A.R. 2010-11

ARID FOREST RESEARCH INSTITUTE, JODHPUR

ANNUAL REPORT 2010-11

Executive Summary

In order to address forestry related research problems of the mandated areas of Rajasthan, Gujrat, Dadar & Nagar Havali, AFRI has taken up projects covering various theme and sub themes, organised training programmes under two VVK's and newly established demo village to the field functionaries and farmers. Out of the 34 projects, two projects were completed and eight projects were initiated in 2010-11. Total 254 sites covering, 238 forest blocks in 12 districts in Rajasthan were surveyed to estimate carbon sequestration in forest soil and vegetation. *Prosopis juliflora* infested about 35% of forest blocks in Rajasthan. Vegetation carbon pool in 19 forest sites (76 plots) and 33 plots under trees outside forest (TOF) have been assessed in ShriganganNagar, Hanumargarh, Churu, Jhunjhunu, Sikar and Jaipur districts of Rajasthan. Five forest blocks studied for identification of indicator species, *Tectona grandis*, *Acacia catechu*, *Anogeissus pendula*, *Wrightia tinctoria* are dominated species in Banswada, Rajsamad, Pali, Sabarkantha and Palanpur sites. Soils of western Rajasthan districts were found different in nitrogen and phosphorus. Overall, 46% soil is sandyloam, 25% loamy sand, 20% sand, 3% sandy clay loam and 0.5% clay loam. Application of rain water harvesting, afforestation and protection found effective in restoration of degraded hills by enhancing soil water, nutrient, number of herbaceous species and biomass. In addition, increased soil carbon stock, water fodder and firewood availability.

Application of fertilizer (FYM + Zh + SSP) has improved fruit yield in *Salvadora persica*. Fruit yield varied from 20-97/g with treatment of fertilizers. Oil yield varied from 38.5% - 43.1%. Effect of different treatments of fertilizers has significant effect on tree growth. Fertilizer treatments have also shown effect on fruiting percentage which, varied from 44.4%-91.6% in *Acacia ampliceps*. Soil structures in saline soil influenced grass (fodder) yield. In case of *Sporobolus diander* platform was the best, followed by slop soil structure for maximum yield (1104/gm^2) due to positive effect of leaching. Survival percentage of progeny trials of 40 CPT's of *Tecomella undulata* was high at Jodhpur (91%) as compared to Bikarner (60%) at the age of 30 months. Growth performance of progenies at Jodhpur was better in terms of height and CD as compared to Bikarner. In *Salvadora persica*, shoot multiplication rate of 2.5 fold achieved on Murashige and Skoog medium for *in vitro* cloning. Based on the protocol developed, produced plants of *Jatropha curcus* through somatic embryogenesis.

Plants produced through somatic embryogenesis and axillary shoot proliferation of *Commiphora wightii* were planted in field and survival was 100%. Variation and inheritance

of fruit and seed traits of teak from Dang region of Gujrat was studied for the first time, selected 10 CPT's of teak, and established progeny trial of 28 families at Sajjangarh, Udaipur. Selected 20 CPT's of *Prosopis cineraria* from Nagour, Sikar, Churu and Jhunjhunu in Rajasthan. Effect of frost varied with the families in progeny trial of *Azadirachta indica* at Govindpura, Jaipur. Amongst the progenies of the 17 CPT's, progenies of CPT 7 have shown the best result based on survival and growth parameters. In multilocational clonal trials of *Eucalyptus camaldulensis* and *Dalbergia sissoo*, three clones (99, 105 and 115) of *E. camaldulensis* growth performance was better at all the 4 locations, similarly three clones (G2, 15 and 35) of *D. sisso* exhibited consistently better growth at 4 locations in Gujrat. Results of demonstration clonal trial of *Ailanthus excelsa* revealed that growth performance (height and CD) of female plants was 10% more than male plants. Surveyed in 16 districts in Rajasthan and found variation in population density from 11-133 plants/ ha of *Commiphora wightii*, an endangered and high value medicinal plant species. Sixty seven candidate plus plants (CPT's) of *C. wightii* were selected and vegetatively propagated for *ex situ* conservation. Results of agroforestry trial revealed that *Cordia myxa* was the best horticulture species and *Prosopsis cineraria* as silvicultural species. Survival and growth was high in agroforestry trial as compared to trees without crop (control).

Antifungal properties of 7 plant species evaluated using aqueous and ethanolic 28 extracts against *Rhizoctonia bataticola* and *Fusarium solani*. Results revealed that *Citrullus colocynthis* is effective against *Rhizoctonia bataticola* & *F. solanii*, whereas, *D. stramonium* against *Alternaria alternata*. Six species of *Glormus* were observed in forest nurseries and plantations in five districts of arid regions of Rajasthan with *Acacia nilotica* and *Ailanthus excelsa* and among these, *G. fasciculatum* was dominated and found in all the sites. Sixteen species of insect, 2 species of mites, 3 species of parasitic nematode, 13 species of disease infestation and 2 species of rust fungi have been document on *Acacia nilotica*. Leaf rust fungus *Ravenelia evansii* was identified as potential biological control of *A. nilotica*. Studies on Khejri mortality revealed that *Ganoderma lucidum* and *Acanthophorus serraticornis* were major biotic factors of Khejri mortality. Mortality rate in four main Khejri growing districts varied from 18.08- 22.67%, minimum in Jhunjhunnu and maximum in Nagour, Rajasthan. Based on the outcome of the previous studies, laid management of Khejri mortality field trials were laid in farmers field in six location in five districts in Rajasthan.

Significant Research Achievements of AFRI

1. Estimated carbon sequestration in soil and vegetation in 254 sites of 238 forest blocks in 12 districts in Rajasthan and *Prosopis juliflora* infestations recorded in 35% forest.
2. Vegetation carbon pool in 19 forest sites (76 plots) and 33 plots under trees outside forest (TOF) assessed in 6 districts in Rajasthan.
3. Soils of western Rajasthan were found different in nitrogen and phosphorus.

4. Developed technologies for the rehabilitation of degraded Aravali hills by the afforestation of tree species, rain water harvesting and protection.
5. Application of fertilizer has enhanced fruit yield and growth in *Salvadora persica* and pod production and growth in *Acacia ampliceps* in salt affected area in Jodhpur.
6. In *Tecomella undulata* variation in survival rate and growth was recorded in progenies of 40 CPT's at Jodhpur (91% survival) and Bikaner (60% survival) at 30 months age.
7. Developed protocol for *in vitro* propagation of *Jatropha curcus* through somatic embryogenesis.
8. Refined protocol for micro progpagation of *Commiphora wightii* through somatic embryogenesis and axillary shoot proliferation and established field trial.
9. Selected 10 CPT's of teak and established progeny trial of 28 families at Sajjanpur, Udaipur in 2010.
10. Evaluated progeny trial of 17 CPT's of *Azadirachta indica* and identified forest sensitive families at Govindpura, Jaipur.
11. Identified 20 CPT's of *Prosopis cineraria* for the establishment of germplasm bank and tree improvement.
12. Evaluated multilocational clonal trials of *Eucalyptus camaldulensis* and *Dalbergia sisso* and identified the best performing 3 clones of each species, which performed better in all four locations in Gujrat.
13. Evaluated clonal field trial of male and female plants of *Ailanthus excelsa* and results revealed that female plants growth performance in terms of height and CD was 10% more in female plants as compared to male plants.
14. Based on field survey, observed variation in population diversity from 11-74 plants/ha of *Commiphora wightii* as endangered high value medicinal plants in 16 districts in Rajasthan.
15. Selected 67 candidate plus plants (CPP's) of *Commiphora wightiian* in 15 districts and propagated vegetatively for *ex situ* conservation.
16. Results of agroforestry trial revealed that *cordia myxa* is the best horticulture species and *Prosopis cineraria* as siliviculture species.
17. Antifungal properties against *Rhizoctonia bataticola* and *Fusarium solani* was found in *Citrullus colocynthis* and against *Alternaria alternata* in *Datura stramonium*.
18. Among the six species of *Glomus* found in nurseries and plantations of *Acacia nilotica* and *Ailanthus excels*, *G. fasciculatum* dominated and found in both in nurseries and plantations in five districts in Rajasthan.
19. Sixteen species of insect, 2 species of mites, 3 species of parasitic nematodes and 13 species of disease infestation was recorded in *Acacia nilotica* and *Ravenelia evansii*, leaf rust fungus was identified as potential biological control agent of *Acacia nilotica*.
20. *Ganoderma lucidum* and *Acanthophorus serraticornis* were identified main biotic

factor of Khejri (*Prosopis cineraria*) mortality, which varied from 18.08- 22.67% in four main Khejri growing districts of Rajasthan.

21. Based on the previous studies, laid 6 field trial for management of Khejri mortality in farmers field in five districts in Rajasthan.

Summary of Projects

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During the Year
Plan	1	16	7
Externally Aided	2	7	1
Total	3	23	8
		Total Projects	**34**

Contents

Institute- At a Glance

- Arid Forest Research Institute, Jodhpur (Rajasthan), is one of the eight institutes of the Indian Council of Forestry Research & Education (ICFRE), an autonomous organization of the Ministry of Environment & Forests, Govt. of India. The objectives of the institute are to carry out scientific research in forestry & allied fields to enhance the productivity & vegetative cover, to conserve the biodiversity and to develop the technologies for the end-users in Rajasthan, Gujarat and Dadra & Nagar Havelli.
- The main emphasis areas of research of the institute are soil, water & nutrient management, technologies for afforestation of stress sites, management of plantations, growth and yield modeling, planting stock improvement, bio-fertilizers and bio-pesticides, Agroforestry, JFM & extension, phytochemistry & non-timber forest products, integrated pest & disease management and forestry education and extension. During 2010-11, thirty four projects were executed including ten externally funded projects from Rajasthan Forest Department, Gujarat Forest Department, Department of Bio-technology, Government of India, New Delhi, National Medicinal Plant Board, New Delhi, CSIR, New Delhi and International funding from Australia.

Fig 1. Mandated states of AFRI, Jodhpur

2 Research Highlights

2.1 Ecosystem Conservation and Management

2.1.1 Overview

2.1.1.1 Summary of the achievements under the Theme

- A total of 254 sites covering 238 forest blocks in 12 districts in Rajasthan have been surveyed to estimate carbon sequestration in forest soil and vegetation.
- *Prosopis juliflora* infested about 35 % of forest blocks in Rajasthan.
- Vegetation carbon pool in 19 forest sites (76 plots) and 33 plots under tree outside forest (TOF) have been assessed in Shri Ganganagar, Hanumangarh, Churu, Jhunjhunu, Sikar and Jaipur districts of Rajasthan, utilizing biomass, litter mass and soil carbon.
- Surveyed in 16 districts in Rajasthan and found variation in population density from 11 to 74 plants/ha in *Commiphora wightii.*
- Sixty seven candidate pluls plants (CPP) of *Commiphora wightii* were selected and propagated by stem cutting for *ex situ* conservation.
- Surveyed Jodhpur, Pali and Churu districts and recorded associated flora and fauna diversity with *Prosopis juliflora* dominated areas and also documented various local uses of this species.

2.1.1.2 Projects under the Theme

Projects	Concluded Projects	Ongoing Projects	New Projects Initiated During the Year
Plan	0	1	1
Externally Aided	1	0	1

2.1.2 & 3 Climate Change/Ecology and Environment

EXTERNALLY AIDED PROJECTS

NEW PROJECTS INITIATED

Nil

PROJECTS CONTINUED

Nil

PROJECTS CONCLUDED

Project 1. Vegetation carbon pool assessment in some districts in Northern Rajasthan (Funded by IIRS, Dehradun) (AFRI-97/FED/IIRS, D.dun/ 2009-11).

Principal Investigator: Dr. G.Singh

Project was started with objectives to estimate carbon in growing vegetation and assess carbon dynamics in the forests as well as trees outside forest (TOF) in ShriGanganagar, Hanumangarh, Churu, Jhunjhunu, Sikar and Jaipur districts. A total number of 19 forest sites (76 plots) and 33 plots under trees outside forest (TOF) have been surveyed in these districts and trees and shrubs have been measured in cluster sample of four plots at each site in the forests blocks. There were 21 numbers of tree and 11 number of shrub species identified in the study area. The highest number of species was in Jaipur, followed by Hanumangarh forest division. Hanumangarh division showed 'Desert thorn forest' of *P. cineraria* and *Z. nummularia,* but now invaded by *Prosopis juliflora,* which dominated in about 25% area. Forest cover in Churu division is dominated by *Acacia senegal* in trees and *Mytenus emarginata/Z. nummularia* in shrubs, whereas, Jhunjhunu is dominated by *P. juliflora*. Forest covers in Sikar division is dominated by *Anogeissus pendula* in (about 75%) area and followed by *Boswellia serrata* in 25% area. In Jaipur, about 18% forests are dominated by *A. penduala*, 36% by *B. serrata*, 18% by *P. juliflora*, 18% by *A. senegal* and 10% by *A. catechu* tree species. Among the shrubs, the dominant species in Jaipur was *M. emarginata*.

Fig 2. Previously *Anogeissus pendula* forest in Jhunjunu

Fig 3. Now dominated by *P. juliflora* forest in Jhunjhunu

West of the dry hilly region in north eastern Rajasthan is occupied by *A. pendula*, but now infested by *P. juliflora* (Fig 2 and 3).

ICFRE FUNDED PLAN PROJECTS

NEW PROJECTS INITITAED

Nil

PROJECTS CONTINUED

Project 2. Studies on carbon sequestration in different forest types of Rajasthan (AFRI-IX/PROJ/ 2008-2012).

Principal Investigator: Dr. G. Singh

Project was started with objectives (i) to estimate carbon stock in forest soils, (ii) to estimate carbon stock in forest litters, and to estimate carbon stock in aboveground and below ground biomass; with broader objective 'to provide an estimate of carbon stock of forests in Rajasthan' for its utilization in planning and execution of afforestation/ reforestation programme in this region.

Twelve districts covering 238 forest blocks and 254 plots were surveyed in 2010-11 and growth of trees and shrubs were measured and shrub/herbage biomass recorded. Litter, plant and soil samples were collected from the plots and analyzed for the carbon. Dune areas of Jaisalmer are dominated partly by *Calligonum polygonoides* that help in control of sand drift. Alwar, Dholpur and Bharatpur are dominated by *P. juliflora*, whereas Udaipur is dominated by *Acacia leucophloea* as the tree species. *Anogeissus pendula* still dominated in Tonk and some parts of Bharatpur division. Ajmer division is dominated by *A.*

senegal, whereas, Baran division is dominated by *Gymnosporia* spp and *B. monopserma*. During survey in Bharatpur, a belt of *Mitragyna parviflora* was also observed, but forest is now infested by *P. juliflora*.

In 27 districts covering 588 blocks, *P. juliflora* recorded in the forest blocks of all districts except, Pratapgarh. Diameter at breast height, height and crown diameter varied from 12.26 to 48.82 cm, 1.51 to 7.83 m and 2.63 to 9.00 m, respectively, whereas, average basal area ranged 111.3 to 2252.8 cm^2 per ha with wide spread root system (**Fig 4**). *P. juliflora* density and frequency of its occurrence (F) varied from 0.8 ha^{-1} and 2.78% in Sikar to 17.81 ha^{-1} (Pali) and 68.97% (Ajmer district), respectively. About 35.4% of forest blocks are infested with *P. juliflora*, which likely to increase in future.

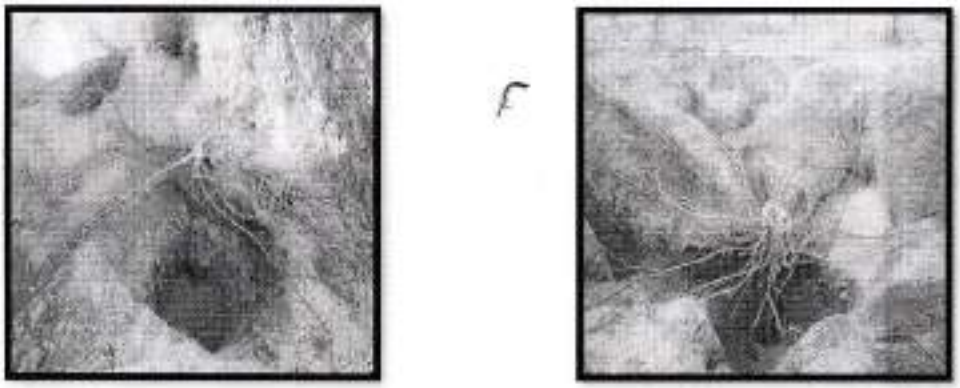


Fig 4. Root systems of *Zizyphus nummularia* (left) and *Prosopis juliflora* (right) excavated for biomass showing both feeders as well as anchoring roots.

PROJECTS CONCLUDED
Nil

2.1.4 Biodiversity

EXTERNALLY AIDED PROJECTS

NEW PROJECTS INITIATED

Project 3. Assessment of Guggul germplasm for studying population density, diversity, female-male plant's ratio for in situ and ex situ conservation in Rajasthan (AFRI- 106/FGTB /SFD-RAJ/ 2010-13, Funded by SFD, Rajastha).

Principal Investigator: Dr. U. K. Tomar

Project has three components viz.; 1. Survey work (to study population density and sex ratio) 2. Conservation and 3. Propagation.

Sixteen districts viz; Ajmer, Barmer, Bhilwara, Churu, Jaisalmer, Jalore, Jhunjhunu, Jodhpur, Karoli, Nagaur, Pali, Rajsamand, Sawai Madhopur, Sikar, Sirohi and Udaipur District were surveyed. Data on number of plants and associated species were recorded in sample plots (size 0.1 ha) with GPS locations. Spatial variation in the *Commiphora wightii* was clearly evident within the area. A positive association was recorded with species like; *Euphorbia caducifolia, Acacia senegal, Boswellia serrata, Anogeissus pendula, Capparis decidua, Zizyphus nummularia.* It was found that in hilly areas, on rocky tracks *C. wightii* usually grows on the foot of hills. It grows well in sandy desert areas (Barmer and Jaisalmer). Plants in high density were found in Sawai Madhopur, Jhunjhunu, Barmer, Jalore, Sikar, Karoli districts, while in Nagaur, Pali, Jaisalmer Sirohi districts low density of guggal plants were observed. In ravines of Chambal river at Mandrayal range in Karoli district, it is widely distributed and density of guggal was 47 plants per hectare. High density of guggal plants were recorded in four places viz. Kot (Udaipurwati) forest block of Jhunjhunu, Tajpur (Sawai Madhopur), Kiradu (Barmer) and Chekla (Jalore). After survey of 16 districts, guggal was found in 61 forest blocks of 15 districts. In Churu no guggal population was recorded. Male plants were not seen during survey.

Conservation: Germplasm was collected for *ex situ* conservation from identified 80 Candidate Plus plants (CPPs). About 948 cuttings of CPPs with detail records were raised in vegetative propagation area.

Propagation: Guggal population at Kaylana (Jodhpur) was selected for annual studies of flowering and fruiting behaviour in Rajasthan where *Commiphora wightii* is growing in natural habitat. Observations on flowering and fruiting were recorded in each month from 66 guggal plants growing in this area. Annual pattern of flowering and fruiting is given in Graph 1. In Jodhpur, guggul plants produced fruits twice a year i.e. from April to July (main fruiting season) and from October to December (delayed fruiting season). No fruiting was observed in Barmer and Jaisalmer districts during surveyed in the month of November and December. Immature fruits were observed in Ajmer, Jodhpur and Pali districts during survey in the month of August, October and November, respectively. These immature fruits were collected (from Barli and Arna sites of Jodhpur district) for *in vitro* germination. Mature fruits were not available at any of sites surveyed during this period (from August to December, 2010).

From Kaylana (Jodhpur) field, mature fruits were collected in March. Two types of seeds, viz. black and white were observed in mature fruits. The seeds were then air dried and kept in separate labelled air tight plastic containers at room temperature. Both black and white seeds were sown. Only the black-coloured seeds were viable, while white seeds were non-viable. Germination percentage of black seeds was found to be 40% and germinated within 5-16 days after sowing.

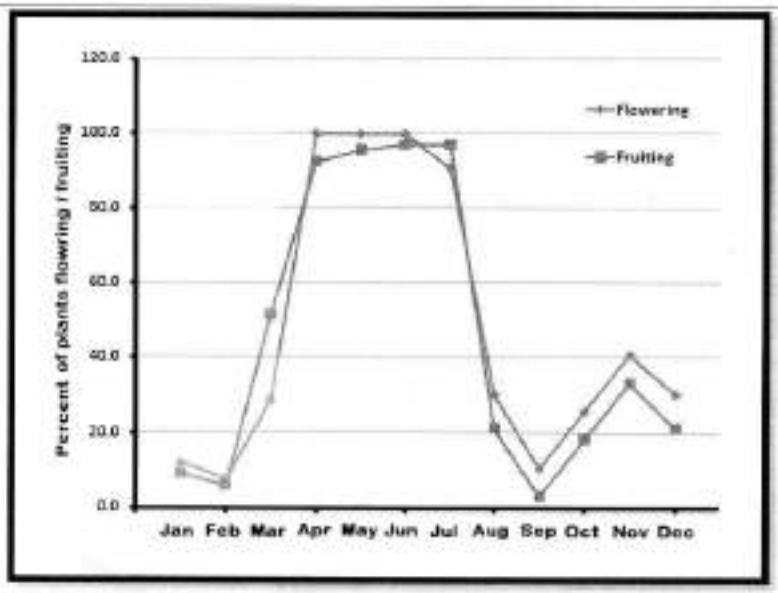


Fig 5. Flowering and fruiting behavior of guggul plants at Kaylana (Jodhpur)

PROJECT CONTINUED

NIL

PROJECT CONCLUDED

NIL

ICFRE FUNDED PLAN PROJECTS

NEW PROJECTS INITIATED

Project 4. Impact of *Prosopis juliflora* on biodiversity, rehabilitation of degraded community lands and as a source of livelihood for people in Rajasthan State (6- AFRI- 2010-2013)

Principal investigator: Smt. Seema Kumar

Survey was carried out to select *Prosopis juliflora* rich sites in Jodhpur, Pali and Churu District. Associated floral and faunal diversity was recorded of the selected sites. *P. juliflora* density was worked out in orans, gochars, reserved forest, saline lands, wastelands, water bodies and agriculture fields. The most common trees found associated with *P. juliflora* were *Anogeissus* species, *Prosopis cineraria, Tamarandus indica, Acacia nilotica, Capparis decidua, Salvadora* spp., *Azadirachta indica, Acacia tortilis, Acacia leucopholea, Acacia senegal, Zizyphus spp. and Agele marmelos.* Other floral diversity included *Calotropis procera, Tephrosia purpurea, Cassia auriculata, Aristida royleana, Aerva tomentosa, Leptadenia pyrotechnica, Euphorbia cauducifolia, Cenchrus ciliaris, Cyperus rotundus, Cynodon dactylon, and Chloris spp.* In *P. juliflora* Inflorescence varied from 5.1 cm to 11.1 cm. Size of pods varied from 7.6 cm to 20.1 cm. Highest size of inflorescenece & pods were recorded in *P. juliflora* growing near water bodies.

Five groups of soil arthropods & entomofaunal invertebrates and four groups of vertebrates were associated with *P. juliflora*. Fauna associated with inflorescence and pods were observed and identified as 2 species of Hymenoptera: *Apis dorsata* and *Apis florea*; 2 species of Diptera & 2 spp. of Lepidoptera from Jodhpur district. Sap sucker *Oxyrachis tarandus* were observed feeding and breeding on the stem and branches and feeding on the green pods in association with black ants. They were predated upon by 3 natural biological predators identified as 1 species of reptile and 2 species of insectivorous birds. Two species of seed bruchids; *Bruchus chinensis* and *Caryedon serratus* were recorded from dried pods. One species of rodent was observed feeding on the semi-dried pods of *Prosopis juliflora*.

It was found that seeds are utilized as fodder, harvested tree used as fuel-wood, bio-fencing, fencing, charcoal manufacturing and making parts of agricultural tools. Dried twigs of *P. juliflora* also used to protect young planted saplings under various programmes. Dried twigs used for nest building by avian species. *Acacia auriculiformis* was not observed during the study period.

Fauna associated with exotic *Leucaena leucocephala* was identified & documented as *Apis dorsata, Apis florae* and *Polistes* spp (Hymenoptera). The pods and seeds are eaten by *Psittacula krameri* especially the females. No insect was observed feeding on the pods or seeds of *Leucaena leucocephala*. It was found that *Acacia tortilis* pods were eaten by hanuman langurs *Semnopithecus entellus*.

PROJECT CONTINUED

Nil

PROJECT CONCLUDED

Nil

2.1.5 Forest Botany

2.1.6 Tribals and Traditional Knowledge System

2.2 Forest Productivity

2.2.1 Overview

The effective planning and implementation of afforestation programmes depends on the availability at all times of sufficient quantities of seeds with right physiological and genetical characteristics. In the first place, the seed must be collected from a genetically proven superior source. Secondly, there must be a continuous checking by testing the physical and physiological characteristics of the seeds. Finally, it is important that seed is stored until required without losing its germinative capacity and viability. Gujarat state Forest Department has selected plus seed stands, established several seed production areas, seedling seed orchards, CSOs under planting stock improvement programme. The seeds obtained from these have not been tested so far and present project is studies were carried out in consultation with SFD, Gujarat to evaluate their

established seed sources for important species. The species taken are *Dalbergia sissoo, Acacia nilotica, A. catechu* and *Tectona grandis*.

2.2.1.1 Summary of the achievements under the Theme

Seed germination studies were conducted on seeds collected from Rajasthan and of *D.sissoo* and *A. catechu* collected from various seed sources of Gujarat.

Five forest blocks studied for identification of indicator species, *Tectona grandis, Lanea coromadelica, Anogeissus pendula, Wrightia tinctoria* and *T. grandis* are the dominant species at the sites in Banswara, Rajsamand, Pali, Palanpur and Sabarkantha districts, respectively.

Soils of Western Rajasthan districts found deficient in nitrogen and phosphorus. Overall 46% soils were sandy loam, 29% - loamy sand, 20% - sandy, 3% - sandy clay loam and 0.5% - clay loam.

Application of rain water harvesting, afforestation and protection helped restoration of degraded hills by enhacing soil water, nutrients, number of herbacious species and biomass. In addition there was increase in carbon stock and water, fodder and fuel wood availability.

2.2.1.2 Projects under the Theme (in table as given at 2.1.1.2)

Projects	Concluded Projects	Ongoing Projects	New Projects Initiated During the Year
Plan	1	3	1
Externally Aided	0	1	0

2.2.2 Silviculture

EXTERNALLY AIDED PROJECTS

Nil

ICFRE Funded Plan Projects

NEW PROJECTS INITIATED

Nil

PROJECTS CONTINUED

Project 5. **Studies on seed traits of seeds collected from seed stands / SPAs / SSOs / CSOs of important species of Gujarat state (AFRI-80/Silvi/2007-12).**

Principal Investigator: Dr. D. K. Mishra

Seeds of 11 species were collected during year 2010-11, amongst them five spp (from 61 seed sources viz. 9 stands of *Acacia catechu*, 04 CPTs of *Delbergia sissoo*, 32 source of *Tectona grandis*, 09 source of *Anogeissus pendula* and 07 source of *A. latifolia*) were tested for germination. 100 seed weight of *A. catechu* varied from 4.50±0.13g in seed-lot of Khakharia, Rajpipla seed stand to 5.66±0.19g in Mandav, Godhara seed stand. Seed germination varied from 64±3.74% in Mandav, Godhara seed stand to 84±1.83% in Keliya Godhara seed stand.

100 pod weights of *D. sissoo* varied from 2.11±0.08g in seed lot collected from Fulwadi, Rajpipla CSO tree no. 5 to 2.51±0.04g in Tree no. 10 of the same CSO. Percent seed germination, varied from 35% in tree no. 2 to 41% in tree 10 of same CSO.

Amongst all the CSO of teak, length, width and 100 stone weight of un-weathered stones varied from 8.20 mm in Manch, Rajpipla to 11.17 mm in Fulwadi, Rajpipla. 8.94 mm in Manch, Rajpipla to 11.38 mm in Manch, Rajpipla and 35.33 g in Fulwadi, Rajpipla to 51.38 g in Manch, Rajpipla, respectively. While from weathered stones the length, width and 100 stone weights ranged from 8.31 mm in Fulwadi Rajpipla to 9.75 mm in Fulwadi, Rajpipla, 7.77 mm in Fulwadi, Rajpipla to 9.94 mm in Manch, Rajpipla and 26.80 g in Fulwadi, Rajpipla to 39.24 g in Manch, Rajpipla, respectively. Locule/stone and seeds/stone varied from 3.56 in Manch, Rajpipla to 3.96 in Manch, Rajpipla to 1.08 in Manch, Rajpipla.

Seeds of *A. pendula* were collected from 09 sources from Ranakpur region of Rajasthan. Seed from all the sources were subjected to seed testing parameters. Number of seeds per gram ranged from 154.50±05.20 in Parasram mahadev to 254.75±18.06 in near Ranakpur temple. Germination percentage and vigour index ranged from 0.80 percent and 1.446 (near Ranakpur temple) to 3.48 percent and 7.274 (Ranakpur/Highway), respectively.

