chaudhary and R.R. Lohara (2003) Effect of Nitrogen and gypsum on establishment and early growth of Salvadora persica (L.) in salt affected soil in hot arid zone, Forests,Trees and Livlihood

22. Mala Rathore and Rajendra Meena (2003), Nutritional evaluation of famine foods of Rajasthan, Indian forester

23. Mala Rathore and Hemant Sharma,(2003) Therapeutically useful oils and fats of forest origin, Van Vigyan

24. Ahmed and S.I. and Meeta Sharma (2003). Relative Resistance of Different Provenances of Marwar Teak to *Patialus tecomella* Pajni, Kumar & Rose (Coleoptera: Curculionidae). *Annals of Arid Zone.*

25. Ahmed, S.I., K.K.Chaudhuri, Meeta Sharma and Shivesh Kumar (2003). New insect pest records of khejri and rohida from rajasthan and their possible management strategies. *Indian Forester.*

26. Kumar Shivesh and S.I.Ahmed (2003). Observations on the biology of *Contarinia prosopidis* Mani, a potential rachis gall midge of *Prosopis cineraria* (L) Druce in Rajasthan. *Indian Forester.*

27. Kumar Shivesh and S.I.Ahmed (2003). Biology and efficacy of *tetrastichus spirabilis* and *Eupelmus sp.,* the potential egg parasites of gall forming insects of *Prosopis cineraria* (L) Druce. *Indian Forester.*

28. Ahmed S. I. and Shivesh Kumar (2003). Histopathological changes occurred during the formation of insect induced galls in various parts of khejri, *Prosopis cineraria* (L) Druce. *Indian Forester.*

29. Ahmed S. I. and Shivesh Kumar (2003). Impact of mite induced galls on the production of fodder/ fruits in lopped and unlopped trees of *Prosopis cineraria* (L) Druce. *Indian Forester.*

30. Kumar Shivesh and S.I.Ahmed (2003). A worldwide checklist of insect pest spectrum of *Prosopis* spp., with new pest records of *p. cineraria* and *p.juliflora* from Indian arid and semi- arid areas. *My Forest.*

31. Ahmed S. I. and Shivesh Kumar (2003). Seasonal fluctuations in the population of *Eurytoma settitibia* Gahan (Eurytomidae: Hymenoptera), a potential stem gall chalcid of khejri *(Prosopis cineraria* Linn) in Rajasthan. *Indian Forester.*

32. Kumar Shivesh and S.I.Ahmed (2003). Seasonal occurrence and population fluctuation of *Eriophyes prosopidis* saxena, a leaf and inflorescence gall mite of *Prosopis cineraria* (Khejri) in Rajasthan .*Indian Journal of Forestry.*

33. Kumar Shivesh and S.I.Ahmed (2003). Seasonal variation in the population of *Contarinia prosopidis* Mani (Cecidomyiidae: diptera), a potential rachis gall midge of Khejri (*Prosopis cineraria* Linn) in Rajasthan. *J. Ttrop. Forestry.*

34. Ahmed S. I. and Shivesh Kumar (2003). Structure and growth of rachis, stem, leaf and inflorescence galls of *Prosopis cineraria* (L) Druce.*My Forest.*

35. Kumar Shivesh and S.I.Ahmed (2003). Morphological observations on the rachis, stem, leaf and inflorescence galls caused by insects and mites in *Prosopis cineraria* (L) Druce in Indian arid zone. *My forest.*

36. Srivastava,K.K,Ostry,M.E and Sunil Kumar.(2004) " Effect of Armicarb ™100 against *Sirococcus clavaganti jugladacearm"* (A butternut canker pathogen) Indian Journal of Forestry

37. Srivastva K.K.,H.P.Srivastava and SunilKumar (2004) " Standardization of inoculum dose in *Tecomella undulata* Sm Seem. The Indian Forester

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. Evaluation of 'Reclamation of wasteland of waterlogged area in Rawatsar, Hanuman garh District in Rajasthan.
2. Evaluation of Combating Desertification works under DDP sponsored by Department of Rural Development, Govt. of Rajasthan in Barmer, Jaisalmer, Sirohi, Jhunjhunu, Sikar, Pali and Nagaur districts.