In *A. latifolia* number of seeds per gram ranged from 146.50±16.54 in Ranakpur to 241.50±05.00 in Jeatran, Rajsamand. Minimum value of germination percent and vigour index observed were 0.175 percent and 0.293, respectively in Jeatran. Whereas, maximum value of germination percent and vigour index were noticed 0.917 percent and 1.333, respectively in Jeatran.

PROJECTS CONCLUDED

Nil

2.2.3 **Social Forestry, Agro-forestry/ Farm Forestry**

EXTERNALLY AIDED PROJECTS

Nil

ICFRE FUNDED PLAN PROJECTS

NEW PROJECTS

Nil

PROJECTS CONTINUED

Project 6. Development of economically viable and integrated Agroforestry models for arid region (AFRI-55/Silvi/2006-12).

Principal Investigator: Dr.Bilas Singh

An Agroforestry model was established in August, 2006 and maintained at farmer's field at village Harsh, Bilara and District - Jodhpur. *Sesbania aculeata* (Dhaincha) was grown in the field for green manuring. Survival, growth and crop production data were recorded, compiled and analyzed. Performance of *Cordia mixa* was found the best as horticultural species and *Prosopis cineraria* as silvicultural species. *Colophospermum mopane* plants attained maximum height (213 cm), followed by *P. cineraria* (203 cm), *A. excelsa* (200 cm) and *Cordia mixa* (183 cm) whereas *Z. mauritiana* attained minimum height (117 cm).

Collar diameter was maximum in *A. excelsa* (8.13 cm), followed by *Cordia myxa* (7.00 cm), *Colophospermum mopane* (5.60 cm) and *P. cineraria* (5.32 cm). The plant growth and survival was higher in agroforestry plots as compared to the control (without crop). Wheat crop production was recorded 14.03 quintal /ha during the year. Wheat crop production was found reduced significantly in *C. mopane* and *Cordia myxa* tree combination plots in fifth year.

PROJECTS CONCLUDED

Nil

2.2.4 Forest Soils & Land Reclamation

EXTERNALLY AIDED PROJECTS

NEW PROJECTS

Nil

PROJECTS CONTINUED

Project 7. Enhancing productivity of saline wastelands in Kachchh- through improved tree planting techniques and silvipastoral study (Gujarat SFD sponsored project- 77/NWFP/SFD/AFRI-2006-11).

Principal Investigator: Dr.Ranjana Arya

Improved tree planting techniques

Research trials were laid with *Acacia ampliceps, A. bivenosa* (exotic) and *Salvadora persica* (indigenous) on black silty clay (medium), soil depth: 40-75 cm at Kordha, Sami Range in Patan, Gujarat at the fringe of Wild Ass Sanctuary (WAS) in July, 2007 to find out suitable exotic and indigenous fodder plant species with appropriate planting practice. *S. persica* proved to be the best species surviving in the extemely harsh conditions of high salinity, heat stress after two consecutive summers (2009 & 2010) and one drought year (2009) suffering almost no casualities and maintaining nearly the same mean survival (91.5%) after 45 months of planting . Fifty percent prunning in winter 2009 to over come water stress. *A. bivenosa* was at second place surviving one summer and one drought year with 77.3% at 30 months . However, survival was significantly reduced in summer 2010 and recorded as 46.3 % at 45 months (Fig 6). Survival of *A. ampliceps* was drastically reduced to only 12.7% ranging from 06.0 % in control to 18.7% in T_3 (Wheat husk) treatments. In general, causalities were high in shallow soil depth for both the *Acacia* spp.

Growth

S. persica attained height after pruning and a mean increment was 12.1%. Despite suffering with high casualities, survived *A. bivenosa* attained height (mean 126.7cm) in all the treatments. However, there was no growth in crown diameter. Treatments influenced the biomass yield and all the treatments recorded higher biomass as compared to control (3.43 Kg). Maximum 12.68 kg biomass yield was obtained for T_3 (Wheat straw) treatment, followed by 10.22 kg for T_2 (FYM) treatment.

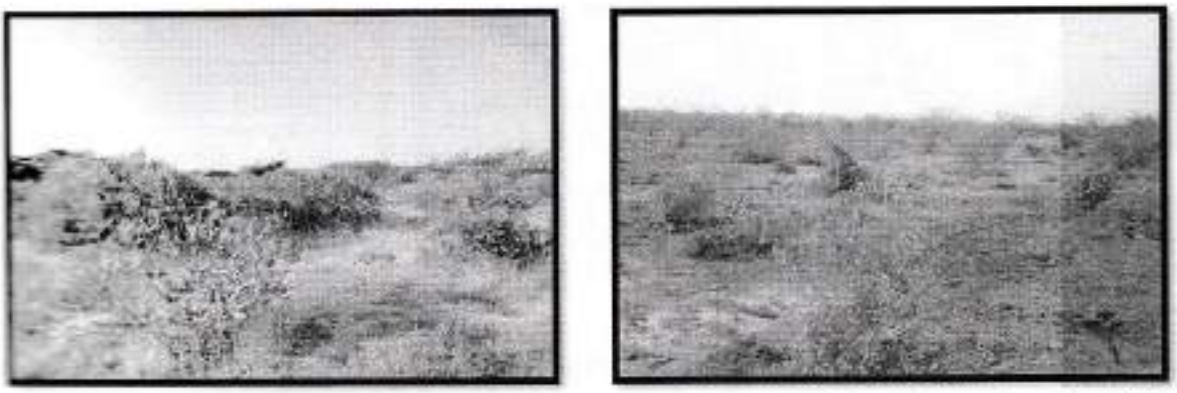


Fig 6. *Acacia bivenosa* (left) and *Salvadora persica* (right) in salt affected site after 38 and 46 months, respectively

Weed Biomass:

Green weed-mass was studied by laying random quadrats (1m x 1m) size in the entire experimental area. Among the plant species, halophytes were not dominated during 2010-11 due to very good rain creating water logging and salt leaching, and favoured species appearance. Grasses dominated and *Chloris virgata* was the most dominant species, followed by *Dactyloctenium aegypticum, Cynodon dactylon, Aristida spp, Cyperus spp. and Echinochloa colonum. Sporobolus sp* also appeared for the first time. Among herbs, *Zygophyllum simplex* was the most dominant, followed by *Taverniera cuneifolia* (Jathi moth), *Sueada fruticosa, Vernonia cinerea* and *Polygala erioptera* (Fig 7 & 8).

Overall 406 gm^2 yield was recorded however, tree species wise, variation was observed and it was 419.0 gm^2 (*A. bivenosa*) 391.2 gm^2 (*S. persica*) and 357.9 g in the shallow water logged area.

Fig. 7 *Taverniera cuneifolia* (Jathi moth)

Fig. 8 *Zygophyllum simplex* (Pat Lani)

Silvipastoral study:

Sub Project B

Trials with four tree species, viz; *Cordia gharaf, Prosopis cineraria, Zizyphus. mauritiana* and *Colophospermum mopane* and two grass species, namely, *Cenchus ciliaris,* and *C. cetigerus* were laid in RBD in three replication at Mochirai, Bhuj in July, 2006.

Survival: At 52 months, in both the experiments survival at 52 months was 93.8 % in *C. setigerus* and 92.6 %for *C. ciliaris*. There was no significant difference between with grass and control treatments. Species wise *Cordia gharaf* recorded overall highest 98.6% survival, followed by *Z. mauritiana* (92.1%) and *P. cineraria* (88.8%).

Height: Plant species attained height between 38-52 months growth period. The mean incremental height was more of *C. setigerus*, 13.7 & 23.5% as compared *C. ciliaris* 7.1 & 9.3% for control and

with grass treatments, respectively. In *C. setigerus* experiment, the mean height was more for control plants(188.2 cm) as compared with grass treatment (148.3 cm), while reverse was true with *C. ciliaris* (Control- (184.9cm) and with grass treatment- 166.5cm). During this period, species wise *Z. mauritiana* and *C. gharaf* recorded same mean height (221.0 cm), followed by *P. cineraria* (74.5 cm), although incremental height was maximum in *P. cineraria* (Fig 9).

Crown diameter: After good rains in the year 2010, crown diameter at 52 months, the incremental crown growth was 20.0 & 32.7 % and 6.7 and 9.9 % for control and with grass treatments respectively, in *C. setigerus* and *C. ciliaris* experiments. *Z. mauritiana* continued to attain significant crown growth (211.3 cm) compared to *C. gharaf* (190.0 cm) and *P. cineraria* (63.2 cm). It recorded 81% & 22.3% incremental crown growth with grass treatment and 41.5% & 10.3% in control with *C. setigerus* and *C. ciliaris,* respectively as compared to growth at 38 months, while it was 6.0 & 0 and 4.6 & 4.3 % only for *C. gharaf* at the same time.

Green grass yield: A long heat spell delayed monsoon, followed by downpour resulted in water stagnation, which adversely affected the green grass yield in both the experiments in the year 2010 and it was 0.67 and 0.45 kg/m2 for *C. ciliaris* and *C. setigerus* , respectively

Physico chemical properties: Soil samples were collected in March, 2010. In case of *C. ciliaris* soil pH values were in normal range (>8.2) for both the soil layers (0-25 & 25-50 cm) inside plant pit and at a distance of 2 m from plant pit. However, with *C. setigerus* values were slightly higher both for pH and EC inside plant pit. Due to depression in field water collection resulting in hydrolysis of salts from soil

In the summer months, percent (SOC) inside plant pit was higher in case of *C. setigerus* for both the soil depths. In both the experiments, control recorded lower SOC values compared to with grass treatment. Percent SOC values at 2 m distance were higher for both the soil depths as compared to plant pit for control and with grass treatments.

A B C

Fig 9 (A-C). *Z mauritiana,: C. ciliaris* and *Cordia gharaf,* Field visit of VVK trainees at Mochirai, Bhuj

A field visit of participants officials to Silvi-pastoral trial at Mochiri, Bhuj was also organized during three days of the farmers, forest officers (guards, foresters, RFOs and ACF) training, organized by VVK, Rajkot, AFRI, Jodhpur at Van Chetna Kendra, Bhuj from 14-12-10 to 16-12-10.

PROJECTS CONCULDED

Nil

ICFRE PLAN FUNDED PROJECTS

PROJECTS CONTINUED

Project 8. Characterization and classification of forest soils of Rajasthan (AFRI-85/FED/2007-2012).

Principal Investigator: Mr. N. Bala

The project has been initiated in September, 2007 with the objective to characterize and classify the forest soils of Rajasthan following the USDA classification system. During the reporting period soil profiles have been studied at 215 places in Chittorgarh, Bhilwara, Jaisalmer, Baran, Tonk, Alwar, Bharatpur, Dungarpur, Jaipur, Pratapgarh, Jodhpur and Rajsamand districts covering 207 forest blocks. Soil texture, structure, consistency, colour, pH, electrical conductivity, organic carbon, NO_3 and NH_4 – nitrogen and phosphorus were estimated for 780 samples covering 12 districts. In the vast sandy northwestern region, soils are predominantly saline or alkaline and sandy in nature. Sand content varied from 66% to 93%. In the eastern and southern districts, soils are neutral to alkaline in nature and soil texture varied between loamy sand to sandy loam with few soils in the category of sandy clay loam (22% clay content). Highest clay content of 32% was found in Bandikui, Dausa and Guapada, Banswara (Fig 10). Overall 46% soils were found to be sandy loam, 29% - loamy sand, 20% - sandy, 3% - sandy clay loam, 1.5% - loam and 0.5% - clay loam. In general, soils of western districts are poor in nitrogen and phosphorous. Available nitrogen and phosphorous varied between 7- 42 kg ha^{-1} and 8-56 kg ha^{-1} respectively. Soils of Chitrimata block (Fig 11), Pratapgarh has higher nitrogen (86 kg ha^{-1}) and phosphorous (78 kg ha^{-1}) content.

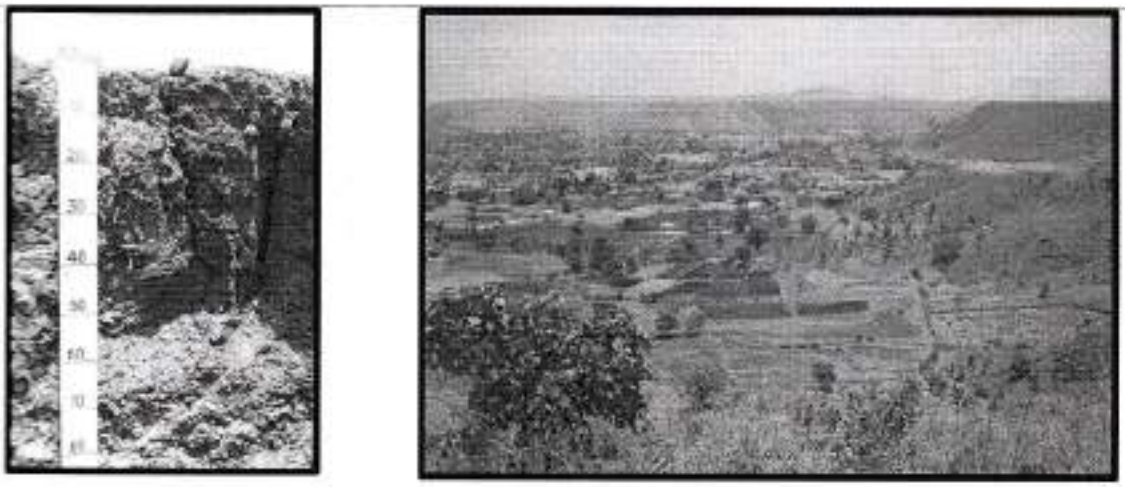


Fig 10. Clay loam soil (left) and landscape (right) at Guapada Forest Block, Banswara

Fig 11. Soil profile (left) and vegetation type (Right) at Chitrimata Forest Block, Pratapgarh

NEW PROJECTS

Project 9. **Identification of soil-vegetation relations and indicator species for assessment and rehabilitation in lower Aravalli of Rajasthan (AFRI-101/EED/ 2010-14).**

Principal Investigator: Dr. G. Singh, Scientist F

This project was started with the objectives (i) to study on physical properties and nutrient status of soil derived from different parent material, and (ii) to study on vegetation structure and indicator species on dominant soil types, for it utilization in assessing land degradation and rehabilitation programme. The study areas are Aravalli/upper Malwa plateau covering five different locations with varying rainfall i.e., Banswara (Bara Nandra kho forest block), Rajasmand (Sabalia forest block)

and Pali (Borvad forest block) in Rajasthan and Sabarkantha (Motimori forest block) and Palanpur (Trisulia forest block) in Gujarat. Twenty five plots of 0.1 ha were laid out in 1 km^2 area following systematic sampling. Number of trees and shrubs were counted and measured for diameter at breast height, crown spread and height. Bara nandra kho site showed highest number of tree species, species richness and species evenness. The highest tree population (32.48 tree 0.1 ha^{-1}) and species diversity (1.08) were in Trisulia, whereas highest tree dominance (0.54) was at Motimori forest block. *Tectona grandis, Lanea coromandelica, Anogeissus pendula, Wrightia tinctoria* (**Fig 12**) and *Tectona grandis* were the dominant tree species in Banswara, Rajasmand, Pali, Palanpur and Sabarknatha sites, respectively. Total number of species was highest (12 ha^{-1}) at Banswara site, but species population was highest (95.56 trees 0.1 ha^{-1}) in Motimori forest block. Species richness (0.57) and diversity (1.18) were highest in Borvad forest block, whereas dominance (0.84) was at Trisulia forest block for shrubs. *Nyctanthes arbor-tristis* as shrub dominated both sites in Gujarat, whereas, *Euphorbia caudicifloia, Lantana camara* and *Rhus mysorensis* dominated at Borwad, Banswara and Rajsmand sites, respectively in Rajasthan.

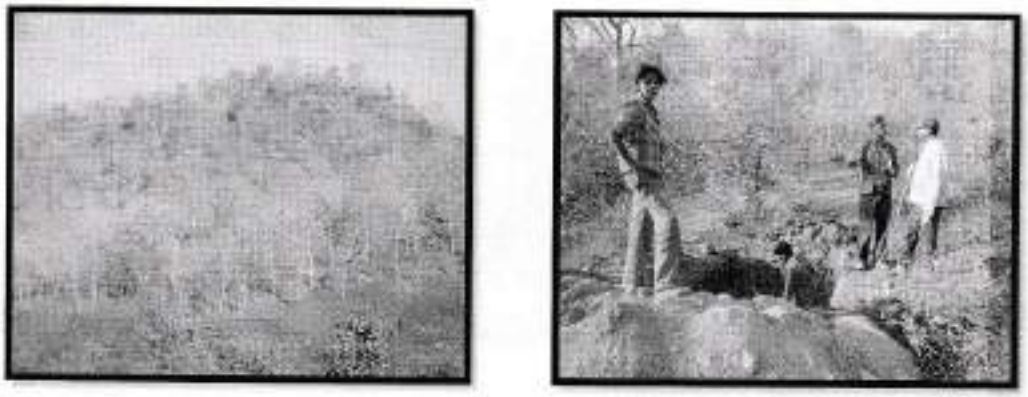


Fig 12. Trisulia forest block dominated by *Wrightia tinctoria* trees (left) and pit opening and growth and diversity study (right) near Ambaji in Palanpur division in Gujarat.

PROJECT CONCLUDED

Nil

2.2.5 Watershed Management

EXTERNALLY AIDED PROJECTS

Nil

ICFRE FUNDED PROJECTS

NEW PROJECTS

Nil

PROJECTS CONTINUED

Nil

PROJECT CONCLUDED

Project 10. Efficacy and economics of water harvesting devices in controlling run-off losses and enhancing biomass productivity in Aravalli ranges (AFRI-39/EED/ 2005-11).

Principal Investigator: Dr. G. Singh, Scientist F

Experiment was started in July, 2005 by financial assistance of Rajasthan Forest department upto three years later on by ICFRE with the objectives (i) to study the potential of different rainwater harvesting (RWH) devices in controlling run-off losses in different topographical condition; (ii) to study the effect of different rainwater harvesting devices on biomass productivity, and (iii) to study the economic viability of RWH devices for their adoption in large scale. For this, a total 75 plots of about 700 m^2 area were laid in 0-10, 10-20% and >20% with control, contour trench, gradonie, Box trench and V-ditch rainwater harvesting treatments. Seedlings of different species were planted and run-off measuring device installed. Plant growth, soil nutrients, run-off water and nutrient losses, soil water content and vegetation diversity and productivity were recorded throughout the study period.

Pooled data of four years indicated an average run-off of 12.58% of the total rainfall. Most effective rainwater harvesting treatments for controlling run-off losses are V-ditch in <10% slope and Contour trench in 10-20 and >20% slope area. The run-off was 14.63% from 10-20% slope area as compared to 10.22% from <10% slope and 12.90% of the total rainfall from >20% slope area. Among the treatments, highest run-off (13.55%) was from the control plots, whereas the lowest water loss was from V-ditch plots (11.05%). Overall soil loss of 3.43, 2.40, 1.21, 0.90, 0.24 and 0.19 g soil l^{-1} water was observed from the area in September, 2005, July, 2006, October, 2006, July, 2007, August, 2007 and July, 2009, respectively. This indicated a decreasing trend in soil loss per liter of water loss under increased vegetation cover in the area.

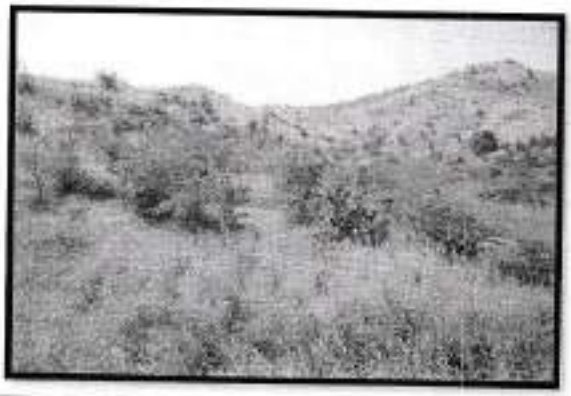
Growing vegetation influenced PAR reaching to the ground surface, and maximum reduction in PAR was in 2010 by both tree and herbaceous vegetation. Soil water, which was retained under the influence of diverse vegetation during monsoon period, was utilized efficiently in rainfed period. There was a decrease in soil pH, EC and nitrogen and increases in PO_4-P (by 2.04-fold) in June, 2010 than in June, 2005. The decrease in nitrogen concentration was lesser (by 9.7%) whereas the increase in PO_4-P was greater in >20% slope greater than in <10% slope. The decrease in soil pH, EC and available nitrogen was greatest in gradonie, contour trench and control plots, respectively. But the increase in the concentrations of PO_4-P was highest in the control plots.

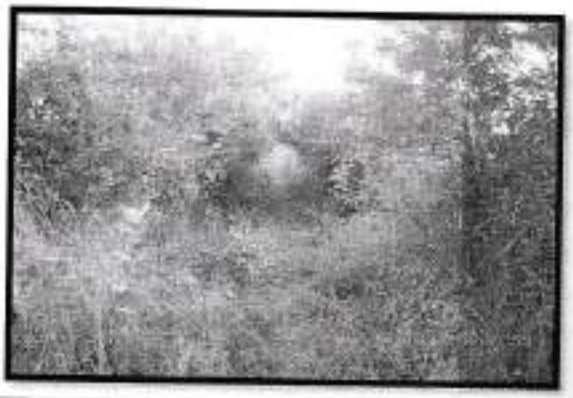
Application of rainwater harvesting improved plant growth. Soil characteristics was the most dominant factors influencing survival and growth indicating greater height and collar growth of *Acacia catechu* and height of *A. indica*, *E. officinalis* and *Z. mauritiana* in >20% slope (relatively deep and well drain soil) than in 10-20% slope (shallow loamy sand soil). Plant growth and MAI

was lowest in the control plots, but gradonie structure was poor for plant growth. Plants were taller with highest MAI for height in CT plots, but thickness was relatively greater in BT plots. *Dendrocalamus strictus*, *Emblica officinalis*, *Zizyphus mauritiana*, *Holoptelia integrifolia* and *Syzygium cumini* were the best suited to contour trench, *Acacia catechu* and *Azadirachta indica* were best suited to VD structure and *Gmelina arborea* was the best suited to BT rainwater harvesting structures. Interestingly all the species of *Acacia* either planted or regenerated performed the best with V-ditch RWH treatment.

Number of herbs and grass species increased from 39 in 2005 to 92 at the end of the experiment. The number of species, population and species dominance increased with time. Species diversity and richness decreased to the lowest value in 2010. Pooled data for the dry biomass of six years ranged from 275.39 to 535.22 gm^{-2}. The lowest biomass was in <10% slope and the highest (P<0.05) was in >20% slope area (26.7% increase over <10% slope). It was lowest in the control plots. The increases in herbage biomass over the control plots were 28.22% in CT, 34.92% in Gradonie, 23.95% in BT and 18.84% in VD plots. But most interesting is the positive relation of species dominance (which increased with time with negative relation with species evenness) with herbage biomass and vegetation height. In general, grass production increased from 15 tones in 2005 to 36 tones in 2010 in about 17 ha area.

Treating the area with different rainwater harvesting structures/ plugging of the drainage lines in 2006 enhanced the water availability, which was utilised by ladies for bathing purpose and by livestock for drinking. Soil fraction, soil organic carbon (SOC) and soil carbon stock increased significantly in June, 2010 and average increases in soil fraction were 3.7-fold in <10% slope, 3.2-fold in 10-20% slope and 4.1-fold in >20% slope. The increases in SOC and soil carbon stock were 0.98-fold and 3.6-fold in <10% slope, 1.3-fold and 4.36-fold in 10-20% slope, and 1.4-fold and 5.9-fold in >20% slope, respectively. Among RWH treatments, the increases in soil fraction was from 3.4-fold in control to 4.2-fold in VD plots, but SOC increased by 12.20% in BT to 28.16% in CT plots. The increase in soil carbon stock was by 4.1-fold in BT plots to 4.9-fold in VD plots.





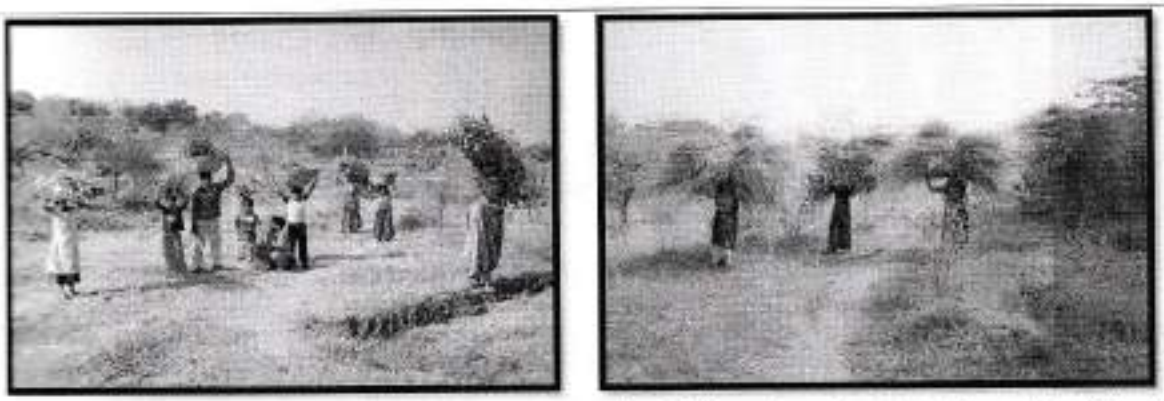


Fig 13. A general view of plants and growing vegetation (top left) and growing plants (top right). Collection of fuel-wood and fodder from the experimental area, Gauapada, Banswara (bottom Left & Right).

2.3 Genetic Improvement

2.3.1 Overview

Variability in the base population is the prerequisite for any successful genetic improvement programme based on selection and breeding. In The states of Rajasthan and Gujarat quite a good numbers of Candidate plus trees have been selected from different locations, and some of these trees have been used to establish clonal seed orchards and also few seedling seed orchards.

Though, selection of phenotypically superior trees is done very carefully and with high selection intensity their genetic worth cannot be guaranteed. Selection can be successful only when the variability in the population is due to genetic causes. The clonal seed orchards available in Western Indian states are established from the first generation selection. These trees, needs to be tested to ascertain their genetic worth by estimating genetic parameters like heritability, genetic gain and combining ability. Estimation of genetic parameters is a very useful tool in predicting the amount of gain envisaged from clonal and progeny material. The variation among progenies and clones is commonly used as an estimate of total genetic variation and to calculate the degree of genetic control for a particular trait. Heritability is the measure of how strongly a particular trait is influenced by genotype and how much by the environment, whereas combing ability estimate gives the indication of the breeding values of selected parents.

2.3.1.1 Summary of the achievements under the Theme

- The survival percentage of progeny trials of 40 CPTs was high at Jodhpur (91%) as compared to Bikaner (only 60 %) at the age of two and half years. An average height of plants at Jodhpur was 84.10 cm, where as average height of progeny at Bikaner was 40.57 cm. The progeny from Chohtan gave best growth at Jodhpur whereas, at Bikaner the progeny from Daichu showed best growth.
- Micropropagation of *Capparis decidua* have been initiated and axillary bud break was

achieved and *in vitro* shoots were multiplied.

- For micropropagation of *Salvadora persica* axillary bud break was achieved on MS medium supplemented with BAP and IAA. 2.5 fold shoot multiplication was obtained on MS medium supplemented with 5.0mg/l BAP.
- In *Jatropha curcus* plants were produced from somatic embryogenesis and hardened. The problem of bacterial infection of cultures was also remedied.
- Identified slat tolerant plant *Lepidium sativum* was hydroponically grown. Four genes (NHX1, SOS1, HKT1 and ClC-c) were shortlisted and gene sequence alignment work was completed.
- Somatic embryo based plant production protocol was scaled up for *Commiphora wightii* and tissue culture raised hardened plants were planted in field where survival rate was 100%.
- Variation and inheritance of fruit and seed traits of teak from Dang region of Gujarat was studied for the first time.
- Genetic variation amongst half sib families was studied. Estimates of heritability and genetic gains were computed and inheritance of growth traits was investigated.
- Selected 10 phenotypically superior trees of teak and established progeny trial of 28 families at Sajjangarh, Rajasthan
- Surveyed different area of Khejari and selected 20 CPTs.
- Progeny trials of Neem were affected by frost (16.5%). Interestingly progeny No. 327 was not affected by frost, whereas progenies of CPT No. 12 was severely (41.2%) affected during winter of 2010-11. Among the progenies of the 17 CPTs, progenies of CPT 7 has shown best performance based on survival and growth parameters.
- At the age of 7 years of multilocational clonal trails of *Eucalyptus camaldulensis* and *Dalbergia sissoo*, clone 99, 105 115 of *E. tereticornis* performance was beter at ball the four locations. Whereas, in *D. sissoo* clone 92, 35 and 15 performed better in all the four locations in Gujarat.
- Grafting technique developed for cloning of male and female plnats. Demonstration clonal trial of male and female plants revealed that female plants growth performance was better (10% more growth in term of height and girth) as compared to male plants.

2.3.1.2 Projects under the Theme (in table as given at 2.1.1.2)

Projects	Concluded Projects	Ongoing Projects	New Projects Initiated During the Year
Plan	0	7	2
Externally Aided	0	0	0

2.3.2 Conservation of Forest Genetic Resources

Nil

2.3.3 Tree Improvement

EXTERNALLY AIDED PROJECTS

ICFRE FUNDED PROJECTS

NEW PROJECTS

PROJECTS CONTINUED

Project 11. **Investigations on genetic variation and inheritance of western Indian teak (*Tectona grandis* L.f) (AFRI-94 /Silvi/2009-2014).**

Principal Investigator: Mr. P.H. Chawhaan

The western Indian region harbours ecologically diverse forests of teak; it includes dry teak forests (5A/C 1b) to very dry teak forests (5A/C 1a). The extent of teak forest of Western Indian states together harbours about 6,192 sq. km. At present, information on the inheritance of teak and estimation of the genetic parameters in western Indian teak is lacking. This Project is planned for ascertaining the genetic worth of the selected trees besides understanding the inheritance pattern of different economically important traits of Western Indian teak, which hitherto remained unvestigated.

Genetic analysis of fruit and seed parameters in teak

Open pollinated seed from 80 phenotypically superior trees from different locations were collected. Fruits from 41 trees of Dang region of Gujarat from this collection were used to carryout studies on seed morphological parameters. Fruits from each tree were divided equally into three lots. Observations on different characters were taken on 50-100 randomly drawn fruits from each lot representing three replications Observations were recorded on stone length (mm), stone width (mm), treated stone length (mm), treated stone width (mm), stone weight (gm), and treated stone weight. Fruits were then carefully cut open horizontally to observe for filled and unfilled locules and counted in numbers. Filled seeds were then carefully extracted and weighed to estimate 100 seed weight. Data so obtained were subjected to analysis of variance, followed by estimation of variance components as well as phenotypic and genotypic correlations (Singh and Chaudhary, 1996). Broad sense heritability (h2) was estimated from replicated plot means and estimates of expected genetic gain was calculated and expressed as per cent of mean (Johnson *et al*, 1955). Phenotypic and genotypic coefficients of variability (PCV

and GCV) were calculated after Singh and Chaudhary (1996). Investigation also revealed highly significant variation for all the fruit and seed parameters in Gujrat teak except no of locules. Interestingly, replication mean squares were found to be non-significant for number of locules and seed weight, which indicate that the development of these characters is not significantly influenced by environmental fluctuations.

Mean values with standard error, range and coefficient of variation are presented in Table 1-A. and estimates of environmental, genotypic and phenotypic components of variation, heritability in broad sense and genetic gain in per cent of means are presented in Table 2-B. Maximum value of coefficient of variation was observed for filled locule (29.86).

Table 1 (A &B). Descriptive statistic and estimates of genetic parameters in Dang Teak

Parameters	Traits								
	Stone length (mm)	Stone width (mm)	stone weigh t (gm)	Stone length treated (mm)	stone width treated (mm)	Stone weight Treated	Number of locules	Filled Locules	Numbe r of un filled locules
A. Descriptive statistics									
Mean	9.88	10.58	39.8 4	8.10	8.59	30.16	4.00	0.93	3.07
Range	3.02	3.36	3.7	3.70	16.43	24.85	0.60	1.70	1.80
Minimum	8.24	8.43	7.32	8.11	26.76	13.98	3.50	0.40	1.80
Maximum	10.87	12.57	9.57	11.82	47.69	38.83	4.10	2.10	3.60
Standard Error	0.06	0.06	0.05	0.05	0.51	0.47	0.01	0.04	0.04
Sample Variance	0.32	0.35	0.19	0.27	23.95	20.82	0.01	0.14	0.14
CV	2.46	4.60	2.65	4.19	4.87	7.65	2.78	29.86	11.72
B. Genetic estimates									
σ^2 g	0.09	0.11	9.51	0.22	0.19	7.54		0.03	0.03
σ^2 p	0.19	0.24	10.1 1	0.31	0.32	8.19		0.10	0.10
GCV	3.00	3.12	7.74	5.74	5.01	9.11		18.25	5.46
PCV	4.43	4.66	7.98	6.85	6.57	9.49	0.55	34.56	10.46
h2	0.46	0.45	0.94	0.70	0.58	0.92	0.00	0.28	0.27
R	0.28	0.30	5.98	0.67	0.52	5.21		0.10	0.09

R % of mean	2.84	2.88	15.01	8.32	6.01	17.28		10.49	3.07

Where: σ^2 g: genotypic variance, σ^2 p: Phenotypic variance, CV: Coefficient of variation, GCV: genotypic coefficient of variation, PCV: Phenotypic coefficient of variation, h2 : Heritability (broad sense)R: Genetic gain

Differences between GCV and PCV for all the traits were found to be less. This suggests that fruit and seed characters are least affected by environmental variations. The investigation also reveals that treated stone length (mm), stone weight (gm), and treated stone weight were found to be the most heritable (Table 1-B). Whereas, stone length, stone width, and number of unfilled chambers are moderately inherited.

Genetic analysis of progeny trial and investigation on inheritance of growth traits in Gujarat Teak:

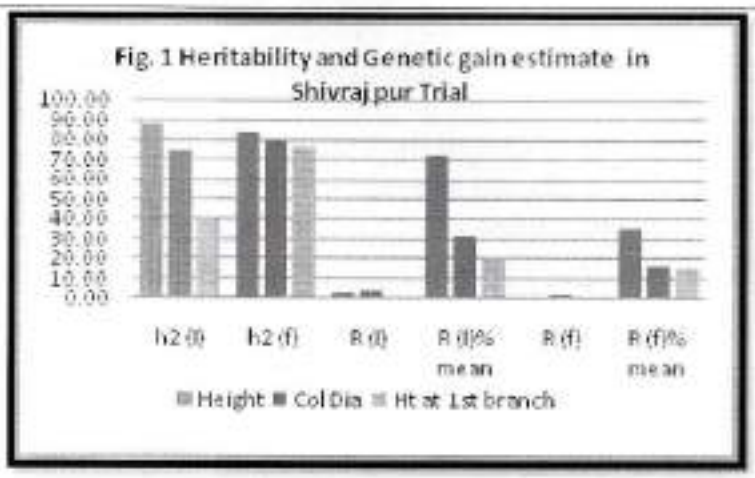
The materials for this investigation was from progeny trial established with 16 half-sib families of teak. The trial was established in 2008 at Shivrajpur under the jurisdiction of Silviculture division, Rajpipla by the SFD, Gujrat. There were 16 progenies of each family replicated five times at an in Randomised Block Design (RBD). In January, 2011 data on growth parameters viz. height, and collar girth height at first branch were collected from individual trees in each plot. Data was subjected to analysis of variance, followed by estimation of variance components, genetic parameters and general combining ability according to Zobal and Talbert (1984). Computation of genetic advance was done using selection intensity of 5 %.

Availability of variation in the population is a prerequisite to make selection effective and similarly the information on extent and nature of genetic variation is of almost importance to develop effective breeding strategy.

Table 2. Analysis of variance (only mean squares) of Shivrajpur progeny trial

Source of variation	Traits		
	Height (m)	Height at 1st br.	GBH (cm)
Replications	73.04*	7.72***	151.12***
Families	26.78***	32.56***	117.95***
Fam. X Rep	34.24***	3.623***	72.52***
Error	10.92***	0.41***	7.86***

*** Significant at 0.1%, * Significant at 5%



Analysis of variance (Table 2) revealed that variation due to families was highly significant for all the traits, except apical, indicating scope for family selection. The significant family x replication variance for most of the traits indicates that in the present materials development of these traits are influenced by environment.

While heritability values express the proportion of variation in the population that is attributable to genetic differences among individuals, genetic advance indicates average improvement in the progeny over the mean of the parents. Genetic advance is realized by selection in the parental generation and its magnitude depends on selection intensity, parental variation and heritability. In the present material, Individual and family heritability values ranged from 40 to 87 and 76 to 84 percent respectively (Fig 1).

Height and girth exhibited very high estimates of narrow sense heritabilities at individual as well as family level. Family heritability values were considerately higher for all the traits suggesting effectiveness for family selection. Genetic advance estimates for these traits also followed similar trend. Values of narrow sense heritability coupled with moderate to low estimates of genetic advance in the present study indicates the presence of both additive and non additive gene action in Gujarat teak.

Establishment of progeny trial and selection of phenotypically superior trees.

A progeny trial comprising of 28 families in RBD with four replications was established in 2010 at sujjangarh, Udaipur, Rajasthan. Data on survival and growth were collected. In addition to this, ten new CPTs of teak have been selected in different location of Gujarat (Fig 14).

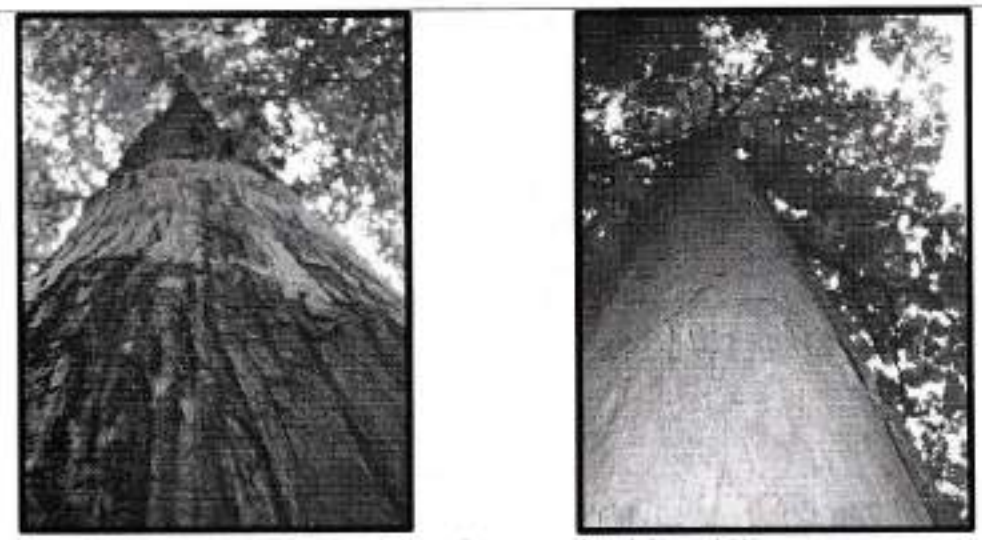


Fig. 14. Candidate plus trees of teak (A and B)

Project 12. Screening of high oil and azadirachtin in neem (AFRI-45/FGTB-8/2002-2013).

Principal Investigator : Dr. U.K. Tomar

Status: Neem progeny trial was established in year 2002 at Govindpura, Jaipur with seedlings of selected 17 CPTs for high Aza content. This trial is 8 years old and significant variation in flowering and fruiting was reported during 2010. Overall fruiting and flowering was very poor. Moreover conversion rate of flowers into fruit was also very poor. Therefore, sufficient seeds were not available for chemical analysis. Frost has affected the leaf biomass of trees (Figure 15), which resulted in inefficient photosynthesized reserve energy resources required for conversion of flowers into fruit and their growth.

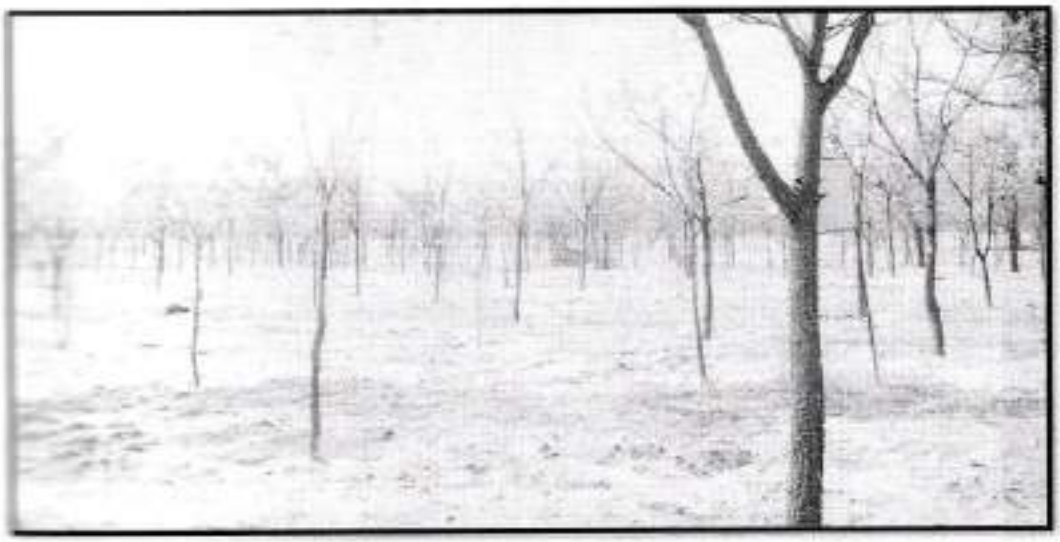
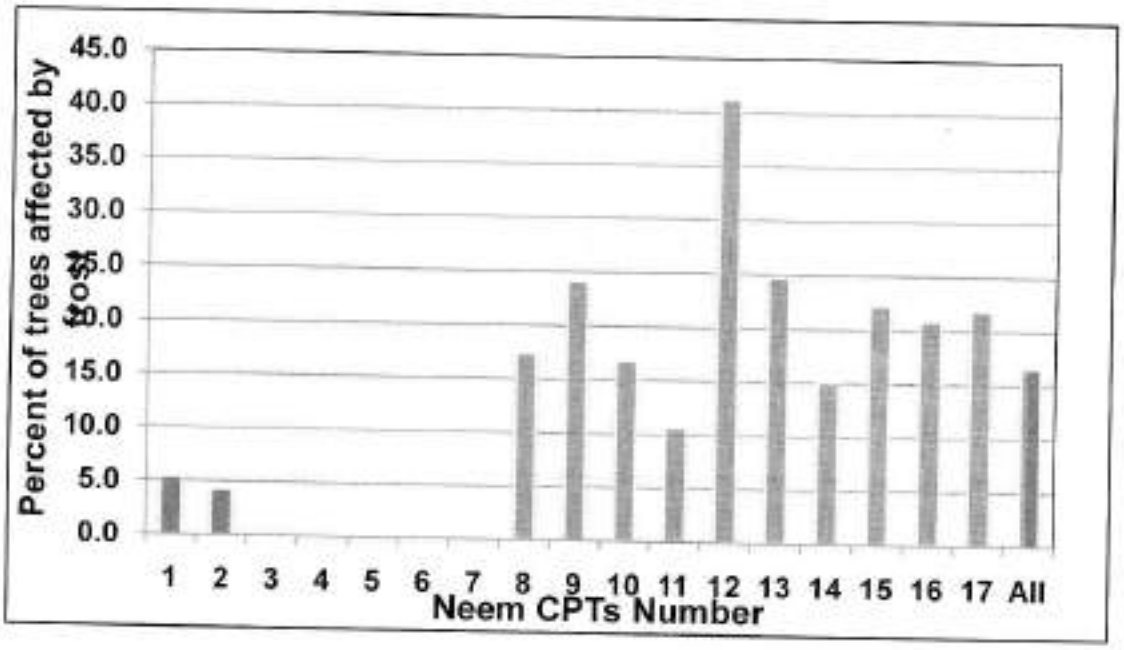


Fig 15: Neem progeny trial established at at Govindpura, Jaipur exhibiting poor leaf biomass.

Data were collected on frost affect on individual trees, which were adversely (more than 50% of the tree is affected by frost) influenced by frost with a view to understand the potential of progenies against frost. Data analysis revealed that overall 16.5% trees of total progeny trail were affected by frost. Interestingly, it was found that neem progenies of CPT No. 3, 4, 5, 6 and 7 was not affected by frost as per criteria selected for data collection. It is interesting to note that CPT number 4 and 7's progenies have shown better performance in height and girth parameters. Unfortunately, CPT number 12, which was one of good performer in girth and height parameters is maximally affect by frost. Where, 41.2% trees are damaged due to frost. This indicates that genetics is playing important role in growth parameters and tolerance towards frost independently. Frost effect on 17 CPT progenies is presented in graph 2.



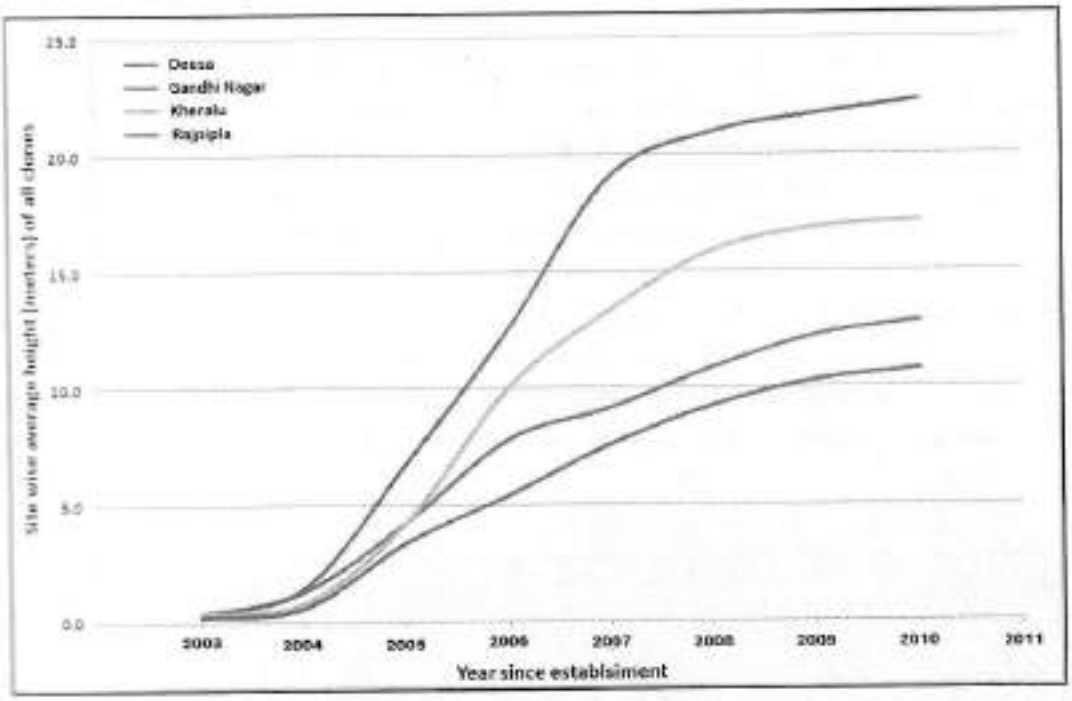
Graph 2. Effect of frost recorded in high azadirachtin Neem progeny trail at Jaipur

Project 13. Multilocational trial of *Eucalyptus camaldulensis* and *Dalbergia sissoo* clones in Gujarat state (AFRI-41/FGTB/2002-2012).

Principal Investigator : Dr. U.K. Tomar

Multilocational trials of *E. camaldulensis* and *D. sissoo* clones were established in 2003 at four locations in Gujarat namely Deesa, Gandhinagar, Kheralu and Rajpipala. Data were collected on growth parameters annually, since establishment. Data on physiological parameters such as photosynthesis and transpiration rate and qualitative parameters were also collected once from all the sites for both species. Data of *E. camaldulensis* being fast growing species were analyzed in details to conclude the results, so that selected clones can be released through ICFRE procedures. Data collected so far from 2003 to 2011 was analyzed. These studies on height indicate that first

year growth (2003-2004) was slow being the establishment phase. But later on (2004 to 2008), growth increased exponentially and the differences in height due to site effect were clearly visible and increased with time. In third phase (2008-2011) again growth rate declined irrespective of site. Maximum growth was recorded in terms of height at Gandhinagar followed by Kheralu. Minimum growth was recorded in Rajpipala as shown in graph 3.



Graph 3: Effect of site on height parameter of Eucalysptus clones

Analysis of variance reveled significant to very highly significant variation between the clones of both the species for most of the traits across the locations. Estimation of genetic parameters showed that the growth traits of *Eucalaptus camaldulensis* are strongly inherited and under the influence of both additive and non additive gene action. Results were presented in "Workshop on All India Multilocational Trials of Eucalyptus" held at Institute of Forest Genetics and Tree Breeding, Coimbatore from 29th & 30th July 2010. A Regional Variety Testing Committee (RVTC) at A.F.R.I. Jodhpur has been constituted to release the potential clones for specific locations.

Project 14. Genetic improvement of ***Tecomella undulata*** **(AFRI- 44/FGTB/7/2002-2012).**

Principal Investigator : Dr. Sarita Arya

Under the tree improvement programme of *T. undulata*. Progeny trials were established at two locations using seedling of 40 CPT's at Bikaner and Jodhpur in August, 2008.

The survival percentage was high at Jodhpur (90%) as compared to only 60% at Bikaner at the age of 30 months. An average height of plants at Jodhpur was 84.10 cm, where as 40.57 cm at Bikaner. An average collar diameter at Jodhpur was 0.98 cm, where as at Bikaner it was 0.82 cm.

The progeny of CPT-19 from Chohtan (Barmer) gave best growth at Jodhpur attaining the height of 102.5 cm and minimum is CPT-2 (Mohangarh) of 73.06 cm in height at Jodhpur. At family level highest survival (97.2%) was found in CPT-15 (Daichu) and minimum (75%) was in progeny of CPT-23 (Chohtan) at progeny trial of Jodhpur, where as in Bikaner, CPT-3 (Mohangarh) exhibited highest survival rate of 75% and minimum (36%) in progenies of CPT-4 (Mohangarh).

Considering collar diameter, CPT-23 progenies of (Chohtan) proved the best 1.28 cm and CPT-40 (Baytu) exhibited minimum collar diameter (0.74 cm) at Jodhpur. At Bikaner highest collar diameter 0.98 cm was in the progenies of CPT-29 (Barmer) and least collar diameter (0.64 cm) of CPT-43 (Baytu). In general, growth performance of progeny trial was poor at Bikaner as compared to Jodhpur.

Fig 16: Progeny trial of *T. undulata* at Bikaner 30 months

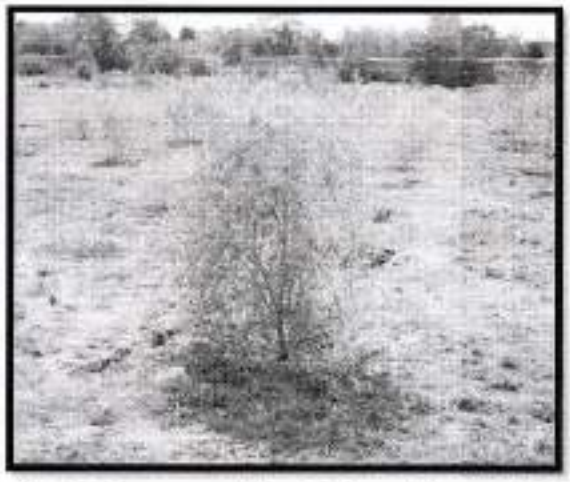


Fig 17: Progeny trial of *T. undulata* at AFRI after 30 months

CONCLUDED PROJECTS

Nil

2.3.4 Vegetative Propagation

EXTERNALLY AIDED PROJECTS

Nil

ICFRE FUNDED PROJECTS

NEW PROJECTS

Nil

PROJECTS CONTINUED

Project 15 - **Demonstration trial of male and female *Ailanthus excelsa* plants raised through grafting (AFRI-79/FGTB/2006-2009).**

Principal Investigator : Dr. U.K. Tomar

Grafting technique for *Ailanthus excelsa* mature trees developed **(Grafting success = 50%)**. At present, this present grafting method is more efficient over any other clonal technique. Wedge grafting gives better success than patch grafting. Clonal propagation of Male and Female plants is achieved successfully by using grafting technique, which is easy and economic. This technique can be handled easily by farmers and field staff of SFDs. Two year old demonstration trail of male female plants raised through grafting exhibited that female plants have about 10% superiorly in height and girth parameters over male plants.

Fig. **18:** Demonstration trial of male and female *Ailanthus excelsa* grafted

PROJECT CONCLUDED

2.3.5 Biotechnology

EXTERNALLY AIDED **PROJECTS**

ICFRE FUNDED PROJECTS

PROJECT CONTINUED

Project 16 In *vitro* mass propagation of *Jatropha curcas* L. and optimization of low cost options for economizing the technology (AFRI- 83/FGTB/7/2007-2011).

Principal Investigator : Dr. Tarun Kant

Protocols of *in vitro* plant propagation through somatic embroygensis and axillary shoot proliferation were developed for *Jatropha curcas*. The first protocol was based on somatic embryogenesis and the second using axillary bud proliferation pathway.

Embryogenic callus cultures were maintained and proliferated through routine subculturing. Mature somatic embryos (SEs) were inoculated on SE germination medium (hormone free MS medium). on which these germinated. Germinated plants were allowed to grow further on the same medium and attained a height of 6-8 cm. SE derived plants are currently undergoing hardening.

In the second protocol based on axillary bud proliferation from mature nodal segments of *J.* curcas, the problem of endophytic bacterial infection in long term maintained cultures was encountered. Experiments to combat this problem were successfully concluded through use of antibiotics. Experiments using following antibiotics at 100, 250 and 500 mg/l were performed: 1. Levofloxacine, 2. Augmentin, 3. Clindamycin, 4. Azithromycin, 5. Gennamycin, 6. Moxifloxacin, 7. Chloromycetin and 8. Cepemine. Two best performers in contamination control in deceresing order of efficacy were Levofloxacin and Moxifloxacin. Cent percent culture recovery was achieved. Rooting experiments are underway.

Experiments on low cost alternatives to gelling agents have been undertaken. Guar gum, sago and isabgoal have been tested for efficiency as gelling agent at bud break and rooting stages. Isabgoal was found the best low cost gelling agent.

Project 17. Development of tissue culture technology for multiplication of economically important desert plant - *Salvadora persica* (AFRI- 92/FGTB/2009-2014).

Principal Investigator: Dr. I.D. Arya

The aim of the study is to develop refined protocol for rapid and mass clonal production of plus trees/superior genotypes of *Salvadora persica*. Towards this end, studies were conducted on the effect of media, growth hormones and incubation conditions (temperature, light, humidity) for high frequency multiple shoot induction and growth. MS medium supplemented with BAP (7.5 mg/l) proved the best and favoured multiple shoot induction(2-3 shoots/explants) in 4 weeks at 25 C

temperature for 12 h photoperiod and 2500 lux intensity of light (Fig 19).

In order to achieve high rate of shoot multiplication, studies were conducted on auxins and cytokinins in MS medium. The results revealed that medium consisted of 5.0mg/l BAP favored 2.5 fold shoot multiplication in four weeks period. Studies are being carried out to improve quality of shoots, shoot growth and further improvement in shoot multiplication rate, before using shoots for rooting experiments (Fig 20).

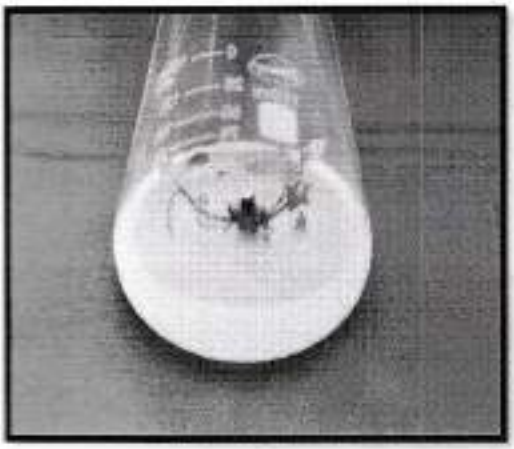


Fig. 19: Shoot initiation in *Salvadora persica*

Fig. 20: Shoot multiplication in *Salvadora persica*

NEW PROJECTS

Project 18 - **Study of salt tolerance through gene expression pattern analysis (AFRI- 102/FGTB/2010-2015).**

*Principal Investigator : **Dr. Tarun Kant***

Exhaustive literature review has been carried out. Review has largely concentrated around finalizing the Cl- channels in plasma membrane and tonoplast. Final list of genes based on clustal W2 multiple nucleic acid sequence alignment was prepared. These genes are; Salt Overly Sensitive (*sos1*), High Affinity Potassium Transporter (*hkt*1); Sodium Protein Exchanger (*nhx*1) and Chloride Channel –c (*clc*-c).

Survey of Sambhar salt lake (saline wet land) region for selection of halophyte was conducted. Twenty halophytic species and soil samples have been collected. *Lepideum sativum* has been finalized as the halophytic species for the studies in this project. An ultra low cost hydroponic system has been developed in-house and tested. *Arabidopsis thaliana* Col0-WT seeds (from JNU, Delhi) and *Lepidium sativum* seeds (from NBPGR, CAZRI, Jodhpur) have been procured and successfully grown hydroponically.