Patents Obtained/ filed : NIL

Commercialization of technology : NIL

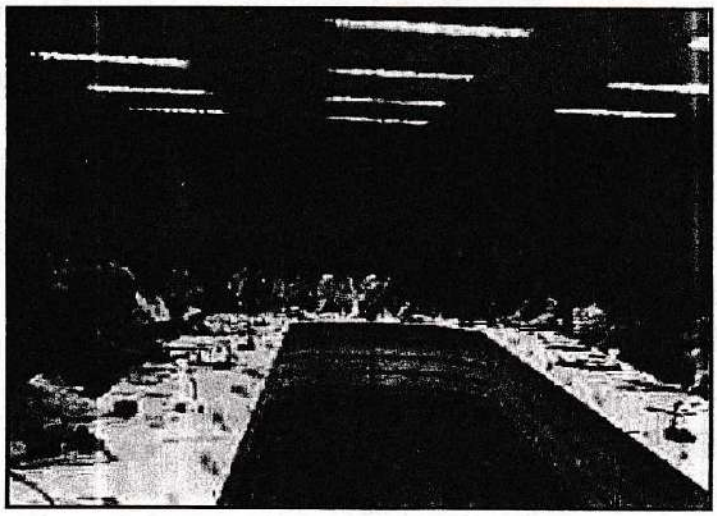
Organized and Participation in conference, meetings, workshops, symposia, Exhibitions:

(a) Organised

1. *Liaison & RAG* meetings on 23-24th December' 2003.
2. Hindi Saptah from 11 –17th September'2003, "AFRI Darpan"- a quarterly newsletter of the Institute was released by Sh. Santokh Singh, Divisional Railways Manager, Jodhpur Division on concluding session of Hindi Saptah.

Institute's News Letter released by Sh. Santokh Singh

3. Maru Gaucher Task Force meeting at AFRI,Jodhpur on 18.07.2003.



(b) **Participation:**

1. workshop on "Conservation and Propagation of medicinal Plants" at Jaipur from 20th -22nd April 2003.

   I Dr. D. K. Mishra

2. Workshop on Criteria and Indicator for Sustainable Forest Management organized by IIFMBhopal, from 5-6th September at Jaipur.

   I. Sh. Balbir Singh
   II. Dr. Sunil Kumar

3. Workshop on *"Current Technologies for plant disease management and future strategies"* from 8-10th October'03 at RAU, Jaipur.

   I. Ms. D. Thangamani.

4. Workshop on "Arravallis mining and forests" on 11th October'03 at JNV, University,Jodhpur

   I. R.L.Meena

5. Workshop on " wood preservation in India : challenges, opportunities and strategies" at Banglore on 20-21st October'03.

   I. Dr. S.H.Jain

6. Seventh International conference on " Desert Technology" from 9-14 November'03 at Jodhpur.

   I. Sh. K.K.Chaudhuri
   II. Sh. R.L.Meena
   III. Dr.V.P.Tiwari
   IV. Dr. G.singh
   V. Sh. C.J.S.K.Emmanuel

7. Sh. Balbir Singh I.F.S., Head, Agroforestry & Extension Division attended three days workshop on Devolution and Community based Forest Management NIRD, Hyderabad from 1st –3rd March 2004.

8. K.K. Chaudhuri National Workshop on 'Conservation & Sustainable Utilization of Lesser-Known Tree Species", FRI Dehradun March 8-10, 2004.

(c) Exhibition

Participated in Swadeshi Mela October' 2003 and Hasthsilp Mela Feb,2004 at Jodhpur and exhibited the research findings and transfer of technology to the end users.