Project 19. Development of technologies for multiplication of economically important desert plant – *Capparis decidua* (AFRI-105/FGTB/2010-2015).

Principal Investigator: Dr. Sarita Arya

Plus tree have been identified. Surface sterilization procedure for explants was standardized. 0.1% $HgCl_2$ for 3-4 min. was found to be best for surface sterilization. Sterilized nodal segments were inoculated on MS medium supplemented with 0.0-5.0 mg/l BAP alone and in combination with NAA. MS medium +4.0 mg/l BAP+ 0.1mg/l NAA was found to be the best, where 2-3 shoots proliferated from axillary bud (Fig 21). These *in vitro* shoots were excised and further multiplied on MS medium supplemented with 2 mg/l BAP, and 0.5 mg/l IAA and additives (Fig 22).

Fig 21: Shoot induction in *Capparis decidua*

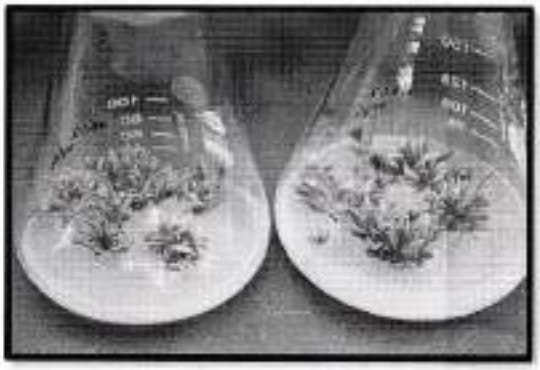


Fig 22: Shoot Multiplication in *Capparis decidua*

CONCLUDED PROJECTS

Nil

2.4 Forest Management

2.4.1 Overview

One of the most important forest policy goals is to improve forest management on sustained basis. For sustainable use of forest resources, the strategy adopted is to harness the potential productivity of forests, simultaneously maximizing net yield from afforested lands. For conceptualizing a production function, forest management essentially needs accurate predictions of output of socio-economic benefits in terms of yields for all relevant combinations of measurable forest characteristics viz., age, site, density and growth. These estimates are crucial for intelligent management decisions on optimum rotation, planting density, thinning schedule, and treatment regime. Too much removal from forests may lead to liquidation of growing stock and too little would be inefficient use because available growth potential is not fully harnessed and society is deprived of immediate benefits. Also such information is required for silvicultural and environmental management.

Unfortunately, information on the growth and yield of many species that are raised in semi-arid area of Rajasthan is meagre. The forest department is very much interested in proper management of its productive resources. Elaborate systematic and scientific studies on the growth and yield aspects of these species are still wanting. It is in this context, the present study has been initiated. Estimation of stand volume with greater accuracy has always been a matter of interest for forest managers as it is directly related with the production estimation. The wood volume equations assume importance in projecting the total volume at different stages (thinning and final harvest) as the plantations mature. Teak is well known of its high grade timber value. The volume equations developed in this project will be useful to the SFD, Gujarat.

2.4.1.1 Summary of the achievements under the Theme

- Conducted market survey of Jaipur and Ahmedabad for collecting various timber related information for submission to ICFRE.
- Field survey was conducted for layingout of samples plots for *A. excelsa,* and *P. cineraria* for growth and yield estimation
- Under the subtheme "Information and Communication Technology", a web portal has been developed in order to disseminate the forestry research carried out by the Institute. On this web portal the information about the projects handled by the Institute since its inception, the technologies developed by the Institute, the research publications produced by the institute, articles on various subjects and the other important information about the institute has been uploaded. In addition to this a web application for searching plants database of arid and semi arid region is under development. Through this web application the user will be able to get the list of the plants satisfying a particular or multiple criteria and will also get the complete datasheet of a particular plant species. Through this application, a common user will get the common information and uses about all the important plant species of arid and semi arid region.

2.4.1.2 Projects under the Theme (in table as given at 2.1.1.2)

Projects	Concluded Projects	Ongoing Projects	New Projects Initiated During the Year
Plan	0	2	0
Externally Aided	0	2	0

2.4.2 Sustainable Forest Management (SFM)

Nil

2.4.3 Forest Economics

Nil

2.4.4 Forest Biometrics

EXTERNALLY FUNDED PROJECTS

NEW PROJECTS

Nil

PROJECT CONTINUED

Project 20 - Productivity and biometrics studies on some important species in semi-arid regions of Rajasthan for their sustainable management (AFRI-95/Silvi/SFD/2009-12).

Principal Investigator : Dr. Sunil Kumar

Laid out seven sample plots in IGNP area (Mohangarh) and Dadia (Sojar) of *Prosopis cineraria* and *Ailanthus excelsa*. The twenty three trees of *P. cineraria* were felled down at represented sites at IGNP, Mohangarh (Jaisalmer) viz. 3 SMG, 1447 RD and 1340 RD, 1355 RD. Measurements of seven sample plots at 3 SMG, 1447 RD, 8 SMG, 1387 RD, 1340 RD and 1335 RD of *P. cineraria* and of *A. excelsa* at Dadia (Sojat) were taken. Observations on diameter and height were recorded for both the species. The surrounding of sample area selected for permanent sample plots (both sides) were marked with rings of red colour paints. The trees lying within the selected area were numbered and plus marked with black paints at 1.37 m height, L –shaped trench were dug in corner of each permanent sample plots. Observations such as DBH of all the trees and heights of trees, number of trees and area of sample plots were recorded. Also, observations such as; DBH over and under bark at each of 3 meter logs, crown diameters and height at first branching were recorded.

Project 21 - Productivity study and modelling growth and yield in Teak Plantation in Gujarat state. (AFRI-96/Silvi/SFD/2009-14).

Principal Investigator : Dr. Sunil Kumar

The survey of teak plantations was conducted at Varodara, Narmada, Panchmahal, Baria, Vyara, Dangs, Rajpipla, Dahod and Godhara divisions. Out of the thirty two sites visited. , sixteen suitable sites were selected for studies. Request was madeto the PCCF, Gujarat State Forest Department to seek permission of lying out of sixteen permanent sample plots in the plantation. Also requested permission for felling of total eighty numbers of trees of *Tectona grandis* of different diameters classes, five each from the surrounding of each permanent sample plots of the plantations for productivity studies.

PROJECT CONCLUDED

Nil

ICFRE FUNDED PROJECTS

NEW PROJECTS

Nil

PROJECTS CONTINUED

Project 22 - **Market survey on selected species in selected markets (AFRI-58/Silvi/1994 continued).**

*Principal Investigator : **Dr. Sunil Kumar***

Collection of market price data from the selected markets of Rajasthan and Gujarat, is of immense use for monitoring the change in prices of timber, fuel wood bamboo and poles for policy, research and decision making point of view.

Conducted market survey of Jaipur and Ahmedabad for collection of various timber related information for submission to ICFRE for compilation.

PROJECTS COMPLETED

Nil

2.4.5 Participatory Forest Management
2.4.6 Policy and Legal Issues
2.4.7 Information and Communication Technology (ICT)

NEW PROJECTS

Nil

PROJECTS CONTINUED

Project 23 - **Development of the web portal for forestry research extension (AFRI-82/IT-cell/2007-2011).**

*Principal Investigator : **Sh. A. K. Sinha***

The web portal of AFRI has been made in Hindi as well as in English and some new features have been added to it. The new features added to the web portal are as follows :

- The web portal of the institute has been redesigned giving it a totally new professional look.
- The list of publications of all the scientists has been added to the web portal.
- The feature of uploading/editing project information of the concluded and ongoing project has been added to the web portal. The brief information of 25 ongoing and 68 concluded projects has been uploaded in the web portal and the user can view the details of the ongoing as well as the concluded projects executed by the Institute.

- The technologies developed by the institute (18) have been uploaded on the web portal.
- The seventeen numbers of articles of the topical information of the arid region have been uploaded on the portal and some more articles are under preparation by the concerned scientists.
- A dynamic directory feature has been introduced in the website so that the employee details with phone number and email address can easily be edited.
- A Bulletin board for uploading latest happenings and a bulletin board for uploading appointments and tenders have been introduced.
- The Hindi version of web portal has been made and the option of uploading Hindi captions etc. has been provided in every feature of the web portal so that the Hindi site can be updated simultaneously with English web site.

The collection of data for some more plant species has been done. In addition to this, the forms for entering/editing the data of a plant species and searching the existing data of plant species has been made in the web application of the plants database. The programming script has been written for the basic search of plants based on their scientific name, environmental search based on environmental conditions, silvicultural search and usage search based on the use of the plants. Programming script has also been written for producing complete data sheet of a particular plant species searched through these searches. The snapshot of various pages of the web application is as below:

Fig 23: Data entry form of the plants database developed on ASP.NET

Fig 24. One of the searches provided on the plants database

Fig **25.** Search results produced by the web application (on test data)

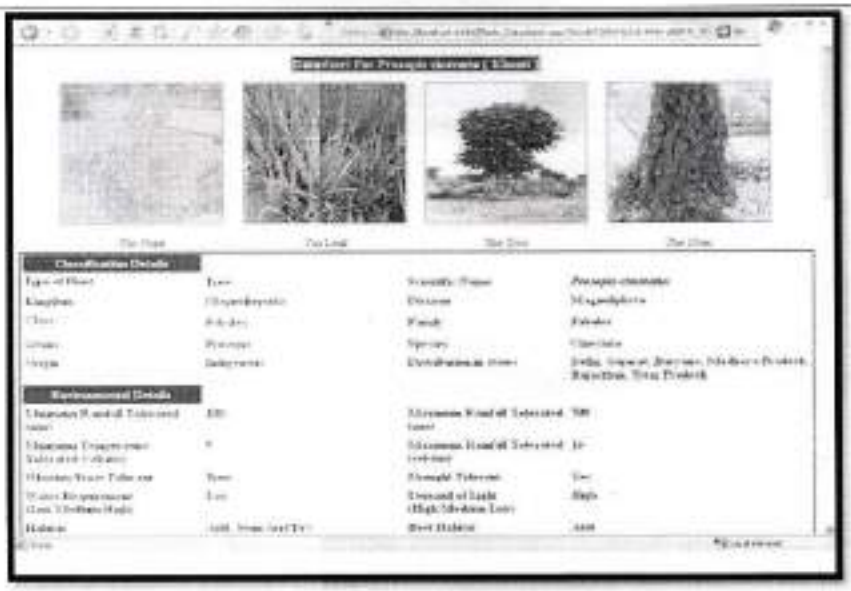


Fig 26. Complete data sheet of a plant species produced by the web application (Snapshots based on test data & test photo's)

PROJECT CONCLUDED

Nil

2.5 Wood Products

2.5.1 Overview

2.5.1.1 Summary of the achievements under the Theme

2.5.1.2 Projects under the Theme (in table as given at 2.1.1.2)

2.5.2 Wood and other Lignocellulosic Composites

2.5.3 Wood Processing

2.5.4 Value Addition and Utilization

2.5.5 Wood Chemistry

2.5.6 Pulp and paper

2.6 Non-wood Forest Products (NWFPs)

2.6.1 Overview

Jatropha curcas, also known as physic nut, is unique among biofuels. Although, oil can be extracted from over 80 known plant species, jatropha is currently the first choice for biodiesel. What makes Jatropha especially attractive to India is that it is a drought-tolerant and can grow in saline, marginal and even otherwise infertile soil, requiring comparatively less water and maintenance. It is hardy and easy to propagate by stem cutting. Considering distribution of *J. curcus* in different parts of India, this plant is expected to have considerable genetic variation. Variability studies which provide the basic information required for genetic improvement of species, are of

paramount importance. Sufficient information on such aspect is lacking in spite of its many uses. Environmental factors in combination with genetic and physiological play important role in determination of plant potential for seed quality. The species is cross-pollinated; therefore asexual propagation of superior phenotypes will yield superior progeny.

In the present study, a total of 161 sources of *J. curcas* representing the promising Jatropha-growing belt of India, were screened and evaluated. The objective of the study was to understand the magnitude of genetic variation in growth, behaviour and adaptability in arid part of India to identify the best sources to be utilized for reforestation and future genetic improvement work.

Commiphora wightii (Arn.) Bhandari belongs to family Burseraceae is commonly known, as Guggal is one of the threatened species, which is becoming rare due to human impact on forests including over exploitation and increasing biotic interference.

Germplasm collection studies have been initiated earlier. However, other studies on germplasm collection and evaluation is lacking in India. Moreover, their collections were based on seed origin. The species is under threat because of its over exploitation for gum resin, slow growth of plant, poor seed set and excessive and unscientific tapping lead to death of the plant. For effective conservation of a species, it is essential to understand the extent and pattern of variability in natural populations. The variability of different traits of natural population in a species may be due to genotypic differences or environmental factors or simply due to age differences. High variations in natural populations provide buffering potential as well as phenotypic stability (homeostatic) of the individual against unpredictable environments. The study of genetic variability and interrelationship of characters may lead to effective selection of plants most suited to arid environment. Attempts have been made to collect and test their performance on clonal basis so that they can represent true nature of mother plant. Clonal propagation techniques have been studied earlier, but it needs scientific statistical refinement. Our studies deals with the standardization of clonal propagation technique and performance of germplasm collected from all guggal growing areas of Rajasthan under arid environment. The work reported herein was carried out under All India Coordinated projects with different National Research Institutes and Universities, funded by CSIR, New Delhi, DBT, New Delhi and NMPB, New Delhi.

2.6.1.1 Summary of the achievements under the Theme

- Application of fertilizer has enhanced fruit yield and growth in *Salvadora persica* and pod production and growth in *Acacia ampliceps* in salt affected area in Jodhpur.
- Various trials on performance, pollarding, spacing, agro-technology of *J. curcas* were maintained and evaluated based on desired parameters
- Maintained seedling seed orchards of *J curcas* for further evaluation
- Maintained various trials and established new trial of micropropagated plants of guggal
- Refined micropropagation protocol for *Commiphora wightii* through somatic embryogenesis

and established field trail, where survival rate is 100%.

- Standarized doses of ethophone for the olio-gum resin production in guggul (*C. wighttii*) by non-destrcutive method.

2.6.1.2 Projects under the Theme (in table as given at 2.1.1.2)

Projects	Concluded Projects	Ongoing Projects	New Projects Initiated During the Year
Plan	0	2	0
Externally Aided	1	3	0

2.6.2 Resource Development of NWFPs

EXTERNALLY AIDED PROJECTS
NEW PROJECTS
Nil

PROJECTS CONTINUED
Nil
PROJECT CONCLUDED
Nil

ICFRE Funded Projects
New Projects
Nil

PROJECTS CONTINUED

Project 24. Effect of fertilizer application on growth and yield of 10 years old *Salvadora persica* and *Acacia ampliceps* plantations under silvipastoral system on arid salt affected soil (AFR-11/NWFPD/2008-11).

Principal Invetigator : Dr. Ranjana Arya

Field trials were laid of *Salvadora persica and Acacia ampliceps in 1997 and 1998 on saline alk sandy soil in* Jodhpur.*In case of S. persica,* thirteen treatments viz; 1.Control; 2. FYM (10 Kg/plant 3.FYM + Urea (500 g N) 4.FYM + $ZnSO_4$ (25 kg/ha) 5.FYM + K_2SO_4 (50 g K_2O) 6.FYM + SSP (500 g P 7.FYM + Urea + $ZnSO_4$, 8. FYM + Urea + K_2SO_4 9.FYM + Urea + SSP, 10. FYM + $ZnSO_4$ + K_2SO_4 11. FYM + $ZnSO_4$ + SSP, 12.FYM + K_2SO_4 + SSP 13. FYM + K_2SO_4 + SSP + Urea + $ZnSO_4$ and in case of *Acacia ampliceps* ten treatments viz. 1.Control; 2. FYM (10 Kg/plant); 3. Urea (500 g N) 4. SSP (500

5. $ZnSO_4$ (25kg/ha); 6. K_2SO_4 (50 g K_2O) 7. FYM + Urea 8. FYM + $ZnSO_4$ 9. FYM + K_2SO_4 10. FYM + SSP were applied in Jan, 2009 to study the effect of fertilizer treatments on growth and yield.

Salvadora persica

After deficient of monsoon, the fruit yield in April, 2010 was maximum (971g) in T_{10}(FYM+U+Zn+K+SSP) treatment, followed by T_4(FYM+Zn) 681g and T_7 (U+Zn) 670g. Yield in other treatments was ranging from 20 to 123g with no fruit yield in T_5 (FYM+SSP) and T_{10} (FYM+Zn+K) treatments. Oil yield was estimated and pink fruit's seed yielded least 37.5%, while purple and white yielded 40.8 and 39.6%, respectively. Oil yield vary from 30.5 to 43.1% with no effect of treatments. Phenological observations in 2010, recorded and early flowering in 93.6% plants in late October. Mostly multicolored fruits were observed, however only white fruits were observed on six plants (Fig. 27). Immature fruit without seed were formed, but aborted and fresh flowering initiated in early December. A total of 93.1% tree flowered second time in February, 2011. Fruit setting took place in March.

Fig 27. *Salvadora persica* in fruiting stage

Annual growth data for the year 2009-10 indicated that treatments are significantly (p-0-00) influencing the height, crown and collar diameter as compared to control. T_{12} was the best treatment recording, maximum overall growth -13.6, 26.6 and 40.1% for height, crown and collar diameter, respectively, followed by T_4 (FYM+Zn) 7.8, 26.5 & 35.3

Acacia *ampliceps*

Early flowering was observed in *A. ampliceps* and 90 % trees flowered in the first week of November, 2010 and maintained upto Jan, 2011 in a well distributed monsoon year with pod setting in 72.5 % plants, which was better as compared to 45% flowering in 2009 with no pod setting. Maximum pod setting was in T_7 (91.6%), followed by T6 88.8% and minimum (44.4%) was control in March, 2011.

After deficient monsoon, *A. ampliceps* recorded a mean 18 % casuality in different treatments during summer of 2010, maximum (42%) morality was in T_4 (FYM + SSP) treatment. The incremental tree growth showed that T_6 (32.2 & 34.2 %) , T_8 (31.4& 36.3%) and T_{10} (26.4& 29.4%) recoded maximum collar and crown diameter, respectively, however, height growth was maximum in T_{12} (37.1%), followed by T_9 (28.8%) and T_8(25.8%) treatments.

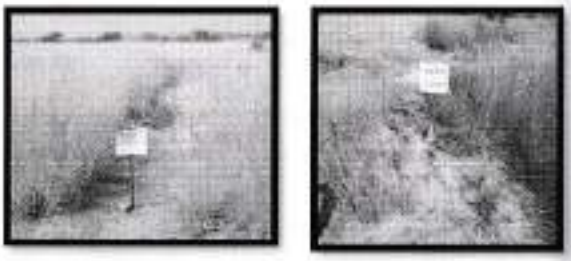
Grass trial:

Field trial was laid with two grass species viz *Cenchrus ciliaris* and *Sporobolus diander* on three soil structures i) raised platform ii) raised bund and iii) control for Silvipastoral study in three replications.

In a good monsoon year, soil structures influenced the green grass yield and it was 906 and 894 g/m^2 for the platform and slope soil structures, respectively as compared to control (465 g/m^2) in *S. diander* (Fig 28). In case of *C. ciliaris*, slope was the best structure with 1104 g/m^2 and yield is 6.5% more than control(169 g/m^2) indicating the positive effect of leaching (Fig 29).

1. Plateform *2. Control*

Fig. 28: *Sporobolus diander*



3. Slope *4. Control*

Fig. 29: *Cenchrus ciliaris*

2.6.3 Sustainable Harvesting and Management

EXTERNALLY AIDED PROJECTS

NEW PROJECTS

Nil

PROJECTS CONTINUED

Project 25. Network research project on guggal *Commiphora wightii* Arn. Bhandari (AFRI-76/Silvi/NMPB/2008-13).

Principal Investigators : Dr. D.K. Mishra, Dr. R. Arya and Dr. Tarun Kant

The clonal performance trial was established in September, 2007 in RBD design with 4 replications and each replication has 8 plants per accession. The trial is 41 months old and survival varied from 44% of Jalore to 100 percent of Jaipur, followed by 94% of Barmer, Bikaner and Dausa. Mean Plant height varied from 112.14cm of Bharatpur to 192.22cm of Tonk, mean crown diameter varied from 104.64cm in Jalore to 183.98cm in Sikar source nearly followed by 183.52cm of Tonk source and mean number of branches ranged from (3.09) in Bhratpur to (5.61) in Jhunjhunu source. The data were significant for all the growth parameters at <0.01 probability level. On the basis of DMRT height of all the 21 clonal sources divided in 10 groups, while crown are in 7 and branches are divided in 6 groups.

The main effects of various irrigation (I_1, I_2, I_3 30, 45, 60 days) and fertilizer treatments (F_0 = No organic manure (FYM),F_1 = 2kg/pit;F_2 = 5kg/pit;F_3 = Urea 50g pit (46% Nitrogen);F_4 = SSP 50 g pit 20% Phosphorus);F_5 = 5kg FYM+ Urea 50g/plant;F_6 = 5kgFYM+ SSP 50g/plant;F_7 = Urea + SSP (50g each)applied in agri-trial of *Commiphora* after 40 months of planting in the field. Mean plant height (cm), number of branches and crown diameter (cm) ranged from 182.69cm in I_3 to 198.69cm in I_1, 4.46 in I_1 to 5.05 in I_3 and 168.96cm in I_1 to 174.08cm in I_3, respectively. The analysis of variance showed that irrigation intervals had high significant effect on mean plant height and number of branches, whereas, crown diameter was not affected by irrigation.

Application of fertilizer treatment showed significant effect on growth of *Commiphora* plants. The mean height, number of branches and crown diameter varied from 182.24cm in treatment F_7 to 205.82cm in F_2, 3.98 in F_1 to 5.66 in F_7 and 160.97cm in F_5 nearly followed by F_1 (161.67cm) to 183.16cm in F_2, respectively. Analysis of variance revealed that effect of fertilizer on plant growth with respect to number of branches was highly-significant while, the plant height and crown diameter were significantly affected by fertilizer response.

Component II To develop methodology for non-destructive gum production

Experimental trials of *Commiphora wightii* were maintained in Kumatia enclosure, Kailana Forest Area, Jodhpur. Protection measures (application of termiticide and fungicide) were applied in June, 2010 and Monthly spray of fungicide and termiticide to all the plants was done from Jan. to March, 2011, while GA_3 was sprayed once on pruned plants. Growth data (height, crown and collar diameter) and vegetation status were recorded in Oct- Nov, 2010. In the experiment 1, the growth data of height ranges from 150 to 216.6 cm, crown diameter 210 to 307.5 cm and collar dia. 4.84 to 6.83 cm with 3-8 number of branches/ plant. In experiment 2, height ranges from 105 to 290 cm, crown diameter 175 to 345 cm and collar diameter 4.41 to 8.33 cm, having 3-7 number of branches/plant.

Percent moisture in thinner branches (post ethephone treated plants) was ranging from 57.2 – 69.1 % in various treatments in the month of Nov, 2010. Pre-ethephone solvent extractions (2009) with petroleum ether, ethyl acetate and acetone extracts were 1.76 to 1.9%, 0.97 to 1.31% and 0.52 to 0.88% respectively. The powdered material of thinner branches (post ethephone -2009) was collected after second consecutive gum extraction. It was extracted with petroleum ether (60-80°), ethyl acetate and acetone. The mean values showed that maximum per cent extractives were recorded with petroleum ether. It was maximum in control 3.0 percent, followed by 2.42 to 2.64 per cent for different doses of ethephone. In case of ethyl acetate, the range was 1.3 per cent for control, while 1.47 to 1.86 per cent for ethephone doses indicated that ethephone application is increasing the yield. It is also reported that Guggulsterone comes in ethyl acetate fraction. In case of acetone, the range was 1.40 per cent in control, while same in different ethephone doses i.e. 1.78 per cent.

Table 1. **Per cent of different solvent extracts of Guggul branches (post ethephone, 2009)**

Chemical Doses		W/o Irrigation and w/o FYM (I)	With FYM			Mean
			I_0	I_1	I_2	
C0	PE	2.30 %	2.57 %	3.02 %	3.41 %	3.0 %

	EtOAc	1.42 %	1.31 %	1.09 %	1.52 %	**1.30 %**
	Acetone	1.36 %	1.38 %	1.35 %	1.48 %	**1.40 %**
C1	PE	2.64 %	1.76 %	2.62 %	2.82 %	**2.40 %**
	EtOAc	2.26 %	1.97 %	2.55 %	1.07 %	**1.86 %**
	Acetone	1.25 %	1.26 %	1.20 %	1.35 %	**1.27 %**
C2	PE	1.87 %	1.31 %	3.52 %	2.68 %	**2.50 %**
	EtOAc	1.41 %	2.01 %	1.35 %	1.37 %	**1.57 %**
	Acetone	1.12 %	1.20 %	1.34 %	1.31 %	**1.28 %**
C3	PE	3.26 %	2.26 %	3.0 %	2.66 %	**2.64 %**
	EtOAc	1.58 %	1.79 %	1.16 %	1.48 %	**1.47 %**
	Acetone	1.40 %	1.10 %	1.32 %	1.42 %	**1.28 %**

I: Without irrigation and without FYM
I_0 : One time irrigation with FYM
I_1: Irrigation at 20 days interval with FYM
I_2 : Irrigation at 30 days interval with FYM

PE= Petroleum ether extract
EtOAc = Ethyl acetate extract
Acetone =Acetone extract

In the second experiment (2010), soil analysis of plant pit samples collected in summer 2010 after cessation of gum exudation has been carried out. The ranges of pH_2, EC_2, % SOC and phosphorus were 7.1 to 8.1, 0.20 to 0.84, 0.21 to 1.30 and 4.21 to 13.88 kg/ha, respectively. There is no significant difference in soil surface and soil depth (0-20 cm).

Phenological observations were recorded on monthly basis for all the plants in exp. 1 and 2. Flowering was noticed in Feb, 2010 in all the plants with leaf initiation in some plants. Sporadic fruiting was observed in almost all the plants in March, 2010 and become dense in April, 2010. Plants were lush green after rains in monsoon (July to October,2010) with occasional fruiting. Leaf started yellowing in early November and all the plants were completely leafless in late Nov, 2010 with fruiting. In the year of 2011, fruiting was observed in February which was one month early as compared to last year.

Tapping experiments were initiated in last week of March, 2011 with varying ethephone doses (0, 175 and 225 mg) and injected at one place in a plant, and 3-4 cuts were given. First gum has been collected. Oozing of gum was observed in treated plants. So far all the trees are healthy. Branch cuttings (1.5 cm to 3.5 cm dia) from these plants were taken after gum exudation and planted. Sprouting was observed in 85% of the cuttings.

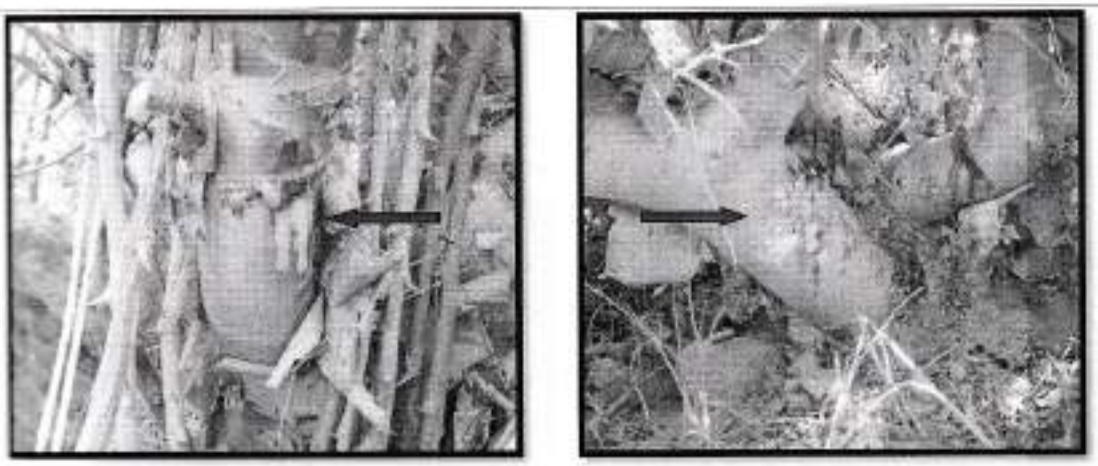


Fig 30. *Commiphora wightii* healed plant showing gum exudation for the third time

Demonstrated ethephone injection based gum-oleo-resin extraction technology at DMAPR, Anand from 8-12 March, 2011 on 12 plants of 9 year old with four ethephone dosages viz; 0, 150, 160 & 170 mg . Collar diameter of branches ranges from 2.60 to 6.91 cm.

Component III: **Scaling-up the tissue culture protocol**

More than three years old embryogenic callus was maintained continuously by subculturing. Secondary and tertiary somatic embryos were also obtained. Cyclic embryogenesis was established and stabilized.

Matured white somatic embryos were used for germination of SEs on different concentrations of gibberellic acid supplemented in modified MS medium. The highest germination percentage (82.25%) of SEs was observed on modified MS medium supplemented with 0.8 mg/l gibberellic acid as well as on control with least abnormal germination of somatic embryos (Fig31. A-F). Plantlet derived from somatic embryo is termed as embling (plantlets).

Harvested mature embryos upon germination and formation of complete plantlets acclimatized to make them ready for transplantation to field conditions. These emblings, 4-5 cm in height were acclimatized in a two step manner. During *in vitro* hardening step, the survival was 61.5% and during *ex vitro* hardening step, it was 100%. Hardened plants (10-12 cm. in height) were transferred to polybags filled with mixture of soil and FYM in the ratio of 2:1 and were kept in 75% shade in agro-net shade for one month and then under tree shade, where they gained height upto 80 cm (Fig 32. G-M).

Five tissue culture raised hardened plants were planted in field in July, 2010 (Fig 33). Out of these, 02 plants were derived from somatic embryogenesis pathway, while 8 plants were derived from axillary bud based micropropagation pathway.The plants are growing well in the field condition for the last 10 months with 100% survival. Six monthly growth data were collected.

Fig 31. Somatic embryogenesis (A- F)
A- Non embryogenic callus turned in embryogenic callus;
B and C- Multiplication and maintenance of embryogenic calli;
D and E- Maturation of somatic embryos;
F- Germination of somatic embryos

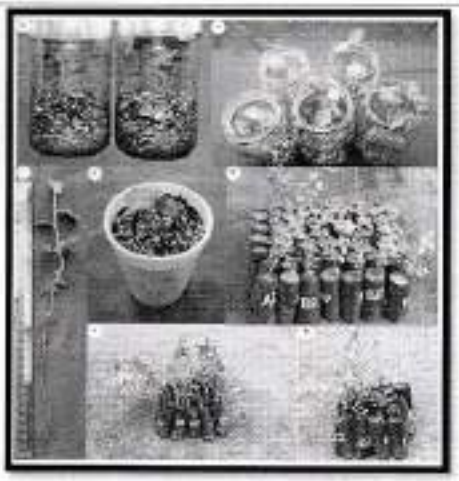


Fig 32. Somatic embryogenesis (G- M)
G- *In vitro* hardening of emblings;
H, I, J, K- *Ex vitro* hardening of emblings;
L- Plantlets under green shade house (Rajsamand district);
M- Plantlets under green shade house (Ajmer district)

Fig 33. Field plantation of tissue culture raised guggal plants in July, 2010

PROJECT CONCLUDED

Nil

ICFRE FUNDED PROJECTS

Nil

2.6.4 Chemistry of NWFPs, Value Addition and Utilization

2.6.5 Biofuels and Bioenergy

ICFRE FUNDED PROJECTS

NEW PROJECTS

Nil

PROJECTS CONTINUED

Project 26. **Survey selection performance trial and estimation of yield potential of *Jatropha curcas* in Rajasthan and Gujarat (AFRI-88/Silvi/2007-12).**

Principal Investigator : Dr. D.K. Mishra

Two progeny trials one with 5 replications at AFRI, Jodhpur and another with 15 replications at Haldughati, Udaipur having single plant per replicate in RBD of 30 CPTs were established in July, 2008. At AFRI, Jodhpur site, the survival percent varied from 40 to 100. Maximum mean height, number of branches and collar diameter was observed 247.5cm, 5.50 and 10.59cm in CSMCRI-1, while these were minimum 117.00cm, 1.80 and 3.98cm, in EL-19 AFRI-17 respectively. At Haldughati, Udaipur site, percent survival varied from 40 to 93 percent. Maximum plant height was 243cm in CSMCRI-3, where as number of branches and collar diameter were 2.50 and 3.89cm in EL 11 AFRI-15. Minimum plant height and collar diameter were 67.50cm and 1.81cm in 94 AFRI-8, and number of branches was 1.00 in 142-AFRI-12, respectively. The CPTs at AFRI, Jodhpur site only yielded fruit and seeds, whereas at Haldughati, Udaipur there was no flowering/fruiting observed. Analysis of variance showed that the number of branches was significant at 0.01 probability level in AFRI, Jodhpur trial, whereas, remaining growth parameter were non-significant at both sites.

Development **of seed yield equations.** Carried out measurement in the two sample plots of *J. curcas* set out at Motiya Research Farm, Rajpipla (Gujarat) during 2010-11. Total mean height, mean collar diameter and mean crown width varied from 2.44m to 2.92m, 12.92cm to 14.2cm and 2.15m to 2.45m, respectively. Observation on the seed yield was also taken, which varied from 103.0g to 193g. Regression could produce relationship between seed yield and height, and SY vs. CD. Two different relationships: one LN (SY) vs. 1/HT or 1/CD, other SY vs. HT or CD. Calculated estimated seed yield based on these equations. The equation which gives more close value to observed data may be considered. It is clear that CSMCRI clones are better as compared to SRT and BCR. They are having more height and seed yield as compared to SRT & BCR though their age is only 4 years, while ART and BCR are of 6 years old.

Based on data recorded from two plots (4-6 years) at Motiya research Farm during 2010-11 ,the seed equation developed as follows:

SY= -165.55+120.9868*HT

SY=844.0604-51.8072*CD

LN(SY(1)= 7.145631-5.60393*1/HT
LNSY(2)= -0.13976+68.55505*1/CD

PROJECT CONCLUDED
Nil

EXTERNALY AIDED PROJECTS
NEW PROJECTS
Nil
PROJECT CONTINUED

Project 27. Establishment of multilocational clonal trial and seedling seed orchard of *Jatropha curcas* (AFRI-81/Silvi/DBT/2007-12).

Principal Investigator : Dr. D.K. Mishra

Two multilocational clonal field trials have been established at Haldughati, Udaipur. The first trial was established in the month of November, 2007, with 12 accessions and the second clonal trial was established with 8 accessions in the month of September, 2008 in RBD with four replications. Seedling seed orchards in Randomized Block Design (RBD) with 5 replications at Arid Forest Research Institute, Jodhpur and 15 replications at Haldughati, Udaipur were estabilished.

Trial-I revealed that percent survival varied from 15 to 56 %. Highest value of mean plant height and collar diameter were observed 124.17cm and 4.62cm, respectively in TERI/DBT/Jat/04-05, whereas, mean number of branches was 1.69 in BTP-K, which was closely followed by 1.66 in TERI/DBT/Jat/04-05. While lowest value of mean plant height, number of branches and collar diameter were observed; 72.73cm, 1.03 and 1.87cm in TERI/DBT-Jat/06/10, TERI/DBT-Jat/06/05-06/12 and TERI/DBT-Jat/06/16, respectively after 40 month of growth period. Data were non-significant for all the three parameters.

In clonal trial-II, percent survival varied from 0 to 22 percent. Maximum value of mean plant height and collar diameter were noticed 78.75cm and 2.94cm in NBRI-JA-126, whereas, maximum number of branches was 1.50 in J-2, Hisar. However, minimum value of plant height, number of branches and collar diameter were 47.50cm in J-2, Hisar & HS-42, 1.00 in HS-41 and 2.21cm in HS-44, respectively.

At AFRI, Jodhpur, percent survival varied from 0 (in 6 accessions) to 100 percent (in 6 accessions). The accession TERI/DBT/JATROPHA/01/15 showed maximum plant height and collar diameter, 260.00cm and 9.13cm, respectively. While minimum plant height and collar diameter was observed 136.70cm in accession TERI/DBT-JATROPHA/05/31 & TERI/DBT-JATROPHA/05/87 and 2.76cm in

TERI/DBT-JATROPHA/05/58 accessions, respectively. Mean number of branches varied from 1.00 to 1.30. Amongst 116 CPTs only 12 CPTs at AFRI, Jodhpur site were seeded during 2010-11, which ranged from 4.72g to 135.26g.

At Haldughati, Udaipur site percent survival varied from 20 to 80 percent. Maximum plant height, number of branches and collar diameter were observed; 140.71cm, 2.75 and 4.47 cm in accession TERI/DBT-JATROPHA/04/16, TERI/DBT-JATROPHA/05/53 and TERI/DBT-JATROPHA/07/05-06/37, respectively. Minimum plant height was showed by accession TERI/DBT-JATROPHA/04/31 (51.30cm), while accession TERI/DBT-JATROPHA/05/26 showed minimum number of branches and collar diameter of 1.00 and 1.74cm, respectively. No fruiting was observed at Haldughati, Udaipur site during 2010-11.

The observations showed that plantation at AFRI, Jodhpur site showed better performance than at Haldughati, Udaipur in term of growth parameters while, accessions planted at Udaipur site showed better survival than Jodhpur site. Data were non-significant for all the parameters.

Project 28. **Genetic improvement of *Jatropha curcas* for adaptability and oil yield (AFRI-Silvi/CSIR/2005-12).**

Principal Investigator : Dr. D.K. Mishra

Survival of 18 selected elite accessions under arid conditions after 65 months of growth period varied from 6 to 69 percent. Overall mean plant height, number of branches and collar diameter varied from 135.00 to 226.67cm, 1.00 to 4.50 and 3.83 to 8.26cm, respectively. Seed yield ranged from no seed to 660.00g per plant.

Performance of 63 native accessions after 54 months of growth period under arid conditions ranged from 33 to 100 percent, where as average plant height, number of branches and collar diameter varied from 155.0 to 295.0cm, 1.00 to 4.00 and 4.55 to 12.55cm, respectively. Seed production varied from 0.00 to 313.0g per plant. On the basis of across site performance, 14 accessions have been selected.

Percent survival in spacing trial after 44 months varied from 14% in 2mx2m to 39% in 3mx3m. Maximum mean plant height was observed (200.22cm) in 4mx4m spacing treatment, while number of branches and collar diameter was maximum 3.08 and 5.76cm in 3mx3m spacing. Minimum plant height, number of branches and collar diameter was observed 179.90cm, 2.00 and 5.24cm in 2mx2m spacing. Only two treatments seeded in 2010 which ranged from 225g per plant in 3mx3m to 313g per plant in 4mx4m spacing. Data were non-significant for all the parameters.

Percent survival in pollarding trial varied from 30 percent in T_2 to 46 percent in T(control). The mean plant height and collar diameter ranged from 151.81cm (T2) to 158.58cm (T3) and 5.42cm

(T2) to 5.59cm (T0), respectively. Whereas, the mean number of branches ranged from 3.87 in control (T_0) to 8.96 in (T_2). No fruiting was observed during 2010-11. Analysis of variance suggested that effect of pruning is significant on number of branches, while non-significant on average plant height and collar diameter after 37 months of imposing treatments.

From the result of main plot analysis (irrigation effect) average plant height was 233.11cm in I_2 (30days) and maximum up to 270.17cm in I_1 (15days). Maximum number of branches and collar diameter was observed 4.45 and 9.65cm in I_2 and I_1, respectively, while these were noticed minimum 3.30 and 8.59cm respectively in control. Three irrigation treatments plant were seeded this year except control, which was ranged from 31.8g per plant in I_3 (45 days) to 81.0g per plant in I_2, followed by 76.4g in I_1 treatment. Only plant height was significantly affected by irrigation treatment whereas number of branches and collar diameter remains unaffected by the irrigation. From sub-plot analysis for fertilizers (F_1 organic maure 2kg/pit; F_2 organic manure 5kg/pit; F_3 = Nitrogen 10g+ P, 20g, K, 10g per pit;F_4 = 2kg organic manure + Nitrogen 10g+ P, 20g, K, 10g) per pit results revealed that mean plant height ranged from 237.50cm in F_2 to 253.85cm in F_3. The mean number of branches and collar diameter were observed maximum 4.00 & 10.31cm in F_4 and minimum 3.62 & 7.69cm in F_1, respectively. All the fertilizer treatments plants were seeded, which ranged from 22.5g in F0 to 58.0g in F2 treatment. Plant growth performance was not significantly affected by fertilizer. Interaction of irrigation and fertilizer does not show any significant effect on growth performance of *Jatropha* after 49 month of planting.

PROJECT CONCLUDED

Project 29. Development of a database on tree-borne oilseeds (TBO) in India (Funded by NOVOD Board through ICFRE).

Principal Investigator : Dr. SuNil Kumar

Overview:

The demand and prices of petroleum products is growing by leaps and bound. The planning commission is examining the possibility of producing blended high speed diesel with 20% Jatropa and other TBO's based diesel. This project was initiated to contribute to the knowledge base of TBO's with an aim to estimate their current availability and future supply, demand analysis and estimation of their contribution to the rural economy of India. The objectives of the project is documentation of the scattered plantations of TBO's in the Rajasthan and Gujarat done by Government organizations, research institutions, etc and to develop a database of its fast retrieval.

Progress of work

In order to estimate state wise acreage of cultivation of seven tree borne oilseed species from

Gujarat and Rajasthan, a detailed list of Government departments/Institutions viz; State Forest Department, Horticulture, Agriculture Departments, Railways and NGO was prepared. Performa for data collection was developed and send to various departments. Under this study, information regarding seven TBOs viz; Jatropha (*Jatropha curcas*), Karanja (*Pongamia pinnata*), Neem (*Azadirachta indica*), Mahua (*Madhuca indica*), Mango (*Mangifera indica*) kernel as feed, Jojoba (*Simmondsia chinesis*) and piloo (*Salvadora spp.*), falling in the jurisdiction of AFRI was collected and compiled.

2.7 Forest Protection

2.7.1 Overview

Forest Protection Division of AFRI deals with the research on the theme which comprise the studies on the insect – pests, diseases and on biofertilizers in arid and semiarid areas of Rajasthan and Gujarat. The division has been engaged in the aforementioned studies for last 20 years. During this period various research projects on different aspects, pertaining to forest protection research were undertaken. The projects were funded by various agencies.

2.7.1.1 Summary of the achievements under the Theme

- 16 species of insects; 2 species of mites;3 species of parasitic nematodes and 13 species of disease infection and 2 species of rust fungi have been documented on *Acacia nilotica*
- Leaf rust fungus *Ravenalia evansii* was identified as potential biological control of *Acacia nilotica*.
- Collected seven species of fungi belonging to different genera were isolated from canker disease of rohida (*Tecomella undulate*) and established cultures in laboratory for pathogencity test.
- Maximum mortality observed in Nagaur district, while minimum was in Jhunjhunu district.
- Major biotic factor responsible for Khejri motality was found to be *Ganoderma lucidum* and *Acanthophorus serraticornis*. The Khejri mortality percentage varied from 18.08 to 22.67 %. Maximum mortality was noted in Nagaur and minimum in Jhunjhunu district.
- Based on outcome of previous studies, management trials were laid in six different localities in five districts of Rajasthan.
- Antifungal properties against *Rhizoctonia bataticola* and *Fusarium solani* was found in *Citrullus colocynthis* and against *Alternaria alternata* in *Datura stramonium*.

Projects under the Theme (in table as given at 2.1.1.2)

Projects	Concluded Projects	Ongoing Projects	New Projects Initiated During the Year
Plan	0	1	3
Externally Aided	0	1	0

2.7.2 Insects pests, diseases and control

EXTERNALLY AIDED PROJECT

NEW PROJECTS

Nil

PROJECTS CONTINUED

Project 30. New biocontrol opportunities for prickly acacia: exploration in India (AFRI/FPD/2008-2011).

Principal Investigator: Dr. S.I. Ahmed

Periodical and systematic surveys of *Acacia nilotica* have been conducted in 17 sites in Rajasthan state and 24 sites in Gujarat state at quarterly intervals. Documented 16 species of insects, 2 species of mites, 3 species of parasitic nematodes and 13 species of diseases have been documented. Among them, one species of shoot galling insect, two species of phytophagous mites and two species of leaf rust appeared to be most potential and promising as bio-control agent of *A. nilotica* var. *indica*. In exclusion trials laid out at various sites viz., Jodhpur, Pali, Hanumangarh and Bharatpur (Rajasthan) and Gandhinagar, Nadiyad, Junagarh and Bhuj (Gujarat). The result revealed that treated seedlings with Monocrotophos (0.02%) + Bavistin (0.1%), which were kept under canopy, exhibited the best performance in almost all the parameters of growth. *i.e.* plant height, number of shoots, number of leaves, root length , basal stem diameter, plant biomass, whereas the seedlings, kept under sun exhibited comparatively poor performance in different parameters. Host specificity test on 14 species of *Acacia* was conducted for rust fungi, *Revenelia evansii* in poly-house at Jodhpur, only eight species performed well in the climatic conditions of temperature and relative humidity at Jodhpur.The cross- infectivity and host specificity test were designed using the seven species of *Acacias* including *A. nilotica indica* against the mites and rust infestations. The experiment on host-speceficity test of mites species, *Tenuipalpus sp.* and *Olingonychus sp.* was conducted *on* eight species of *Acacias*. Both the species responded for feeding to only *A. nilotica var. indica* and not at all exhibited any feeding symptoms towards other species of *Acacias*. The percentage infestation ranged from 40 to 50%. The rate of infestation decreased with the increase

temperature range. Percentage infestation started decreasing in the field conditions.On the basis findings, most of the insects pests and pathogens have a wide host range, hence rejected for further studies. One species of pathogen *Ravenalia evansii* and two species of mites were recorded to be highly host- specific. The leaf rust, *Revanelia evansii* has been prioritized for further study on host specificity.

PROJECT CONCLUDED

NONE

CENTRE FUNDED PROJECTS

NEW PROJECTS INITIATED

Project 31. **Induction of systemic acquired resistance in rohida against stem canker (AFRI-99/FPD/2010-2013).**

Principal Investigator : ***Dr. Sangeeta Singh***

Survey was carried out to select experimental site and collection of infested samples, isolation and identification of pathogen responsible for stem canker of rohida (*Tecomella undulate*). In Bikaner, survey was made at IGNP area and Khajuwala and at Chohtan and Sindhari in Barmer. Experimental site was selected in Chohtan of Barmer district. 200 seedlings were raised and maintained in the nursery for pathogenecity test and study of infection process. Seven fungi have been isolated from different sites from infected rohida trees. The fungi has been identified to be *Botrydiploidia theobromae*, *Stemphylum* sp, *Alternaria* sp, rest of the other species are unidentified and will be sent to IMTECH Chandigarh for proper identification. Individual fungus species and in combination were inoculated on healthy branches of rohida for pahogenecity testing. Seedlings are being maintained in the nursery for further studies.

Botrydiploidia sp. has been inoculated on one year old seedling of rohida in nursery for study infection process. 6mm diameter bit of plant material with fungus was taken out with the help of cork borer and were inoculated on each healthy seedlings for pathogenecity studies. The cfu of each 6mm bit was 10^8. Samples are collected at 15 days interval to study the biochemical changes in healthy and infected tissues.

Project 32. A **Coordinated project on integrated management of Khejri mortality for socio-economic upliftment in Rajasthan (AFRI-99/FPD/2010-2015).**

Principal Investigator : ***Dr. S.I. Ahmed***

Collection component :

Field surveys were made in 4 districts *viz.*, Nagaur, Sikar, Churu and Jhunjhunu to assess the extent of mortality. In Nagaur, 24 sites (14 sites exhibited severe mortality), 13 sites in Sikar (4 sites severe mortality), 10 sites in churu (8 sites faced severe mortality), 12 sites in Jhunjhunu (4 sites had severe mortality). In addition, one more site i.e., Surani, has been selected in Shergarh district of Rajasthan. Trees were marked for treatment according to their severity. The percentage khejri mortality ranged between 18.08 to 22.67 % with an average mortality of 20.93 % in all the surveyed districts. The affected area in Churu districts was surveyed and the mortality percentage was 18.67%. Based on the actual data of tree mortality in the randomly selected pockets at different localities, in addition to *Ganoderma lucidum, Macrophomina phaseolina* was isolated from infected khejri roots. Eggs and larvae of different instars of *Acanthophorus serraticornis* have been collected for rearing in the lab condition. Six sites were selected in five districts viz; Surani (Balesar Road, Jodhpur), Raghunatpura (Didwana, Nagaur), Jhareli (Jayal, Nagaur), Goshala (Fatehpur, Sikar) and Churu (Churu), Sultana (Jhunjhnu) for the laying out of experiment. The treatments were given as recommended by CAZRI, AFRI & ARS. Before treatments, observations were recorded on DBH, root infection with borer/fungus defoliation percentage, and weight of loong production by visual and actual record.

Pathological aspects: Soil samples were collected to study the population of soil borne fungi before treatment. Three species of *Aspergillus*, one species of *Trichoderma* and six different species of unidentified fungi have been isolated from the soil samples collected from different sites. The colony forming unit of microfloral at different sites in untreated soil was 10^4-10^6. Fruiting bodies of *Ganoderma* lucidum were collected from infected khjeri trees. The fungus was isolated and multiplied on sorghum seeds. Freshly prepared culture of *Rhizoctonia bataticola* causing charcoal root rot in khejri trees was inoculated on the young seedling for pathogenecity test. Till now three different strains of *Trichoderma* spp have been isolated from the soil collected from different sites.

Entomological Aspects:

The bio-ecology of *Acanthophorus serraticornis* was studied in the laboratory as well as in the insectary conditions. The eggs have been laid by female beetles in the month of September-October in the moist soil of around the collar region of trees. The eggs are oval in the shape, white and measured 4.76 mm in length and 2.38 mm in width. Incubation period varies from 9-11 days. The maximum length of newly hatched Ist instar larvae are 25 mm, long, creamish-white with blackish brown head. The Ist instar larvae life is of 45-50 days. Life generations of *Acanthophorus serraticornis* overlap considerably and different instars larvae have been collected from field during January to March. A workshop was organized to review the work done by AFRI. Suggestions & future line of action have been finalized.

Genetics and **Biotechnology:**

Genetics: Systematic surveys were conducted at different areas of Rajasthan viz; Nagaur, Sikar, Churu and Jhunjhunu and 20 CPTs were selected from these districts. To be more precise, out of these trees, 10 CPTs were from Fatepur (Sikar), 4 from Ragunathapura (Nagur), 2 from jhareli, 2 from Rotu (Naguar) and 2 from from Churu. Sangries (immature pods) from 6 CPTs were collected individually and data on morphological parameters were collected. Cutting and layering experiments were done on mature plant of *Prosopis cineraria* with using different concentrations of IBA (500ppm, 1000 ppm and 1500ppm). None of the treatments produced satisfactory results in the prelimnary trials.

Biotechnology: Surface sterilization procedure for mature tree derived stem nodal segments of *Prosopis cineraris* has been done using both NaOCl and $HgCl_2$. NaOCl treated explants showed significantly better axillary bud break. Experiments based on an earlier report on *in vitro* clonal propagation of *Prosopis cineraria* by Shekhawat et al., (1993) were initiated using MS medium supplemented with IAA (0.1 mg/l) + BAP (2.5 mg/l) + additives. Bud break was seen. Experiments on use of various combinations of auxins and cytokinins have been performed for further bud break and multiplication of *P. cineraria*. *In vitro* culturing of juveNile explants has also been initiated.

Ecology **Component:**

Systematic surveys were conducted at different areas of Rajasthan, viz. Nagaur, Sikar, Churu, Jhunjhunu and Jodhpur and 6 sites were selected from these districts. Soil samples were collected from 6 sites viz., Surani (Jodhpur), Jhareli, Didwana and Rotu (Nagaur) ; Churu (Churu); Fatehpur (Sikar) and Sultana (Jhunjhunu) for nutrient studies. Soil physico-chemical parameters like; soil moisture, pH, electrical conductivity, organic and Inorganic carbon, nitrogen and phosphorus were estimated in all the samples. Metrological data i.e. temperature, relative humidity, rainfall, wind speed evaporation of Jodhpur district were recorded.

Plant diversity was assessed in Surani by laying out the sample plots at three locations in khejri mortality area. The plots with dominant shrubs were *Aerva pseudotomaentosa, Capparis decidua, Calotropis burhia* and Zizyphus nummularia. The plots with dominant herbs and grasses were *Desmodium diffusa, Brachiaria ramosa, Cenchrus biflorus, Corchorus trides, Crotolaria medicagenia, Cyperus rotandus,* Eclipta *sp., Heliotropium subulatum, Indigofera cordifolia, Phyllanthus amarus* and *Tribulus terrestris.*

Biochemical **Studies:**

Plant and soil samples have been collected for isolation of pathogen/microorganism related to the mortality. Two fungi have been isolated from the infected soil sample and identification work is in process. One species of *Trichoderma* has been isolated from the soil collected from Surani. Isolation

of other fungi like *Ganoderma lucidum* and *Macrophomina phaseolina* has been carried out. Pathogen responsible to play a major role in Khejri mortality has been isolated and identified as *Ganoderma lucidum*. The pathogen is cultured in laboratory on PDA medium for bio-assay.

Socio-economic studies

The study area of this project are; Nagour, Churu, Sikar, Jhunjhunu and Jodhpur in Rajasthan. The recanassaince survey of the areas of twenty villages of five districts viz; Nagour, Churu, Sikar, Jhunjhunu and Jodhpur were completed. The questionnaire has been prepared, updated and tested. Fiffteen villages of Nagour and Sikar were surveyed and interviewed of 112 households for assessing the economic loss from the widespread mortality of Khejri tree.

Extension component

Collected literature for printing of pamphlets on khejri mortality. After this, pamphlet *"KHEJRI MORTALITY: CAUSES, SEVERITY & REMEDIES IN RAJASTHAN"* were published for raising awareness in public about Khejri mortality problem and its interim control measures. In this pamphlet, problem of khejri mortality and recommendation for control and various factors affecting khejri tree were explained in simple language. Total 10800 pamphlet were published, 7200 in Hindi & 3600 nos. in English. These pamphlets were distributed to farmers/Forest staff/NGO during their visits to the institute and trainings. Besides this, some display boards related to Khejri mortality problem and its management were also prepared.

PROJECTS CONTINUED

Project 33. Evaluation of antifungal potential and identification of broad spectrum antifungal compound from selected tree/shrubs/weeds of Indian arid region (93 AFRI/AFED/2009-14).

Principal Investigator : Mrs. Bhawana Sharma

Antifungal properties of selected 7 plant parts were evaluated against fungal pathogen. Collection of various plant parts of the selected plant species (7 plant parts Leaves, root, seed of *Datura stramonium* , fruit of *Balanites aegyptiaca*, root and fruit of *Citrulus colocynthis* and flowers of *Tephrosia purpurea*) have been carried out for antifungal properties. The collected plant materia were washed with distill water and dried in shade. Dried plant material was finely ground. The powdered plant material of each plant was further extracted with respective solvents using soxhlet. Ethanolic extracts were dried with the help of rotary evaporator and water extracts were dried with the help of water bath. These two types of extracts; aqueous and ethanolic forms were prepared plant parts, thus total 28 extracts were prepared and evaluated against target fungi.

For antifungal assay, pure cultures of fungi have been collected from Plant Pathology Division of FRI. These fungal pathogen are periodically sub-cultured and maintained on PDA medium and pure

cultures are stored in refrigerator for further use. Antifungal activities of extract were determined by agar diffusion assay. Potato dextrose agar (PDA) was used as the medium for anti fungal assay by well diffusion method. In petriplates well of 6mm diameter were made and filled with a known concentration (50mg/ml) of extracts and kept in incubator at 28°C temperature and the inhibition zones from the centre of the well were measured in millimeters and recorded.

Total fourteen extracts were tested against five fungus for their antifungal properties, out of these fourteen extract following results were recorded ; 1) Aqueous extract of *Citrulus colycynthis* root showed good antifungal activity against *Rizoctonia bataticola*, 2) Alcohalic extract of *citrulus colycynthis* root showed antifungal activity against *Fusarium solani* (Fig 34) and 3) Aqueous and ethanolic extract of *Citrulus colycynthis* leaves showed mild to moderate antifungal activity against selected fungi (Fig 35) 4) Aqueous extract of *Datura stramonium* seed showed good antifungal activity against *alternaria alternate*, and *5)* Alcohalic extract of *Daturastramonium* seed showed moderate to mild antifungal activity against all five fungus.

Fig **34.** Inhibition zone by aqueous extract of *Citrulus colycinthis* root

Fig 35. Inhibition zone by aqueous extract of *Citrulus colycinthis* fruit

PROJECT **CONCLUDED**

2.7.3 **Mycorrhizae, rhizobia and other useful microbes**

ICFRE **FUNDED PROJECTS**

NEW **PROJECTS INITIATED**

Project **34. Evaluation and selection of efficient strains of AM fungi and *Rhizobium* for *Acacia nilotica* and *Ailanthus excelsa* in western Rajasthan (AFRI-103/FPD/2010-13).**

Principal Investigator: Dr. Neelam Verma

Rhizosphere soil and root samples of *Acacia nilotica* and *Ailanthus excelsa* were collected from various forest nurseries viz; AFRI model nursery, Bhuteshwer nursery, Jodhpur; Navalgarh forest nursery, Jhunjhunun and high tech nursery of Forest Department, Sojat Road (Pali). In plantations, rhizosphere soil samples of *Acacia nilotica var. indica* were collected from various sites *viz.*, Nagaur (4), Bikaner (2), Barmer (3), Pali (5) and Sirohi (5 sites) (Fig. 36) districts. For *Acacia nilotica var. cupressiformis*, samples were collected from Nagaur (1), Pali (5 sites) (Fig. 37) and Sirohi district (5) and samples of *Ailanthus excelsa* were collected from Nagaur (1), Bikaner (1) and Barmer (3) district. Soil samples were analyzed for pH, EC, (%) organic carbon (% OC), phosphorous (P) and carried out isolation of AM fungi. The important genera were identified as *Acaulospora, Gigaspora, Glomus and Sclerocystis* (Fig. 38). Among these four genera, *Glomus* occurred most frequently. The different species of *Glomus* were recorded as *G. aggregatum* (Fig 39), *G. fasciculatum, G. mosseae, G. macrocarpum G. microcarpum* (Fig 40), *G. constrictum* and *Glomus species* (unidentified, Fig 41). Out of which, *G. fasciculatum* was dominant species in all the sites of nurseries as well as in plantations. The spore population was varied from site to site and ranged between 163 to 480 propagules per 100 gm soil.