Extension publications

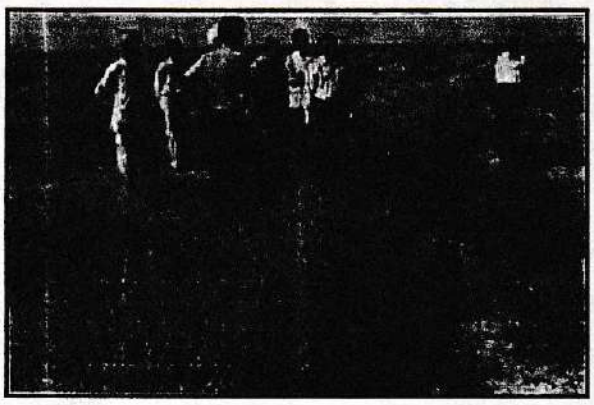
1. "AFRI Darpan"- quarterly newsletter for the period from April to June' 03 & July to September'03.

News Articles: NIL

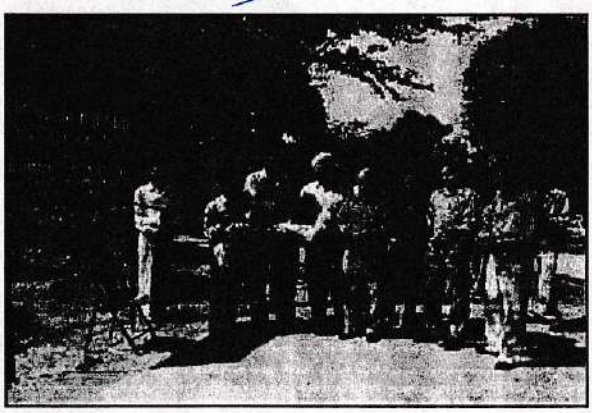
Awards: NIL

Distinguished Visitors:

1. Hon'ble Minister of Forests & Environment, Rajasthan & the PCCF, Rajasthan on 28th August'2003.
2. Prof. Kaus Seeland, Forest politic & Forest economic, Swiss Federal Institute of Technology, Zurich on 22nd October'2003.
3. Sh.R.P.S.Katwal, Director General, ICFRE, Dehradun reviewed the research works on 14 October' 03 to 18 October''03.



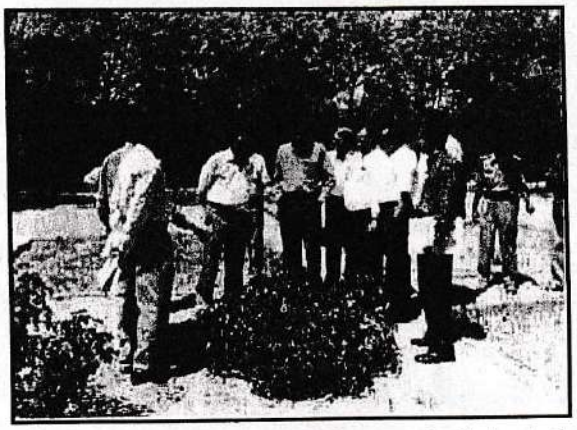
Tulesar Charan Silvipasture model being developed by AFRI



Inauguration of Medicinal Germ plasm bank by the DG,ICFRE

4. SHRI JOGESH CH. BARMAN, Hon'ble Minister-In-Charge, Department of Forest, Government of West Bengal on 10th December'2003

5. Sh. J. Hari Narayan IAS, Addl. Secretary (Land Reforms), Ministry of Rural Development , Govt. of India visited the institute on 30.03.2004. Director AFRI gave a presentation on research activities of the Institute followed by visit to Medicinal Germ Plasm Bank.



Sh. J. Hari Narayan IAS, Addl. Secretary, MORD at Medicinal Germ Plasm Bank.

Miscellaneous

1. Organized sports meets and cultural activities on 15th August' 2003 .
2. Observed "Vigilance Awareness Week" from 31st October to 6th November 2003 & Kaumi Ekta week from 19-25th November'2003. The pledges were administered to all officers, scientists and staff by the director, followed by reading of the messages of dignitaries.
3. National Science day was celebrated on 28.02.2004 at AFRI by way of organizing Elocution and Quiz competition on the environment, forestry & wildlife among the children of AFRI campus.

Dr. V.P.Tewari conducting the Quiz competition