Fig 36. *Acacia nilotica* var. *indica* at Sirohi

Fig 37. *Acacia nilotica* var. *cupressiformis* at Pali

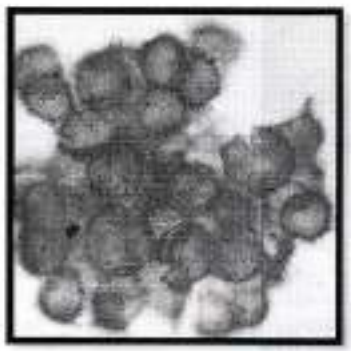


Fig 38. *Sclerocystis* species

Fig 39. *Glomus aggregatum*

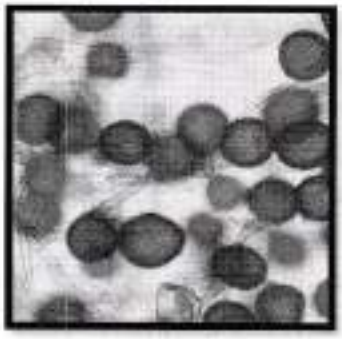


Fig 40. *Glomus microcarpum*

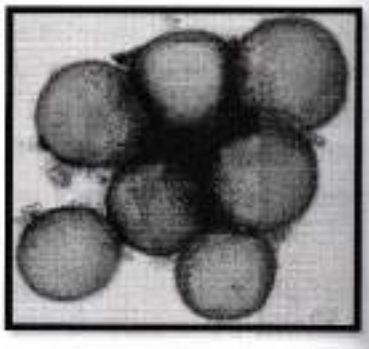


Fig 41. *Glomus species*

PROJECTS CONTINUED

Nil

PROJECTS **CONCLUDED**

3. Education Visits / Activities

- Fourty seven trainees of Balaghat Forest Ranger College, Balaghat (M.P.) visited AFRI, Jodhpur on 4th May, 2010. They gained knowledge about developed technologies and activities of AFRI through visiting the Extension & Interpretation Centre and experimental nursery of AFRI.
- Thirty students of B. Sc. Lachoo Memorial College of Science and Technology, Jodhpur visited AFRI, Jodhpur on 7th May, 2010. They learned about the technologies developed and activities of AFRI by visiting the soil and water analysis Laboratory, Plant Tissue culture Laboratory, Non wood forest product Laboratory and extension & interpretation Centre, AFRI.
- Twenty five students of M. Sc. (Final), Botany Department, Jainarayan Vyas University, Jodhpur visited AFRI, Jodhpur on 9th June, 2010. They learned about developed technologies and activities of AFRI through visiting to the plant tissue culture laboratory and extension & interpretation centre, AFRI.
- Thirty numbers of farmers from Ganganagar district, Rajasthan along with Agriculture officers visited on 2nd July, 2010 to extension and interpretation center, AFRI, Jodhpur to know the forestry research activities of this institute. They were addressed by Director, AFRI and Head, Ecology Division, AFRI, Jodhpur.
- Thirty four participants from Jal Bhagirathi Foundation, Jodhpur visited AFRI, Jodhpur on 13th August, 2010. Dr. G. Singh, Head, Ecology Division, AFRI, Jodhpur delivered details about research activities. They learned about developed technologies and activities of AFRI through visiting various labratories viz: soil and water analysis lab, plant tissue culture, and Non wood forest product and extension & interpretation centre, Experimental Nursery of AFRI.
- The twenty eight student of M. Sc. Wood Science and Technology, FRI Deemed University, Dehradun visited AFRI, Jodhpur on 24th August, 2010. Shri Ashok Kumar, Group Coordinator (Research), AFRI, Jodhpur delivered details about research activities and functioning of the institute. They gained knowledge about developed technologies and activities of AFRI through visiting various laboratories viz: soil and water analysis, plant tissue culture and Non wood forest product laboratories extension & interpretation centre and Experimental nursery of AFRI.
- M.Sc. (forestry) IV Year students (17 nos) of College of Forestry, Sirsi campus, University of Agricultural Sciences, Dharwad (Karnataka) visited AFRI on 2nd Sep 2010. Dr. T. S. Rarthore, Directore, AFRI, Jodhpur delivered details about research activities and functioning of the institute. They gained knowledge about developed technologies and extension activities of AFRI through visiting Forest Ecology Division, FGTB Div, Extension & Interpretation Centre of

Agroforestry & Extension Division and Experimental Nursery of Silviculture Division, AFRI.

- Twenty five university teachers of refresher course of Zoology Department, Jainarayan Vyas University, Jodhpur visited AFRI, Jodhpur on 23rd September, 2010. They learned about developed technologies and activities of AFRI through visiting to the plant tissue culture and, Forest Ecology laboratories and demonstrated at Extension & Interpretation Centre, AFRI.
- Twenty seven foresters of Forest Training College, Alwar Rajasthan visited AFRI, Jodhpur on 26th September, 2010. They gained knowledge about developed technologies and activities of AFRI through visiting the Extension & Interpretation Centre, Agroforestry & Extension Division and Experimental Nursery of AFRI.
- Dr. T. S. Rathore, Director briefed through to the SFS probationers (40+41 nos.), Central Academy, Dehradun during visit at AFRI, Jodhpur on 10th Oct, 2010 and 19th Oct, 2010. They learned about developed technologies and activities by AFRI, Jodhpur.
- Sh. Anant Roy, Honourable Forest Minister, West Bengal state visited AFRI, Jodhpur on 20th and 21st October, 2010. He learned about developed technologies and activities by AFRI, Jodhpur. He visited Forest Ecology labs, interacted and addressed to Forest officials and scientists of AFRI, visited AFRI nursery. Director AFRI, CCFs Jodhpur and WL informed to MIC, FT, WB about various works. Later on, as per his prefixed programme he visited VVK works at Mohangarh and Bikaner with Sh M R Baloch, IFS HoD/AFED and Silva, AFRI and with local Forest officials from RFD.
- Acquainted 70 students of M.Sc. Botany and B.Sc. Biotechnology, RKKGPS with the Research Highlights of the Institute. They also visited AFRI Model Nursery and Extension and Interpretation Centre on 4th December, 2010.
- Fourty two participants as lecturers from UGC -Academic Staff College, Jai Narayan Vyas University, Jodhpur visited Institute, AFRI Model Nuresery and Extension and Interpretation Centre on 8th December, 2010.
- Acquainted 99 students of B.Sc., RKKGPS with the Research Highlights of the Institute on 10th December, 2010. They learned about developed technologies and activities of AFRI through visiting to the plant tissue culture techniques in the lab. Forest Ecology Division and demonstrated at Extension & Interpretation Centre, AFRI.
- Eighteen numbers of foresters of Forest Training Institute, Pinjore and Haryana visited AFRI, Jodhpur on 2nd January, 2011. They gained knowledge about developed technologies and activities of AFRI through visiting various divisions viz: soil and water analysis, plant tissue culture and Non wood forest product laboratories, Extension & Interpretation Centre and Experimental Nursery AFRI.
- Participated in XI Paschimi Rajasthan Hasta-shilp Utsav 2011, Jodhpur organized by DIC and District Administration to acquaint students, NGOs, progressive farmers and others with research highlights and technologies of AFRI from 2nd to 11th January, 2011.
- Fiffty four students Aryabhatta College, Ajmer (Rajasthan) visited AFRI, Jodhpur on 7th January, 2011. They learned about developed technologies and activities of AFRI through

visiting laboratories and Extension & Interpretation Centre.

- Fourty four students of College of Forestry, Dr. Y. S. Parmar University of Horticulture and Forestry Solen (H.P.) visited AFRI, Jodhpur on 11th January, 2011. They learned about developed technologies and activities of AFRI through visiting laboratories Extension & Interpretation Centre and Experimental Nursery of Silviculture Division, AFRI.
- Shri K.S.Chouhan, IFS, CCF, Haryana, Panchkula, Shri Jagdish Chander, IFS,CF, Research Circle, Pinjore, Shri Balbir Singh Khokha, HFS, Divisional Forest Officer, Seed Collection Division, Pinjore and Shri Paramjit Sagwan, Divisional Forest Officer, Research Division, Pinjore visited Institute from 31-1-11 to 2-2-11.Dr. T.S. Rathore, Director, AFRI briefed them about the Research Highlights of the Institute. They also visited Gangani Experimental Trial, AFRI Model Nursery and Extension and Interpretation Centre.
- Sixty students of M.Sc. Botany (Prev. & Final) escorted by two lecturers from Govt. Lohiya College, Churu, Rajasthan visited Institute on 3rd February, 2011.They were acquainted with the Research Highlights of the Institute. They also visited AFRI Model Nursery and Extension and Interpretation Centre.
- Thirty four participants of 74th Orientation Programme organized by UGC-Academic Staff College, Jai Narayan Vyas University, Jodhpur visited Institute, AFRI Model Nursery and Extension and Interpretation Centre on 3rd February, 2011. They learned about developed technologies and activities of AFRI.
- Thirty four participants of UGC-Academic Staff College, Jai Narayan Vyas University, Jodhpur visited Institute, AFRI Model Nursery and Extension and Interpretation Centre on 9th Feb, 2011. They learned about developed technologies and activities of AFRI.
- Thirty farmers from IFFCO, Jodhpur Division visited different research divisions of the Institute, AFRI Model Nursery and Extension and Interpretation Centre on 10th February, 2011. They learned about developed technologies and activities of AFRI.
- Twenty five Forest Range Officers as trainees of Uttarakhand Forest Training Academy, Haldwani, and Nainital visited AFRI, Jodhpur on 24th February, 2011. They gained knowledge about developed technologies and activities of AFRI through visiting various divisions and demonstrated Extension & Interpretation Centre.

3.1 FRI University (Applicable for FRI, Dehradun only)

3.2 Trainings Organized

- Organized a technical training on increasing productivity of wastelands, for 35 farmers and officials of Agriculture Department, Sri Ganganagar district, on 2nd July, 2010.
- Organized traning cum field visit in coloabration with Jal Bhagirathi Foundation, Jodhpur for farmers and field functionaries on 13th August, 2010.
- Organized workshop-cum meeting on Khejri mortality on 21st -23rd August 2010 in which Scientists from different Institutes of ICFRE, ICAR, NGO's, and progressive farmers participated and visited to Khejri mortality areas in Nagour, Rajasthan.
- Organised one week refresher course training for IFS officers from 27-31st December, 2010

on integrated approach for sustainable development of fragile desert ecosystem.

- Organised summer training on plant tissue culture and biotechnology during 1st -14st June, 2010.
- One days training programme`Van Ayum Krishi Utthan`was jointly organized by AFRI with Vichar Munch Abu Road for around 100 nos of farmers on 5th May, 2011 in which Dr T S Rathore Director AFRI, Sh M R Baloch IFS Head Extension and Dr G Singh, Sc F Head,FE Div delivered the lectures on various forestry research activities of AFRI.
- Three days VVK training was organized at Kishan Bhawan, Bikaner during 4-6th Oct, 2010. Total 41 participants (31 forest staffs and 10 farmers) were attended training. They learned techniques of conservation and economic benefits of agroforestry, cultivation of arid fruit tree and production, losses from rat and its control, nursery techniques for cutting, grafting and high quality seed production, use of biofertilizers in forestry and composting techniques. Training was organized by delivering both lectures and onsite demonstration way.

Fig 42. VVK training inauguration (by DCF, Bhuj) at Van Chetana Kendra, Bhuj on 14th Dec, 2010

Fig 43. VVK training at Van Chetana Kendra, Bhuj on 14th Dec, 2010

Fig 44. Demonstration of macro propagation techniques at Hi-Tech nursery, Bhuj, on 15th Dec, 2010

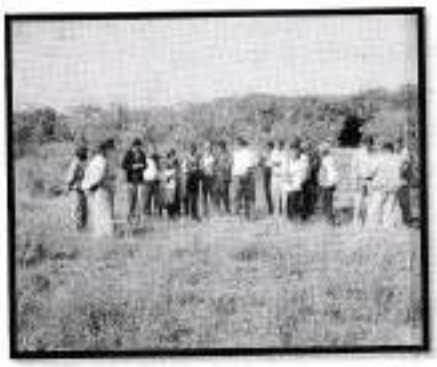


Fig 45. VVK training participants visiting AFRI developed Silvi-pastural model at Mocharai, Bhuj on 15th Dec, 2010

- Demo **training:** One days Demo village training was organized at the Arid Forest Research Institute, Jodhpur on 4th March, 2011. The total 35 participants (12 forest staffs and 23 farmers) were attended training. They learned about various nursery techniques and VAM, composting manure forming techniques. Training were mainly organized in demonstration mode.

Fig 46. Demo village training inauguration at AFRI, Jodhpur on 4th March, 2011

Fig 47. Demonstration of composting techniques to the participants at experimental nursery, AFRI on 4th March, 2011.

Fig 48. Demo training participants visit to medicinal garden at nursery, AFRI on 4th March, 2011.

Fig 49. Demonstration of VAM application in nursery to trainees at nursery, AFRI on 4th March, 2011.

3.3 Visits Abroad

Nil

3.4 Participation in Seminars/Symposia/ Workshops/Trainings

- Smt. Bhawana Sharma, Scientist B attended and presented paper on role of mycorrhizal fungi in enhancing fertility of forest soil of arid zone, in National seminar on "Impact of climate change on biodiversity and challenges in thar desert" on 9th July, 2010 at Desert Regional Centre, Zoological Survey of India, Jodhpur.

- Smt. Bhawana Sharma participated in national seminar on Impact of climate change on biodiversity and challenges in Thar Desert held on 9th July, 2010, organised by Desert Regional Centre, Zoological Survey of India, Jodhpur.

- Dr. Bilas Singh, Research Officer, G. Singh, Scientist F & T. S. Rathore, Director attended workshop on "Sustainable participatory management of natural resources to control land degradation in the thar desert ecosystem" at Jal Bhagirathi Foundation, Bijolia, Jodhpur (Rajasthan) on 20th October,2010.

- Dr. Bilas Singh, Research Officer attended seminar on Bamboo under National bamboo mission organized by Agriculture Department at Abu Road, Sirohi, Rajasthan on 3rd Feb, 2011.

- Dr. Bilas Singh, Research Officer participated in National workshop on *Prosopis juliflora*: Past Present & Future at Central Arid Zone Research Institute, Jodhpur on 23-24 March, 2011.

- Dr. Bilas Singh, Research Officer participated in one day water management training on 29th March, 2011 organized by Central Ground Water Board (WZ), Jaipur at CAZRI, Jodhpur.

- Dr. G. Singh, Scientist F attended and presented paper on habitats and vegetation diversity in benefits of local people of thar desert of India, Desert biodiversity workshop: Priority conservation of grasses, trees and fauna," organized by WWF-India, Mehrangarh Museum Trust, INTACH, AFRI, Tiger Watch, Bishnoi Tigers Vanya and Paryavaran Sanstha, and TWSI at AFRI, Jodhpur, on 11-12th October, 2010.

- Dr. G. Singh, Scientist F and Bilas Singh, R.O. Attended and presented paper on Biomass production and equations for predicting biomass of different component of *Prosopis juliflora* growing naturally in arid and semi arid areas of Rajasthan, National workshop on 'Prospis juliflora: past, present and future, held at CAZRI, Jodhpur on 23-24 March 2011.

- Dr. G. Singh, Scientist F participated and presented different technologies related to land degradation in SLEM workshop held at ICFRE, Dehradun on 29-30th September, 2010.

- Dr. G. Singh, Scientist F attended participated in workshop on 'Science-based policy options for climate change adaptation in Rajasthan' organized by Rajasthan Pollution Control Board, Jaipur 24-25th Feb, 2011.

- Dr. G.Singh and N.Bala attended National workshop on *Prosopis juliflora*: past present and future. 23rd and 24th March 2011.CAZRI, Jodhpur.

- Dr. K.K. Srivastava, participated in national seminar on Impact of climate change on biodiversity and challenges in thar desert held on 9th July, 2010 organised by Desert Regional Centre, Zoological Survey of India, Jodhpur.

- Dr. K.K. Srivastava, Scientist F attended and presented paper on A-mycorrhizal diversity in mehndi & ashwagandha at western Rajasthan" poster presentation in National seminar on *"Impact of climate change on biodiversity and challenges in thar desert" on 9th July, 2010* at Desert Regional Centre, Zoological Survey of India, Jodhpur.

- Dr. Mala Rathore, Scientist D attended National seminar on impact of climate change on biodiversity and challenges in thar desert organaized by ZSI, Jodhpur on 9 July, 2010 and presented paper on Endangered plant species of arid and semi-arid zone and award received on the poster presentation.

- Shri M. R. Baloch, Head, Agroforestry & Extension Division attended two days workshop for IFS officers on the subject 'Personal & Employees job satisfaction at IMTR, Goa held from December 02-03, 2010.

- Shri N. Bala, Scientist E attended one day Seminar on "Krishi prodyogiki dwara khaddann, poshan ebam Paryavaran suraksha" at Agriculture Research Station, Keshwana, Jalore on18th February, 2011.

- Shri N. Bala, Scientist E, attended National seminar on combating environmental degradation on 26th -27th July, 2010 organized by Gujarat Ecology Commission, at Gandhinagar.

- Shri N. K. Limba attended the 8th All India People's Technology Congress, 11th - 12th February, 2011. Science City & Energy Park, Kolkata.

- Dr. Neelam Verma, Research Officer attended and presented paper Seasonal variation of am fungi in khejri (P. cineraria l. druce) in western Rajasthan in National seminar on "Impact of climate change on biodiversity and challenges in thar desert" on 9th July, 2010 at Desert Regional Centre, Zoological Survey of India, Jodhpur.
- डॉ. नीलम वर्मा शुष्क एवं अर्द्धशुष्क क्षेत्रों में बबूल के रोग एवं इनके उपचार, राजभाषा वैज्ञानिक संगोष्ठी, रक्षा प्रयोगशाला, जोधपुर 10-11 मार्च, 2011, पृष्ठ सं. 32-36 ।
- डॉ. नीलम वर्मा बेल का पेड़- गुणों की खान, राजभाषा वैज्ञानिक संगोष्ठी, रक्षा प्रयोगशाला, जोधपुर 10-11 मार्च, 2011, पृष्ठ सं. 37-39 ।

- Dr. Ranjana Arya, Scientist E, attended IUFRO symposium on, Short rotation forestry: synergies for wood production and environmental amelioration at Punjab Agriculture University, Ludhiana on Feb 10-11th, 2011 and presented paper on biomass production from *Salvadora persica* and *Acacia ampliceps* after five years of growth on arid salt affected sandy soils in India.

- Dr. Ranjana Arya, Scientist E attended National symposium organized by Gujarat Institute of Desert Ecology at Bhuj from 4-5th march, 2011 and presented paper on Silvi-pastoral studies using *Cenchrus ciliaris and C. setigerous* in combination with two different top feed species to enhance the productivity of degraded forest land.

- Dr. Ranjana Arya , Scientist E, attended Biodiversity workshop on 9-10 Sep, 2010 organized by WWF-India, Mehrangarh Museum Trust, INTACH, AFRI, Tiger Watch, Bishnoi Tigers Vanya and Paryavaran Sanstha, and TWSI at AFRI, Jodhpur, on 11-12th October, 2010 and presented paper "Effect of plantation activities on biodiversity status on arid salt affected soil".

- Dr. Ranjana Arya , Scientist E attended workshop on New frontiers and future of wood science and technology in India" at IWST Bangalore on 20th Jan, 2011 and presented paper potential of lesser known timber species of arid region for handicraft industries of Rajasthan and received second prize .

- Dr. Ranjana Arya , Scientist E attended National Workshop on *Prosopis juloflora*: Past, Present and Future organized by the CAZRI, Jodhpur on 23-24 March, 2011 and presented paper on Natural germination of *Salvadora persica* under *Prosopis juliflora* in the protected conditions on arid salt affected soils in Jodhpur, Rajasthan.

- Dr. S.I. Ahmed, Scientist F attended and presented paper Effect of bio-agents/biopesticidal treatment on yield of mehndi & isabgol crops against key insect pests & diseases, in National seminar on "Impact of climate change on biodiversity and challenges in thar desert" on 9th July, 2010 at Desert Regional Centre, Zoological Survey of India, Jodhpur.

- S Dr. angeeta Singh, Research Officer attended the Induction training for scientists and research officers of ICFRE at Dehradun from 15th March to 21st May, 2010.

- Smt. Sangeeta Tripathi, RO attended National conference on forest people interaction held in Pokhara, Nepal on 6-7June, 2010.

- Smt. Seema Kumar, Scientist D, G. Singh, Scientist F & T. S. Rathore, Director, AFRI, participated in one day consultative meeting on 'Biodiversity: challenges and issues' organized by ICFRE and FRI, Dehradun on 16th December, 2010.

- Smt. Seema Kumar attended and participated in the meeting organised by President, Agriculture technology management agency (ATMA), Jodhpur held at Zila Collector's office, Jodhpur on May 6th, 2010.

- Smt. Seema Kumar participated in national workshop on *Prosopis juliflora*: Past, present and future (NAIP component-II) held at CAZRI, Jodhpur from March, 23rd to 24th, 2011.

- Dr. T. S. Rathore, Director, AFRI, I. D. Arya, Scientist F & Sarita Arya, Scientist E participated in National Symposiym on "Recent advances in plant tissue culture and biotechnological researches in India & XXXII Annual meet of Plant tissue culture association (INDIA) February 4th- 6th, 2011.

- Dr. T.S.Rathore and Dr. G.Singh attended National Seminar on impact of climate change on biodiversity and challenges in Thar Desert, 9th July, 2010, organised by Desert Regional Centre, Zoological survey of India, Jodhpur. ZSI, Jodhpur.

- Dr. U.K. Tomar, Scientist E attended and participated as a resource person in three days VVK training for farmers/forest field functionaries of Kutchh Circle at Bhuj, Gujarat during Dec. 13-15, 2010.

- Dr. U.K. Tomar, Scientist E attended and participated in specialized training on "Climate Change & Forest" at ICFRE Dehradun from Jan 29-Feb 6, 2011.

- Dr. U.K. Tomar, Scientist E attended and participated Consultative workshop on Forest Genetics Resource Management Network (FGRMN) at IFGTB Coimbatore on March 9-10, 2011.

4. Extension Panorama/Activities

- National Forest Library and Information Centre **(NFLIC) (Applicable for FRI, Dehradun only)**
- Environmental Information System (ENVIS) (Applicable for FRI, Dehradun only)

4.1 Report on Van Vigyan Kendra (VVK) and Demo Village (DV)

Progress/Status Report of Van Vigyan Kendras, under AFRI, Jodhpur

State wise locations of established and proposed VVKs

Bichhwal (Bikaner), Rajasthan, **established**
Chhipardi Beedi (Rajkot) Gujarat, **established**
Pudana Nursery, Khanwel (Silvasa) Dadra & Nagar Haveli and Daman, **under process**

VVK at Bichhawal Nursery, Bikaner (Rajasthan)

Various meetings were conducted with Rajasthan Forest officials regarding VVK works. Under Rajasthan VVK hi-tech nurseries (at Bichhwal, Bikaner with its satellite facility at Mohangargh) of DFO Rajasthan were upgraded/renovated in 2009-10

Maintenance of Hi-Tech Nursery Bichhwal, Bikaner -

Maintenance works of Hi –Tech nursery Bichhwal, Bikaner have been executed; rice husk for potting medium, insecticide, seeds and PVC pipe were procured for the Hi-Tech nursery.

- Raising/ Distribution of Seedlings: - In 2010-11, 3000 quality seedlings of *Prosopis cineraria* and *Dalbergia sissoo* have been raised in Hi-Tech nursery Bichhwal, under VVK. Total 10,000 nos of Khejri (*P. cinareria*) seedlings raised in 2009-10 under VVK were distributed/sold during 2010-11 to 66 farmers on subsidised rate.
- Extension activities: Display boards (6 nos) were displayed at the Hi-Tech nursery Bichhwal, Bikaner for farmers/stakeholders under VVK, Bikaner.
- VVK Training - Three days training programme for farmers and field functionaries under Van Vigyan Kendra (VVK) Bikaner was organized by the AFRI, Jodhpur with the help of Rajasthan Forest Department on 4-6th Oct, 2010 at Kisan Bhawan, Bikaner. 41 participants (31 forest staffs and 10 farmers) from various villages/ranges of Bikaner, Chhattargarh, and Shree Ganganagar divisions were attended training. Training was given on conservation and

economic benefits of agroforestry, cultivation of arid fruit tree and production, losses from rat and its control, nursery techniques for cutting, grafting and high quality seed production, use of biofertilizers in forestry and organic and composting techniques. Training was organized by delivering lectures and onsite demonstratio. Director AFRI and senior scientist/Officers from AFRI delivered lectures & demonstrated techniques on various aspect of forestry. Some local resource persons were also invited for lecture from the Institute of Arid Horticulture and Ganga Singh University, Bikaner.

VVK at Chhipardi Beedi, Rajkot (Gujarat)

Meetings organized between AFRI official and additional PCCF (Research), CF (Research) and DCF (Research) and Nodal Officer (VVK) at GFRI, Gandhinagar regarding research demonstration, renovation of Hi-Tech nursery, raising of high quality seedlings and training works for financial year 2010-11. DCF (Res) was briefed about the works under VVK, which need to be taken up at VVK Display Centre & VVK's modal nursery at R&D Centre, Rajkot

- **Maintenance of Hi-tech nursery:** Maintenance works of Hi –Tech nursery, Chhipardi Beedi, Rajkot have been executed. Garden pipe, fogger and accessories, fertilizer and insecticide were procured for the Hi-Tech nursery.
- **Extension activities:** Display boards (6 nos) displayed at the Research and Development Centre, Rajkot for farmers/stakeholders under VVK, Rajkot.
- ***VVK training:*** Three days training programme for farmers and field functionaries under Van Vigyan Kendra, organized by the AFRI, Jodhpur, with the help of Gujarat Forest Department on 14-16th Dec, 2010 at Van Chetana Kenda, Bhuj (Gujarat). Total 59 participants (38 forest staffs and 21 farmers) were attended training. Both classroom lecturers and field visit were included in this training programme. Training was given on economic benefits of agroforestry, silvipastural techniques for fodder production Kutchh region, types of grasses & range management of Kutchh region, Tree improvement programme, soil & water conservation techniques, and afforestation techniques for saline land of Kutchh region, peoples sensitization techniques for forestry extension and organic farming and composting techniques. Training was organized by delivering lectures and onsite demonstration. During the field visit, the participants learned the advance techniques through demonstrations of vegetative propagation of tree species, vermi composting at Hi-tech nursery, Bhuj, guggal plantation and nursery, Vandai. VVK training participants also visited silvi-pastural model developed by the AFRI at Mocharai, Bhuj.
- ***High Quality Seedling raising and distribution:*** Total 3000 high quality seedlings of *Cordia mixa, Casuarina equisetifolia* and *Eucalyptus* hybrid from seeds/cuttings and *Zizyphus mauritiana, , Emblica officinalis by grafting*/budding produced, 500 seedlings were raised of each species in hi-tech nursery at Research and Development Centre, Rajkot for farmers/stakeholders under VVK during 2010-11 for distribution to stakeholders on subsidized rates.
- Total 4995 seedlings raised in 2009-10 under VVK were distributed/sold to 15 farmers.

- The maintained hi-tech nursery facilities and utilized by the GFD for vegetative propagation and raising seed based quality seedlings of various species.

Fig 50. Meeting of ICFRE team with DCF(T), Silvasa

Fig 51. Building and the site for proposed VVK, Silvasa

Khanwel (Dadra & Nagar Haveli and Daman) proposed VVK

Establishment and strengthening of VVK

Shri Rabindra kumar, DDG (Ext), ICFRE, Dehradun and Dr. Bilas Singh, Research Officer visited Silvasa, Dadra & Nagar Haveli and meetings held with DCF, Silvasa on 28th Jan, 2011 with ICFRE officials, Shri Kamal Datta, CF (Daman) and O/C of DCF (T), Silvasa and Shri Dilip Singh Mangrola, ACF (Wild), Silvasa, Dadra & Nagar Haveli FD regarding signing of MOU and VVK activities carried regular correspondence through telephonic, fax and e-mail for signing of MOU & VVK works. The above officers had a visit to proposed nursery and VVK display centre at Khanvel, around 19 km away from Silvasa. During visit of the nursery, it was visualized that exiting proposed VVK building will require repairing before establishing VVK display centre.

The Model MOU further handed over to Shri Kamal Datta, CF for approval. However, MOU of VVK, Khanwell, Silvasa has not been approved till date by DNH authority. Therefore, FD, DNH could not permit AFRI to take up any activities of VVK at Khanwel, Silvasa.

Demo village, Salavas, (Jodhpur)

Establishment and strengthening: MOU signed between Director, AFRI and Sarpanch, Salawas village, Jodhpur for establishment of Demo village at Tikeshwar Bakari, Salawas, Jodhpur on 14th October, 2010. Fifty seedlings of different tree species were planted at Tikeshwar Bakari, Salawas by AFRI officials and Salawas villagers as ceremonial function. Demontration Hall of Demo village and display material were inaugurated by the Director, AFRI, Jodhpur and Sarpanch, Salawas village, Jodhpur.

Fig 52. AFRI Scientists visited proposed Demo village site, Tikeswar Bhakari, Salawas, Jodhpur on 14th Oct, 2010 for technology demonstration

Fig 53. Sarpanch Sh. Oma Ram Patel, planting sapling during ceremonial planting function at Demo village site, Tikeswar Bhakari, Salawas, Jodhpur on 14th Oct, 2010

Fig 54. Dr. T.S. Rathore, Director, AFRI, Jodhpur inaugurating Demo village display centre building at Tikeswar Bhakari, Salawas, Jodhpur on 14th Oct,2010

Fig 55. MOU signing between the Director, AFRI, Jodhpur and Sarpanch, Salawas village, Jodhpur at Tikeswar Bhakari, Salawas on 14th Oct, 2010

Demo site: Site was selected near to SFD nursery, Salawas, Jodhpur to establish agroshed compost unit and other nursery activities for demonstration purposes as well as high quality seedling production for farmer/stakeholders. Compost chamber and agroshade net house and soil conservation works have been taken up through Silviculture and Forest Ecology Division, AFRI, Jodhpur.

The selected area (7.0 ha) of community land at Tikeswar Bhakari, Salawas surveyed, plan and map were prepared to execute the soil and water conservation measures and silvipastoral model. The MoU with Salavas (Gram Panchayat) was signed on Oct 14th, 2010. Later on in Nov, 2010 additional land (1.5 ha) of Salavas GP has been earmarked for Demo site adjacent to Salavas nursery.Salavas GP's land (1800 M^2) presently under the custody of RFD at Salavas Nursery also has been allowed for Demo purpose through a MoU (with DFO/Jodhpur) on Feb, 2011.

Demo training: One days demo training was organized at nursery AFRI, Jodhpur on 4th March, 2011. The total 35 participants (12 forest staffs and 23 farmers) attended training. Training was given on various nursery techniques, VAM, organic and composting techniques etc. Training was mainly organized in demonstration mode.

Mass **communication material and media**

- **Information booklet of AFRI:** Information booklets of AFRI in Hindi language (4750 numbers) were published under VVK for wide circulation and distribution to farmers/ stakeholders/organisaions. Training programmes of VVK of Bikaner and Rajkot and Demo village were given wide publicity in many daily local news papers (Hindi and Gujarati).
- **AFRI Darpan:** Special issues of AFRI Darpan (Quarterly Magazine in Hindi, Vol 1-2, Year 8,) on VVK and Demo and extension activities was brought to highlight AFRI's extension activities.
- **AFRI Publications**: Published 12,800 pamphlets (4600 in English and 8200 in Hindi) on "Khejri Mortality: Causes, severity and Remedies in Rajasthan" and "पश्चिमी राजस्थान में खेजड़ी मर्त्यता** respectively.
- Prepared 30 display Boards (15 each) on Deficiency symptoms of various nutrients in plants and "मरुस्थल की जीवन रेखा । खेजड़ी कल्पवृक्ष को बचाने का संकल्प"
- AFRI Calendar-2010 Short Term Training Courses & Other Activities.
- Following pamphlet were published:
    - The International Day for biological diversity 2010
    - June World Environment Day Many Species, One Planet, One Future
    - 17 June 2010 World Day to Combat Desertification
- *Abstract entitled Prosopis juliflora* – a tree for prosperity of arid lands" **In:** *Prosopis juliflora*: Past, Present and Future. pg. 36. CAZRI, Jodhpur, ICAR Publication."

Evaluation **of VVK-Demo:**

Shri Pankaj Agarwal, ADG (PF), ICFRE, Dehradun visited Demo village site Salavas, Jodhpur along with Dr. T.S. Rathore, Director, Shri . M.R. Baloch, HOD/AF&E Div. and Dr. Bilas Singh, RO, AFRI and evaluated the Demo activities on 29th Nov, 2010. He also discussed with Rajasthan Forest Department officials and villagers of Salavas.

Shri Pankaj Agarwal, IFS, ADG (PF), ICFRE, Dehradun evaluated the VVK activities in Bikaner & Satelite nursery at Mohangarh, Jaisalmer. A meeting was held on 30th Nov, 2010 at CCF office, Bikaner between ICFRE officers and SFD officials during VVK evaluation visit of Shri Pankaj Agarwal. The meeting was organized to discuss about VVK activities and issues and attended by Sh. A. S. Guru, CCF, Sh. Udai Shankar, CF and Sh. D.R. Sharan, DCF & Nodal Offier, Bikaner Div-I, IGNP area, Bikaner, Shri Pankaj Agarwal and Dr. Bilas Singh, AFRI, Jodhpur. The ADG (PF) expressed his views regarding VVK concept, activities, progress linking VVK development with SFD works. The CCF & DCF also discussed about other relevant issues common to AFRI & SFD. They visited renovated Hi-Tech nursery under VVK and provenance trial of Rohida (*Tecomella undulata*), Bicchwal, Bikaner. Also visited renovated satellite nursery at Mohangarh, Jaisalmer on 1st Dec, 2010.

Fig 56. Shri Pankaj Agarwal, ADG (PF), ICFRE, Dehradun visited Demo village site at Salavas, Jodhpur along with Dr. T.S. Rathore, Director, Shri. M.R. Baloch, HOD/AF&E Div

Fig 57. Shri Pankaj Agarwal, ADG (PF), ICFRE, discussing with Shri A.S. Guru, CCF, IGNP area, Bikaner in the renovated Hi-Tech nursery, Bicchwal, Bikaner

Fig 58. Shri Pankaj Agarwal, ADG (PF), ICFRE, Dehradun observing display material with Shri Udai Shnkar, CF, IGNP area, Bikaner in the VVK Display room, Hi-Tech nursery, Bicchwal, Bikaner on 30th Nov, 2010

Fig 59. Shri Pankaj Agarwal, ADG (PF), ICFRE, Dehradun with RFD Officials at renovated satellite nursery Mohangarh, Jaisalmer under VVK, Bikaner on 1st Dec, 2010

4.2 Technology Transffered

1. Rehabilitation of degraded Aravlli hills

Disturbances to the natural habitats through overgrazing, vegetation removal and mining is a common feature in most of the hilly areas like Aravallis, which is an ancient mountain and one of the oldest geological formations in the world and the home of many tribes of India, leading biological invasion and land degradation i.e., desertification. To restore these degraded hills, an experiment was conducted by applying rainwater harvesting (RWH) and afforestation with different tree species (*Zizyphus mauritiana, Acacia catechu, Azadirachta indica, Emblica officinalis, Dendrocalamus strictus, Gmelina arborea, Holoptelia integrifolia* and *Syzigium cumini*). RWH structures (Contour trench [CT], gradonie [GD], box trench [BT], V-ditch [VD] and a control) and slope gradient (<10%, 10-20% and >20%) of plots were two levels of treatments. Application on RWH improved soil characteristics like, reduction in soil pH and EC, and increase in soil organic carbon, NO_3-N and PO_4-P and reduced the gradients in soil water and nutrients

between the plots of <10% slope and >20% slope. This not only reduced run-off water, soil and nutrient losses and enhanced the growth of the planted seedlings, but also increased herbaceous layer productivity by 24 to 62% (average of six years) and soil carbon stock (by 3.8-fold). Contour trench and box trench were beneficial in plant growth, whereas gradonie and V-ditch treatments were best for herbaceous growth and productivity. The impact of this practice was an increase in number of species from 39 in 2005 to 92 in 2009, increased water availability period from November to January/ March, fuel wood supply and fodder availability that resulted in enhanced socioeconomic condition of the tribal people residing nearby areas. Thus, RWH and afforestation facilitates restoration process in degraded hills by improving soil nutrients, reducing resource gradient between slopes and enhancing plant growth and herbage biomass.

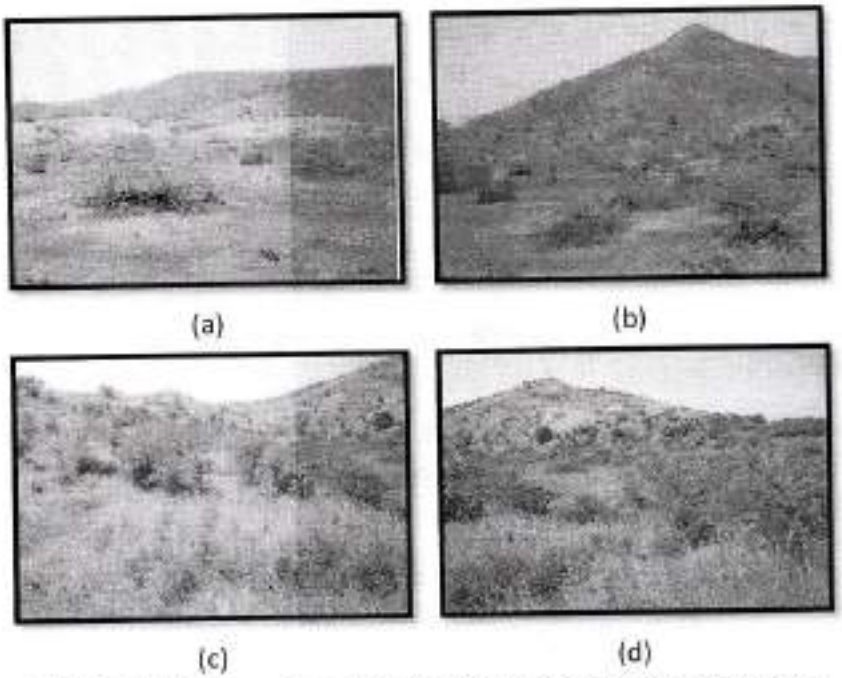


Fig 60. Initial status of the hills (a & b) and herbaceous layer and plant growth during restoration of degraded Aravalli at Banswara in October, 2010 (c & d).

Extension: Visits were made by the state forest department officials for replication by them for the adoption of technology and rehabilitation of degraded Aravalli hills. Results were published and presented in seminars, workshops and training programmes for wider publicity for adoption.

4.3 Research Publications

A. Research Papers in Scientific Journals

- Abha Rani, Pravin H. Chawhaan and Mala Rathore (2010). Extraction and X ray diffraction studies on starches of forest origin. *Indian Forester* 136(12): 1688-1692.
- Abha Rani, Pravin H. Chawhaan and Mala Rathore (2011). Seeds of *Hyptis suaveolens*- A source of mucilage. *Indian Forester* 137(6): 744-750.
- Annapurna, D. and T.S. Rathore (2010). Direct adventitious shoot induction and plant regeneration of *Embelia ribes* Burn F. *Plant Cell tissue and Organ Cultur.* 101:269-277.
- Annapurna, D. and T.S. Rathore (2010). Micropropagation of *Embelia ribes* Burn F. thorugh prolifcation of adult plant axillary shoots. *In vitro Celluar and Development Biology-Plant* 46(2):180-191
- Arya, S., Sharma, S., Rathi N., Kamal, B. and I.D. Arya (2010). Conservation of biodiversity of highly important medicinal plants of India through tissue culture technology- a review. *Agric. Biol. J.N. Am.*, 2151-7517 (2010).
- Bilas Singh and S. K. Sharma (2010). An impact assessment of sustainable forest management on socio-economic development in Gujarat state of India. *Nature and Science* 8(8): 168-173.
- D. K. Mishra (2009). Selection of candidate plus phenotypes of *Jatropha curcas* L. using method of pair comparisons. Biomass & Bioenergy. 33:542-544.
- D. K. Mishra and Devendra Kumar (2009). Development of suitable agronomic practices for important medicinal plants under irrigated and rainfed conditions in Rajasthan. Indian Forester, 135(8): 1088-1098.
- D. K. Mishra and N. K. Bohra (2010). Establishment of seed production area of *Eucalyptus camaldulensis* var. *camaldulensis* in Rajasthan. Green Farming 1(1): 34-37.
- D. K. Mishra and N. K. Bohra (2011). Establishment of seed production area of *Acacia nilotica* (L.) delile var. *indica* in Rajasthan. Green Farming 2(2): 162-165.
- Devendra Kumar and D. K. Mishra (2009). Influence of chemicals pre-treatment on germination and seedlings performance of fresh and stored Neem (*Azadirachta indica* A. Juss.) seed. Annals of Forestry 17 (2): 168-176.
- Devendra Kumar and D. K. Mishra, (2009) Influence of morphologically superior and inferior trees on germination, storability and seedling performance of neem (*Azadirachta indica* A. Juss.) seed. Indian Forester, 135(5): 697-706.
- G. Singh and B. Singh (2010). Assessment of growth and biomass production of *Cenchrus*

ciliaris based silvipastoral system in community pastureland in Bhilwara district of Rajasthan. *Indian Forester*, 136(7): 898-909.

- G. Singh and M. Bhati and T. R. Rathod (2010). Use of tree seedlings for phytoremediation of a municipal effluent used in dry areas of north-western India: plant growth and nutrient uptake. *Ecological Engineering*, 36: 1299-1306.

- G. Singh and T.R. Rathod (2010). Irrigation levels, nutrient uptake and productivity in *Acacia nilotica* seedlings in Indian desert. *Archive of Agronomy & Soil Science*, 56(3): 311-323.

- G. Singh, Abha Rani, N. Bala, S. Upadhyaya, S.R. Baloch and N.K. Limba (2010). Resource availability through rainwater harvesting influenced vegetation diversity and herbage yield in southern Aravalli hills of India. *Frontiers of Agriculture in China*, 4(2): 145-158.

- Genda Singh and Bilas Singh (2010). Assessment of growth and biomass production of *Cenchrus setigerus* based silvipastoral system in community pasture land in Bhilwara District of Rajasthan. *Indian Forester* 136(7): 898-909.

- G. Singh, N. Bala and C.S. Purohit (2011). *Eragrostis tremula* (Lam.) Hochst. ex Steud var. Gajanandii, a new variety from Indian desert. *Indian Forester*, (6):796-798.

- Mala Rathore (2010). Chemical constituents from *Calotropis procera*–the Giant Milkweed, Envis For. Bull. 10(1):172-180.

- Mala Rathore (2010). Leaf protein concentrate as food supplement from arid zone plants. J Dietary Sup.7 (2):97-103.

- Mala Rathore (2011). Utilizing wastelands for growing *Cymbopogon* spp in arid zone' Agric. Biol. Res. 27(1): 32-40.

- Mala Rathore and R.K. Meena (2010). Potential of utilizing *Calotropis procera* flower biomass as a renewable source of energy. J. Phytology 2(1):78-83.

- N. K. Bohra, J. K. Shukla, A. Tripathi and D. K. Mishra (2011). Neem - a wonder tree. MFP News XXI. (1): 13-15.

- Ranjana Arya and Hemant Kumar (2010). Chemistry of *Salvadora persica* (Miswak): A boon to saline wasteland. Envis Forestry Bulletin 10(1):159-165.

- Ranjana Arya, R. R. lohara and R. L. Meena (2010). Performance of exotic *Acacia* spp on highly saline black silty clay soil in the little rann of Kachchh. Current Agriculture 34(1-2): 69-73.

- S.K. Sharma, L.M. Choube, S. Arya and I.D. Arya (2010). Suitability of important bamboo species for pulp and paper industry: A vital source of long fiber pulp in India. Indian J. Crop Sciences 5(1-2): 95-97.

- S. Sharma, B. Kamal, N. Rathi, S. Chauhan, and S. Arya (2010). *In vitro* rapid and mass

multiplication of highly valuable medicinal plant *Bacopa monnieri* (L.) Wetlist. African Journal of Biotechnology, 9 (49): 8318-8322.

- S. Sharma, N. Rathi, S. Nautiyal and I.D. Arya (2010). Micropropagation studies in important forest tree of high importance: An effort for large scale commercial multiplication and their field plantation. Acta HoRt. (ISHS) 865: 255-264 .

- Tarun Kant (2010). Open source bioinformatics workbench options for life science researchers. New York Sci. J. 3(10): 82 – 87.

- Tarun Kant, Sushma Prajapati and Ashok Kumar Parmar (2010). Efficient micropropagation from cotyledonary node cultures of *Commiphora wightii* (Arn.) Bhandari, an endangered medicinally important desert plant. J. Plant Develop. 17: 37-48.

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4.4 Seminar/Symposia/Workshop Organized

- Organized one day interactive workshop on Climate Change Concerns: Needs, opportunities and gaps" on 14th June 2010 at Arid Forest Research Institute, Jodhpur, to discuss on research needs, and the financial, technological and capacity needs and constraints to address climate change concerns vis a vis forest products in the arid zone of India.
- Organized an interactive workshop on National Mission on Green India- linking research and future scope on 2nd July, 2010 at Arid Forest Research Institute, Jodhpur to discuss the opportunities and challenges to linking research to the mission activities and goal.
- Organized a three days workshop-cum meeting on Khejri mortality on 21st -23rd August, 2010 in which Scientists from different Institutes of ICFRE, ICAR, NGO's, and progressive farmers participated.
- Organized DST-Group monitoring workshop for Technology interventions for addressing the societal needs (TIASN) on 18th and 19th November, 2010.
- Organized two days workshop on Desert Biodiversity: Priority conservation of grass, trees and fauna on October, 2010 in collabration with INTAC, WWF Indian and Tiger Watch.

4.5 Consultancies

4.6 Technical Services

- Evaluation of plantation work on GAURAV PATH developed by Jodhpur Development Authority (JDA), Jodhpur.
- Prepared display materials and demonstrated research findings on forest soils, Biodrainage, rain water harvesting for increasing productivity of degraded Aravalli hills at Van Vigyan Kendra and Kisan mela.
- Disseminated research findings to farmers through lectures organized at different institutions
- As and when required provided technical services to SFD, Rajasthan , Gujrat, Ministry of Environment and Forest, New Delhi, Farmers and NGO's in the forestry and allied aspect with particular emphasis on combating desertification, rehabilitation of degraded land, silviculture, modern nursery, forest protection and tree improvement.

4.7 Activities of Rajbhasha

राजभाषा वार्षिक प्रतिवेदन वर्ष 2010-11

वर्ष 2010-11 के दौरान फाईलों पर औसतन 88.24 फीसदी टिप्पणियां हिंदी में लिखी गई। कुल 04 हिंदी कार्यशालाएं आयोजित हुई। संस्थान की वेबसाइट को हिंदी में किए जाने हेतु प्रयास हुए। वन विस्तार कार्यकलापों में हिंदी के प्रयोग को बढ़ावा मिला। संस्थान की हिंदी पत्रिका " आफरी दर्पण" को जन उपयोगी तथा स्तरीय स्वरूप प्रदान किया गया तथा शोध गतिविधियों को सरल हिंदी भाषा के द्वारा प्रचारित-प्रसारित किया गया। 14-28 सितम्बर, 2010 को हिंदी पखवाड़ा आयोजित किया गया जिसमें सरकारी कामकाज में हिंदी के प्रयोग को बढ़ावा दिए जाने से संबंधित प्रतियोगिताओं का आयोजन किया गया। हिंदी दिवस (14 सितम्बर) पर निदेशक की ओर से हिंदी में कार्य को बढ़ावा दिए जाने के आशय की 'अपील' भी जारी की गई। हिंदी पखवाड़ा के दौरान वर्ष 2009-2010 के हिंदी कार्यों के लिए कर्मचारियों को राजभाषा पुरस्कार प्रदान किए गए। अंग्रेजी में प्राप्त होने वाले पत्रों का हिंदी में उत्तर दिए जाने हेतु प्रयास हुए। संस्थान के 02 कर्मचारियों ने सी-डैक, नोएडा के मार्फत 5 दिवसीय कंप्यूटर पर हिंदी कार्य का प्रशिक्षण प्राप्त किया। संस्थान की 'सूचना पुस्तिका' हिंदी में प्रकाशित हुई। संस्थान को वर्ष 2009-10 को नराकास, जोधपुर की ओर से नगर राजभाषा चल वैजयंती एवं प्रशस्ति पत्र प्रदान कर सम्मानित किया गया जो कि संस्थान को हिंदी प्रयोग के लिए प्राप्त हुआ। प्रशिक्षण सामग्री तथा प्रचार-प्रसार सामग्री हिंदी में तैयार पर वितरित हुई। विभिन्न हिंदी पत्रिकाओं के लिए उपयोगी एवं स्तरीय वैज्ञानिक लेख/सामग्री प्रकाशन हेतु भेजी गई।

4.8 Awards and Honours

Nil

4.9 Special Activities (Such as Van Mahotsava, Forestry Day and Other occasions)

- Participated in XI Paschimi Rajasthan Hasta-shilp Utsav 2011, Jodhpur organized by DIC and District administration to acquaint students, NGOs, progressive farmers and others with research highlights and technologies of AFRI from Jan 2nd to 11th, 2011.
- International Day for Biological Diversity 22 May, 2010 was celebrated by way of preparation of banner on the theme "Biodiversity, Development and Poverty Alleviation" and various activities such as lectures by scientific dignitaries and plantation of tree saplings. A pamphlet was also released on the occasion and distributed for wide publicity to create awereness among the people.
- World Environment Day 5 June, 2010 was celebrated by way of preparation of banner on the theme "Many Species, One Planet, One Future" and various activities such as lectures and plantation of tree saplings. A pamphlet was also released on the occasion and

distributed for wide publicity to create awereness among the people.

- World Day to Combat Desertification 17 June, 2010 was celebrated by way of preparation of banner on the theme "Enhancing soils anywhere enhances life everywhere" and various activities such as lectures and plantation of tree saplings. A pamphlet was also released on the occasion.

- AFRI celebrated *'Van Mahotsav '* at Kendriya Vidhalya No. 2, Sikargarh Army Area, Jodhpur on 23rd July 2010. Around 150 seedlings of various shade trees were planted by the teachers and student in the KV campus. Director, Principal, HODs and some of students put their views on importance of forest and wild life. On the occasion of *'Van Mahotsav '* a brochure was published on 23rd July, 2010 and distributed among student of Kendriya Vidhalya No. 2, Sikargarh Army Area, Jodhpur.

Distinguished Visitors

- Dr. Phil Harris, Prof. of Plant Scinece, Deptt. of Geography and Enviornment, Conventry University, UK visited AFRI, Jodhpur and delivered a guest lecture on 17th May, 2010.

- Shri Anant Roy, Honourable Forest Minister, West Bangal visited AFRI, Jodhpur on 20th and 21st October, 2010. He learned about developed technologies and activities by AFRI, Jodhpur. He visited labs, interacted and addressed to Forest officials and scientists of AFRI, visited AFRI nursery. Director AFRI, CCFs Jodhpur and wild life informed to MIC, FT WB about various works. He also visited VVK works at Mohangarh and Bikaner with Shri M R Baloch, Head, Agroforestry and Extension Division, AFRI and with local Forest officials of state forest department, Rajasthan.

- Shri K.S.Chouhan, IFS, CCF, Haryana, Panchkula, Shri Jagdish Chander, IFS,CF, Research Circle, Pinjore, Shri Balbir Singh Khokha, HFS, Divisional Forest Officer, Seed Collection Division, Pinjore and Sh. Paramjit Sagwan, Divisional Forest Officer, Research Division, Pinjore visited Institute from Jan 31st to Feb 2nd, 2011. Detailed discussion was held with Director, Head of the Divisions related to forestry and agroforestry work of AFRI in arid regions of Rajasthan.

5. Administration and Information Technology

Introduction

3.5 Information Technology

IT Infrastructure Development

1. **Purchase and installation of six laptop computers.**

Six laptop computers have been procured and provided Head of the Division and senior

scientist of the Institute.

2. **Purchase and installation of Network Access Storage device.**

The network access storage device has been procured and installed. This device will be connected to the computers of all the officers/scientists over LAN. A folder of each computer will be synchronized to the folder on NAS. Whatever saved in the NAS synchronized folder of the computer will be backed on NAS .The user can access his folder on NAS from anywhere in the network. By this facility, the users will have will have backup of their current data always available on NAS and the data can always be accessed from anywhere in the network.

3. **Purchase and installation of two projectors.**

Two multimedia projectors have been procured and installed on the roof of the seminar hall and the conference hall of the Institute. The projectors are Wi-Fi enabled and the presentation can be done directly by any Wi-Fi enabled laptop.

4. **Installation of coreldraw graphic suite X5, Adobe X standard and dreamweaver CS5 Ver 11.0 software.**

CorelDraw Graphic Suite X5, Adobe X standard and Dreamweaver CS5 Ver 11.0 software has been procured and installed.

5. **Purchase of Wi-Fi access points**

Wi-Fi access points have been procured in order to make the seminar hall, conference hall, Director's Office and Video conferencing hall Wi-Fi, so that the network can be accessed by using any Wi-Fi enabled laptop/Desktop computer.

6. **Extension of EPABX facility in the residences, scientist hostel and rewiring of EPABX in the office buildings and guest House.**

The EPABX facility has been extended to the residences of all the officers, scientists and RO's Scientist Hostel by using wireless media and EPABX rewiring has been done in the office buildings and the guest house for communication, to deal scientific and administrative matters promptly.

E-**governance**

7. **Go-Live of the PIMS Module**

The PIMS module of the IFRIS was made operational in November, 2010 and is working

since then in the institute. Three rounds of trainings were imparted to the employees for using the PIMS module. The PIMS module has been implemented successfully and all the employees are now applying their leave through this module dispensing the existing manual system.In addition to this, the employees can view their monthly payslips from through this module.

8. **Uploading of the service books of the employees of AFRI in the EDMS module**

The service books of all the 108 employees of AFRI have been scanned and uploaded in the EDMS module of IFRIS in order to create redundancy for this important document.

9. **Financial Accounting System (FAS),Payroll System (PMS) and Research Information Management System (RIMS)**

The FAS and the PMS module of IFRIS was run successfully during the year 2010-2011.

Redesign of the Institute's Website in Hindi as well as English

The web portal of the institute has been redesigned in Hindi as well as English as a part of the project "Development of Web Portal for forestry research extension" giving it a totally new professional look. The website of the institute has been enriched by incorporating the following information about the institute as per the directions received from ICFRE

1) The list of publications of all the scientists has been added to the web portal.
2) The feature of uploading/editing project information of the concluded and ongoing project has been added to the web portal. The brief information of twenty five ongoing and sixty eight concluded projects has been uploaded in the web portal and the user can view the details of the ongoing as well as the concluded projects executed by the Institute.
3) The technologies developed by the institute (18) have been uploaded on the web portal.
4) The seventeen numbers of articles (17) of the topical information of the arid region have been uploaded on the portal and some more articles are under preparation by the concerned scientists.
5) A dynamic directory feature has been introduced in the website so that the employee details with phone number and email address can easily be edited.
6) A bulletin board for uploading latest happenings and a bulletin board for uploading Appointments and tenders have been introduced.
7) The RTI section has also been incorporated in the website.
8) The Hindi version of web portal has been made and the option of uploading Hindi captions etc. has been provided in every feature of the web portal so that the Hindi site

The website of the institute is being updated regularly and more relevant information is put on the website on regular basis.In addition to these works, regular works of the IT-Cell like maintenance of network and computing equipments, regular updation of the website of AFRI, documentation work and the other IT related works were carried out time to time.

5.2 Sevottam: Activities relating to the Citizens/Clients Charter as detailed below has to be included in the Annual Report 2010-2011.

5.2.1 Action taken to formulate the Charter for the Department and its subordinate formation:

The charter has been prepared based on the seven steps mentioned in Sevottam. As ICFRE has already mandated its mission "To generate, preserve, disseminate advance knowledge, technologies and solutions for addressing issues related to forests and promote linkages arising out of interactions between people, forests and environment on a sustained basis through research, education and extension". Under the auspices, AFRI is enduring its forestry research for conservation of biodiversity and enhancement of bio-productivity in Rajasthan, Gujarat and Dadra & Nagar Haveli with special emphasis on arid and semi-arid regions. Keeping the National Forestry Research Plan (NFRP) in view, the AFRI has identified its thrust areas based on the inputs and active participation of populace represented by different stake holders. Under these thrust areas, Institute is implementing its research endeavors after duly recognizing the users need. Main research focus of the institute includes :-

1. Soil, water and nutrient management: Technologies for afforestation of stress sites,
2. Management of plantations,
3. Planting stock improvement and nursery and plantation techniques,
4. Biofertilizers and biopesticides,
5. Phytochemistry; non-wood forest products,
6. Biodiversity conservation and climate change
7. Agroforestry, JFM & extension &
8. Forestry Education & Training.

5.2.2 Action taken to implement the charter

To fulfill the charter, research projects have been prepared in consultation with the stakeholders in Rajasthan and Gujarat, vetted by outside experts, RAG members and finally by RPC for internal funding and implementation. Projects have also been submitted for various donor agencies for implementing the Charter. Stakeholders meet of AFRI, Jodhpur was organized at Jaipur under Chairmanship of Shri U.M. Sahai, PCCF, Rajasthan on 9th June, 2010. A second stakeholder meet was held at Forest Training Institute, Gandhinagar under Chairmanship of Shri Pradeep Khanna, PCCF, Gujarat on 19th July 2010. RAG Meeting of AFRI was held on 28th-29th October 2010. New project proposals (11) of various divisions were presented by the PIs. RAG Meeting was

chaired by Shri R.N.Tripathi, Addl. PCCF, Gujarat. Projects approved by RAG were presented in RPC meeting held in February, 2010 at ICFRE, Dehradun by the Director, AFRI.

5.2.3 Details of training programmes, workshops etc. held for proper implementation of Charter

- Thrity five kisan and forester from Salawas demo village visited AFRI on 4th March, 2011.
- A team of sixty farmers from KVK Ganganagar visited AFRI Nursery. The farmers were shown interpretation centre, medicinal plants garden, composting units and other facilities of nursery during the month of July, 2010.
- A team of 35 members including farmers and project officials of Jal Bhagirathi Foundation visited interpretation centre and AFRI Nursery on 13th August, 2010 for onsite demonstration of nursery and plantation techniques & management.
- Dr. T.S. Rathore, Director, AFRI delivered talk on "Model nursery practices in the production of quality seedlings" in Refresher Course organized by Botany Department, JNV University on 23rd October, 2010.
- Dr. Ranjana Arya, Head, NWFP Division delivered a lecture on "Afforestation techniques for salt affected soil with different management practices" in three days farmers, forest officers (guards, foresters, RFOs and ACF) training organized by VVK Rajkot, AFRI, Jodhpur at Van Chetna Kendra, Bhuj from 14th-16th December, 2010.
- Training on growing Jatropha in Rajasthan has been conducted to 45 farmers at Soniana village, District – Rajsamand on 18th January, 2011.
- Forty farmers of Jodhpur Division visited institute's model nursery and Interpretation centre on 9th February, 2011 and were demonstrated the developments made in nursery techniques.
- Total 366 students from 14 different colleges/universities are visited AFRI model nursery during April 2010 to March 2011.

5.2.4 Details of publicity efforts made and awareness campaigns organized on Charter for the Citizen/Clients

- Dr. G. Singh, Scientist-E delivered lecture on 'Tibba sthrikaran, Jal sangarahan evam Mashsthan Paristhiki in a three days training programme organized for farmers and regional workers on 13th March, 2010 at VVK, Bikaner.
- Dr. T.S. Rathore, Director, AFRI, Sh. M.R. Baloch, Head Agroforestry & Extension Division and Dr. G. Singh, Head, Ecology Division participated and delivered lectures in "Van Evam Krishi Uthan" organized by Vichar Manch at Abu Road on 5th May 2010.
- Smt. Sangeeta Tripathi, RO delivered a Radio Talk on important medicinal plants of

Rajasthan on Suryanagri Channel of Aakashvani Jodhpur.

- A team of the scientists of AFRI and other National Institutes visited severely affected area of Khejri Mortality in Nagur District on 22th August, 2010.
- Dr. G. Singh, Head, Forest Ecology Division delivered a lecture on carbon budgeting of forest ecosystem on 2nd October, 2010 Botany Department, JNV University, Jodhpur.
- Dr. T.S. Rathore, Director, AFRI delivered talk on "Applications and limitations of biotechnological tools, propagation, conservation and improvement of Forestry plants" on 18th October, 2010 in Botany Department, JNV University, Jodhpur.
- Dr. T.S. Rathore, Director AFRI delivered inaugural talk in seminar on "Current status and opportunities in medicinal plants of Thar Desert" on 9th December, 2010 organized by Mahila PG Mahavidhyalya, Jodhpur.
- Dr. G. Singh, Head, Ecology Division delivered a lecture on "Bio-resources in Dry areas" during farmers training programme organized by Government Bangar PG College Pali, Rajasthan on 26th November, 2010.
- Dr. T. S. Rathore, Director, AFRI delivered invited talk of biotechnology in 21st Centuary on 1st December, 2010 in JNV University, Jodhpur for the trainees of the orientation course for the University teachers.
- Dr. G. Singh, Head, Ecology Division delivered a lecture on "Impact of land degradation in common property Resources and Mitigating land Degradation" during farmers training programme organized by Jal Bhagirathi Foundation, Jodhpur on 2nd December, 2010.
- Dr. T. S. Rathore, Director, AFRI delivered invited talk on Organic farming and participated in discussion of Kisan Swaraj Yatra (Nation wide programme) at Jodhpur on 8th December, 2010.

5.2.5 Details of internal and external evaluation of implementation of Charter in the Organization and assessment of the level of satisfaction among Citizens/Clients

One research project of AFRI has been evaluated by external experts. AFRI has evaluated three Forestry projects/ plantations under Harayali Scheme of Rajasthan Forest Department, Urban Plantation of Jodhpur Development Authority and Jojoba Plantation at Patan & Shri Ganganagar.

5.3 Welfare measures for the SC / ST / backward / minority communities

A SC/ST/backward/minority communities welfare committee has been constituted at the Institute. Shri P.H.Chawhaan, Scientist-E has been designated as the Chief Liason Officer of the committee with four other members. The committee looks after the welfare aspect and the grievances of the employees of the SC/ST/backward/minority communities, if any. It is

pertinent to mention that no such grievance was reported in the year 2010-2011 from the employees of AFRI, Jodhpur.

6. Annexures

1. RTI

Names and addresses of public information officers and appellate authorities under the right to information act 2005 in ICFRE and its institutes

Headquarters / Institutes	Appellate Authorities	Public Information Officers	Subject matter(s) allocated
Arid Forest Research Institute	Dr. T.S. Rathore Director, AFRI 0291-2722764 Email: dir_afri@icfre.org Phone : 0291-2742549 FAX : 0291-2722764	Shri M.R.Baloch, IFS, Head Agroforestry & Extension and Silviculture Division,AFRI Email: **mrbaloch@icfre.org** Phone : 0291-2727271 0291-2729198 FAX : 0291-2722764	All matters related to AFRI, Jodhpur

Details enclosed in Annexure III

2. Email and Postal addresses

Arid Forest Research Institute,
P.O. Krishi Upaz Mandi,
New Pali Road, Jodhpur, 342005
Email : dir_afri@icfre.org
Phone : 0291-2742549
FAX : 0291-2722764

Name of Officials	Designation	Phone	Email Address
Sh. T.S. Rathore, IFS	Director	2722549, 2729101	dir_afri@icfre.org
Sh. Ashok Kumar, IFS	Group Coordinator (Research)	2721594 2729104	groupco_afri@icfre.org
Sh. M.R. Baloch, IFS	Head, Agro Forestry & Extension Division and Silviculture Division	2729198	mrbaloch@icfre.org
Dr. S .I. Ahmed	Scientist -F & Head, Forest Protection Division	2729119	siahmed@icfre.org
Dr. I.D. Arya	Scientist -F & Head, Forest Genetics & Tree Breeding Division	2729138	aryaid@icfre.org
Dr. G. Singh	Scientist - F & Head, Forest Ecology Division	2729143	gsingh@icfre.org
Dr. (Km.) Ranjana Arya	Scientist -F & Head Non Wood Forest Product Division	2729171	**rarya@icfre.org**
Sh. A. K. Sinha	Scientist "D" & Incharge IT Cell	2729115, 2729113, 2722548	aksinha@icfre.org
Dr. K.K.Srivastava	Controller	2725322, 2729126	controller_afri@icfre.org kksrivastava@icfre.org
Sh. K.C. Gupta	Hindi Officer	2729122	guptakc@icfre.org
Sh. C. P. Rahangdale	Est.& Acct. Officer	2729118	ddo_afri@icfre.org

3. Intellectual Property

3.1 Patents Granted

Nil

3.2 Others

Nil

Annexure I

List of Abbreviations

ABA	Abscisic Acid
ADG	Assistant Director General
AFED	Agroforestry and Extension Division
AFRI	Arid Forest Research Institute
AMF	Arbuscular Mycorrhyzal Fungi
ANOVA	Analysis of Variance
ATMA	Agricultural Technology Management Authority
BAP	Benzlaminopurine
BOD	Biochemical Oxygen Demand
BT	Box trench
C & I	Criteria and Indicator
CAZRI	Central Arid Zone Research Institute
CBL	Clear Bole Length
CCF	Chief Conservator of Forests
CF	Conservator of Forests
CO(F)	Coordinator (Facilities)
CPTs	Candidate Plus Trees
CRIDA	Central Research Institute for Dryland Agriculture
CSIR	Council of Scientific and Industrial Research
CSMCRI	Central Salt & Marine Chemical Research Institute
CSOs	Clonal Seed Orchards
CT	Contour Trench
DBH	Diameter at Breast Height
DBT	Department of Biotechnology
DCF	Deputy Conservator of Forests
DEMO	Demostration
DNH	Dadra & Nagar Haveli
DV	Demo Village
EC	Electrical Conductivity
ENVIS	Environmental Information System
FAS	Financial Accounting System
FED	Forest Ecology Division
FGTB	Forest Genetics and Tree Breeding
FPD	Forest Protection Division
FRI	Forest Research Institute
FYM	Farmyard Manure
G	Gradonie

GBH	Girth at Breast Height
GCA	General Combining Ability
GCV	Genotypic Coefficient of Variation
GEER	Gujarat Ecological Education & Research
GFD	Gujarat Forest Department
GFRC	Gujarat Forest Rangers College
GIS	Geographic Information System
GSFD	Gujarat State Forest Department
GSFDC	Gujarat State Forest Development Corporation
HSCST	Haryana State Council for Science and Technology
ICFRE	Indian Council of Forestry Research & Education
ICT	Information and Communication Technology
IFRIS	Indian Forestry Research Information System
IGNP	Indira Gandhi Nahar Pariyojana
IIRS	Indian Institute of Remote Sensing
IT	Information Technology
IWST	Institute of Wood Science & Technology
JFM	Joint Forest Management
MD	Managing Director
Mg	Mega Gram(10^6g)
MKU	Madurai Kamaraj University
MLA	Member of Legislative Assembly
MMS	Modified Murashige and Skoog
MOU	Memorandum of Understanding
MOWR	Ministry of Water Resources
MS	Murashige and Skoog
NABARD	Nationalene Bank for Agriculture and Rural Development
NBPGR	National Bureau of Plant Genetic Research
NBRI	National Botanical Research Institute
NFLIC	**National Forest Library and Information Centre**
NGO	Non Governmental Organization
NMPB	National Medicinal Plant Board
NPK	Nitrigen-Phosphorus-Potassium
NTFP	Non Timber Forest Product
NWFP	Non Wood Forest Product
OBC	Other Backward Class
PCCF	Principal Chief Conservator of Forests
PCV	Phenotypic Coefficient of Variation
PDA	Potato Dextrose Agar
PDKV	Dr Panjabrao Deshmukh Krishi Vidyapeeth

PIMS	Personnel Information Management System
PMS	Payroll Management System
R/S	Root/Shoot
RBD	Randomized Block Design
RFD	Rajasthan Forest Department
RIMS	Research Management Information System
RSFD	Rajasthan State Forest Department
RTI	Right To Information
SAUs	State Agriculture Universities
SC	Schedule Caste
SE	Somatic Embryo
SFD	State Forest Department
SIC	Soil Inorganic Carbon
SOC	Soil Organic Carbon
SOM	Soil Organic Matter
SPAs	Seed Production Areas
SSOs	Seedling Seed Orchards
ST	Scheduled Tribe
SWC	Soil water Content
TANU University	Tamilnadu Agriculture University
TDZ	Thidiazuron
TERI	The Energy & Resources Institute
TOF	Tree Outside Forest
TREE	Training Research Extension & Education
USDA	United States Department of Agriculture
UT	Union Territory
UV	Ultra Violet
VAM	Vesicular Arbuscular Mycorrhiza
VD	V-ditch
VVK	Van Vigyan Kendra
WAS	Wild Ass Sanctuary
ZSI	Zoological Survey of India

Annexure II

PROJECTS OF AFRI, JODHPUR AT A GLANCE (20010-2011)

	Project title	Status of the project	Raj.	Guj.
Theme : 2.1 Ecosystem Conservation and Management				
Sub Theme : 2.1.2 & 3 Climate Change/Ecology and Environment				
EXTERNALLY AIDED				
	Project 1. Vegetation carbon pool assessment in some districts in Northern Rajasthan (Funded by IIRS, Dehradun) (AFRI-97/FED/IIRS, D.dun/ 2009-11).	**Concluded** (1)		
PLAN PROJECT				
	Project 2. Studies on carbon sequestration in different forest types of Rajasthan (AFRI-98/FED/ 2008-2012).	**Continued**		
Sub Theme: 2.1.4 Biodiversity				
PLAN PROJECT				
	Project 3. Impact of *Prosopis juliflora* on biodiversity, rehabilitation of degraded community lands and as a source of livelihood for people in Rajasthan state. (AFRI-104/AFED/2010- 2015).	**New**		
EXTERNALLY AIDED				
	Project 4. Assessment of guggul germplasm for studying population density, diversity, female-male plant's ratio for *in situ* and *ex situ* conservation in Rajasthan (AFRI-106/FGTB/SFD-RAJ/2010-13, funded by SFD, Rajasthan).	**New** (2)		
Theme : 2.2 Forest Productivity				
Sub Theme : 2.2.2 Silviculture				
EXTERNALLY AIDED				
PLAN PROJECT				
	Project 5.Studies on seed traits of seeds collected from seed stands/SPAs/ SSOs/CSOs of important species of Gujarat state(AFRI-80/Silvi/2007-12).	**Continued**		
Sub Theme : 2.2.3 Social Forestry, Agro-forestry/ Farm Forestry				
PLAN PROJECT				
	Project 6. Development of economically viable and integrated Agroforestry models for arid region (AFRI-55/Silvi/2006-12).	**Continued**		
Sub Theme 2.2.4 Forest Soils & Land Reclamation				
PLAN PROJECT				

	Project 7. Characterization and classification of forest soils of Rajasthan (AFRI-85/FED/2007-2012).	Continued		
	Project 8. Identification of soil-vegetation relations and indicator species for assessment and rehabilitation in lower Aravalli. (AFRI-101/FED/2010- 2014).	New		
EXTERNALLY AIDED				
	Project 9. Enhancing productivity of saline wastelands in Kachchh- through improved tree planting techniques and silvipastoral study (Gujarat SFD sponsored project-77/NWFP/SFD/AFRI-2006-12).	Continued (3)		
Sub Theme : 2.2.5 Watershed Management				
PLAN PROJECT				
	Project 10. Efficacy and economics of water harvesting devices in controlling run-off losses and enhancing biomass productivity in Aravalli ranges (Funded by the State Forest Department, Rajasthan and ICFRE) (AFRI-39/EED/ 2005-11).	Concluded		
Theme : 2.3 Genetic Improvement				
Sub Theme 2.3.3 Tree Improvement				
PLAN PROJECT				
	Project 11. Investigations on genetic variation and inheritance of western Indian teak (Tectona grandis L.f) (AFRI-94 /Silvi/2009-2014).	Continued		
	Project 12. Screening of high oil and *azadirachtin* in neem (AFRI-45/FGTB-8/2002-2013).	Continued		
	Project 13. Multilocational trial of *Eucalyptus camaldulensis* and *Dalbergia sissoo* clones in Gujarat state (AFRI-41/FGTB/2002-12).	Continued		
	Project 14. Genetic improvement of *Tecomella undulata* (AFRI-44/FGTB/7/2002-2012).	Continued		
Sub Theme : 2.3.4 Vegetative Propagation				
PLAN PROJECTS				
	Project 15. Demonstration trial of male and female *Ailanthus 102excelsa* plants raised through grafting (AFRI-79/FGTB/2007-2014).	Continued		
Sub Theme 2.3.5 Biotechnology				
PLAN PROJECT				
	Project 16. In vitro mass propagation of *Jatropha curcas* L. and optimization of low cost options for economizing the technology (AFRI- 83/FGTB/2007-2012).	Continued		
	Project 17. Development of tissue culture technology for multiplication of economically important desert plant – *Salvadora persica* (AFRI-	Continued		

	92/FGTB/2009-2014).			
	Project 18. Study of salt tolerance through gene expression pattern analysis. (AFRI-102/FGTB/2010- 2015).	New		
	Project 19. Development of technologies for multiplication of economically important desert plant - *Capparis deciduas*. (AFRI-105/FGTB/2010- 2015).	New		
Theme 2.4 Forest management				
Sub Theme 2.4.4 Forest Biometrics				
EXTERNALLY AIDED				
	Project 20 . Productivity and biometrics studies on some important species in semi-arid regions of Rajasthan for their sustainable management (AFRI-95/Silvi/SFD/2009-12).	**Continued** (4)		
	Project 21. Productivity study and modelling growth and yield in Teak Plantation in Gujarat state.(AFRI-96/Silvi/SFD/2009-14).	**Continued** (5)		
PLAN PROJECT				
	Project 22. Market survey on selected species in selected markets (AFRI-58/Silvi/1994 continued).	**Continued**		
Information and communication technology (ICT)				
	Project 23. Development of the web portal for forestry research extension.(AFRI-82/IT Cell/2007-13).	**Continued**		
Theme : 2.6 Non-wood and Forest Products (NWFPs)				
Sub Theme : 2.6.2 Resource Development of NWFPs				
PLAN PROJECT				
	Project 24. Effect of fertilizer application on growth and yield of 10 years old *Salvadora persica* and *Acacia ampliceps* plantations under silvipastoral system on arid salt affected soil (AFRI-11/NWFPD/2008-12).	**Continued**		
Sub Theme : 2.6.3 Sustainable harvesting and management				
EXTERNALLY AIDED				
	Project 25. Network research project on guggal *Commiphora wightii* Arn. Bhandari (AFRI-76/Silvi/NMPB/2008-13).	**Continued** (6)		
Sub Theme 2.6.5 Biofuels and Bioenergy				
PLAN PROJECT				
	Project 26. Survey selection performance trial and estimation of yield potential of *Jatropha curcas* in Rajasthan and Gujarat (AFRI-88/Silvi/2007-12).	**Continued**		
EXTERNALLY AIDED				

	Project 27. Establishment of multilocational clonal trial and seedling seed orchard of *Jatropha curcas* (AFRI-81/Silvi/DBT/2007-12).	**Continued**		
	Project 28. Genetic improvement of *Jatropha curcas* for adaptability and oil yield (AFRI-66/Silvi/CSIR/2005-12).	**Continued**		
	Project 29: Develop a database for tree borne oilseeds in India (Funded by NOVOD Board through ICFRE).	**Concluded**		
Theme 2.7 Forest Protection				
Sub Theme 2.7.2 Insects pests, diseases and control				
PLAN PROJECT				
	Project 30. Evaluation of antifungal potential and identification of broad spectrum antifungal compound from selected tree/shrubs/weeds of Indian arid region (93 AFRI/AFED/2009-14).	**Continued**		
	Project 31. A coordinated project on Integrated management of khejri mortality for socio-economic upliftment in Rajasthan. (AFRI-99 /FPD/2010- 2015).	**New**		
	Project 32. Induction of systemic acquired resistance in Rohida (*Tecomella undulata* (Sm.) Seem.) against stem canker. (AFRI-100 /FPD/2010- 2013).	**New**		
EXTERANALLY AIDED				
	Project 33. New biocontrol opportunities for prickly acacia: exploration in India (AFRI/FPD/2007-2011).	**Continued**		
Sub Theme : 2.7.3 Mycorrhizae, rhizobia and other useful microbes				
PLAN PROJECT				
	Project 34. Evaluation and selection of efficient strains of AM fungi & *Rhizobium* for *Acacia nilotica* and *Ailanthus excelsa* in western Rajasthan. (AFRI-103 /FPD/2010- 2013).	**New**		

Annexure III

RTI Annual Return Information System

Quarterly Return Form

Public Authority : Ministry of Environment & Forests

Quarter:1st

Year: 2010-2011

Quarter – April to June, 2011

Mode: Insert

Status : New Return

		Progress during the month				
	Opening Balance as on beginning of Ist Quarter	No. Of applications received as transfer from other PAs u/s 6(3)	Received during the Quarter (including cases transferred to other PAs)	No. Of cases transferred to other PAs u/s 6(3)	Decision where requests/ appeals rejected	Decision where requests/appeals accepted
Requests	01	Nil	06	04	01	05
First Appeals	Nil	Nil	Nil	N.A.	N.A.	N.A.

Total no. of CAPIOs designated	Total no. of CPIOs designated	Total no. of AA's designated
Nil	01	01

Block II (Details about fees collected, penalty imposed and disciplinary action taken)

Registration Fee Collected (in Rs.) u/s 7(1)	Additional fee collected (in Rs.) u/s 7(3)	Penalities Amount Recovered (in Rs.) as directed by CIC u/s 20(1)	No. Of cases where disciplinary action taken against any officer u/s 20(2)
Rs.60/-	Rs.530/-	Nil	Nil

Block III (Details of various provisions of section 8 while rejecting the requested information) - NA

No. of times various provisions were invoked while rejecting requests

Relevant Section of RTI Act 2005

Section 8(1)										Sections			
a	b	c	d	e	f	g	h	i	j	9	11	24	other

Block IV (Details regarding compliance of direction/recommendation of the Commission) - NA

S.No.	Reference No. Of cases wherein Commission made specific recommendation as per section 25(5) (max. 20 chars.)	Whether action is initiated to comply with recommendation of Commission.	Details, thereof (max. 250 chars.)
1-		-Select-	
2-		-Select-	
3-		-Select-	
4-		-Select-	

If the Public Authority made any changes in regard to its rules/regulations/procedures as a result of requested information by the citizens, please provide the summarized details of the changes (max. 500 chars.)

Block V (Details regarding compliance of direction/recommendation of the Commission) - NA

Last Date of Uploading the Pro-active Disclosures on the webside of PA	Name of the person who is entering/updating data	Designation of the person who is entering/updating data
General Information uploaded	Smt. Kusum Parihar	Research Assistant – II C/o Incharge, IT-Cell of the Institute.

RTI Annual Return Information System

Quarterly Return Form

Public Authority : Ministry of Environment & Forests

Quarter:1st

Year: 2010-2011

Quarter – July to Sept., 2011

Mode: Insert

Status : New Return

		Progress during the month				
	Opening Balance as on beginning of Ist Quarter	No. Of applications received as transfer from other PAs u/s 6(3)	Received during the Quarter (including cases transferred to other PAs)	No. Of cases transferred to other PAs u/s 6(3)	Decision where requests/ appeals rejected	Decision where requests/appeals accepted
Requests	Nil	Nil	09	04	Nil	Nil
First Appeals	Nil	Nil	01	Nil	Nil	01

Total no. of CAPIOs designated	Total no. of CPIOs designated	Total no. of AA's designated
01	01	01

Block II (Details about fees collected, penalty imposed and disciplinary action taken)

Registration Fee Collected (in Rs.) u/s 7(1)	Additional fee collected (in Rs.) u/s 7(3)	Penalities Amount Recovered (in Rs.) as directed by CIC u/s 20(1)	No. Of cases where disciplinary action taken against any officer u/s 20(2)
Rs.90/-	Rs.100/-	Nil	Nil

Block III (Details of various provisions of section 8 while rejecting the requested information) - NA

No. of times various provisions were invoked while rejecting requests													
Relevant Section of RTI Act 2005													
Section 8(1)										Sections			
a	b	c	d	e	f	g	h	i	j	9	11	24	other

Block IV (Details regarding compliance of direction/recommendation of the Commission) - NA

S.No.	Reference No. Of cases wherein Commission made specific recommendation as per section 25(5) (max. 20 chars.)	Whether action is initiated to comply with recommendation of Commission.	Details, thereof (max. 250 chars.)
1-		-Select-	
2-		-Select-	
3-		-Select-	
4-		-Select-	

If the Public Authority made any changes in regard to its rules/regulations/procedures as a result of requested information by the citizens, please provide the summarized details of the changes (max. 500 chars.)

Block V (Details regarding compliance of direction/recommendation of the Commission) - NA

Last Date of Uploading the Pro-active Disclosures on the webside of PA	Name of the person who is entering/updating data	Designation of the person who is entering/updating data
General Information uploaded	Smt. Kusum Parihar	Research Assistant – II C/o Incharge, IT-Cell of the Institute

RTI Annual Return Information System

Quarterly Return Form

Public Authority : Ministry of Environment & Forests

Quarter:1st

Year: 2010-2011

Quarter – October to Dec., 2011

Mode: Insert

Status : New Return

		Progress during the month				
	Opening Balance as on beginning of Ist Quarter	No. Of applications received as transfer from other PAs u/s 6(3)	Received during the Quarter (including cases transferred to other PAs)	No. Of cases transferred to other PAs u/s 6(3)	Decision where requests/ appeals rejected	Decision where requests/appeals accepted
Requests	05	Nil	04	01	Nil	04
First Appeals	01	Nil	Nil	Nil	Nil	01

Total no. of CAPIOs designated	Total no. of CPIOs designated	Total no. of AA's designated
01	01	01

Block II (Details about fees collected, penalty imposed and disciplinary action taken)			
Registration Fee Collected (in Rs.) u/s 7(1)	Additional fee collected (in Rs.) u/s 7(3)	Penalities Amount Recovered (in Rs.) as directed by CIC u/s 20(1)	No. Of cases where disciplinary action taken against any officer u/s 20(2)
Rs.40/-	Rs.158/-	Nil	Nil

Block III (Details of various provisions of section 8 while rejecting the requested information) - NA													
No. of times various provisions were invoked while rejecting requests													
Relevant Section of RTI Act 2005													
Section 8(1)										Sections			
a	b	c	d	e	f	g	h	i	j	9	11	24	other

Block IV (Details regarding compliance of direction/recommendation of the Commission) – NA			
S.No.	Reference No. Of cases wherein Commission made specific recommendation as per section 25(5) (max. 20 chars.)	Whether action is initiated to comply with recommendation of Commission.	Details, thereof (max. 250 chars.)
1.		-Select-	
2.		-Select-	
3.		-Select-	
4.		-Select-	
If the Public Authority made any changes in regard to its rules/regulations/procedures as a result of requested information by the citizens, please provide the summarized details of the changes (max. 500 chars.)			

Block V (Details regarding compliance of direction/recommendation of the Commission) - NA		
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General Information uploaded	Smt. Kusum Parihar	Research Assistant – II C/o Incharge, IT-Cell of the Institute

RTI Annual Return Information System

Quarterly Return Form

Public Authority : Ministry of Environment & Forests

Quarter:1st

Year: 2010-2011

Quarter – January 2011 to March 2011

Mode: Insert

Status : New Return

		Progress during the month				
	Opening Balance as on beginning of Ist Quarter	No. Of applications received as transfer from other PAs u/s 6(3)	Received during the Quarter (including cases transferred to other PAs)	No. Of cases transferred to other PAs u/s 6(3)	Decision where requests/ appeals rejected	Decision where requests/appeals accepted
Requests	05	Nil	06	02	Nil	06
First Appeals	Nil	Nil	Nil	Nil	N.A.	N. A.

Total no. of CAPIOs designated	Total no. of CPIOs designated	Total no. of AA's designated
01	01	01

Block II (Details about fees collected, penalty imposed and disciplinary action taken)			
Registration Fee Collected (in Rs.) u/s 7(1)	Additional fee collected (in Rs.) u/s 7(3)	Penalities Amount Recovered (in Rs.) as directed by CIC u/s 20(1)	No. Of cases where disciplinary action taken against any officer u/s 20(2)
Rs.60/-	Rs.230/-	Nil	Nil

Block III (Details of various provisions of section 8 while rejecting the requested information) - NA													
No. of times various provisions were invoked while rejecting requests													
Relevant Section of RTI Act 2005													
Section 8(1)										Sections			
a	b	c	d	e	f	g	h	i	j	9	11	24	other

Block IV (Details regarding compliance of direction/recommendation of the Commission) – NA			
S.No.	Reference No. Of cases wherein Commission made specific recommendation as per section 25(5) (max. 20 chars.)	Whether action is initiated to comply with recommendation of Commission.	Details, thereof (max. 250 chars.)
1-		-Select-	
2-		-Select-	
3-		-Select-	
4-		-Select-	
If the Public Authority made any changes in regard to its rules/regulations/procedures as a result of requested information by the citizens, please provide the summarized details of the changes (max. 500 chars.)			

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General Information uploaded	Smt. Kusum Parihar	Research Assistant – II C/o Incharge, IT-Cell of the Institute