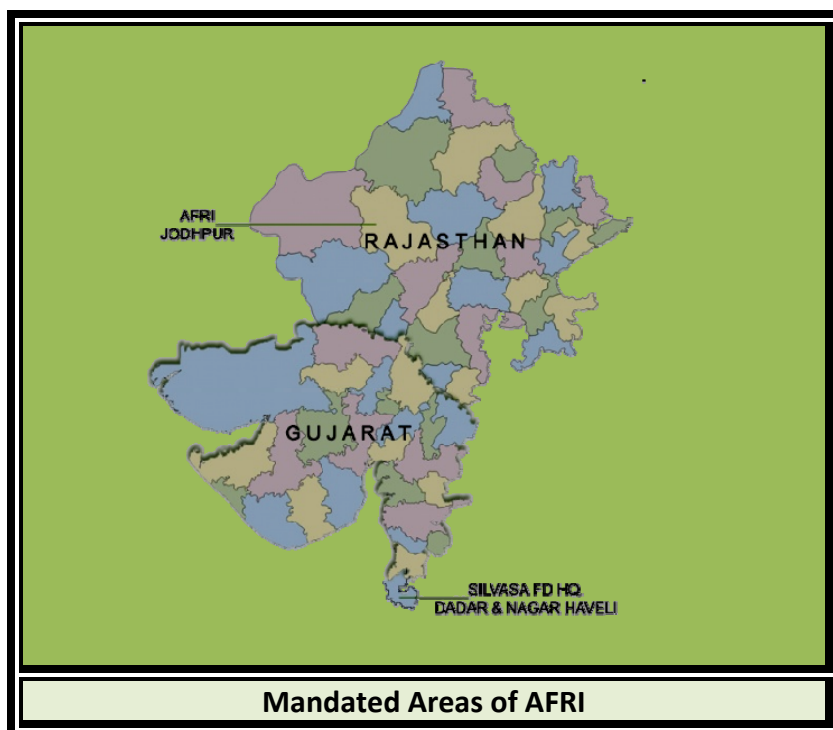


## Initiatives and Achievements of AFRI, Jodhpur in Arid and Semi Arid Areas of Rajasthan, Gujarat and Dadar & Nagar Haveli

### Background

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 Haveli.

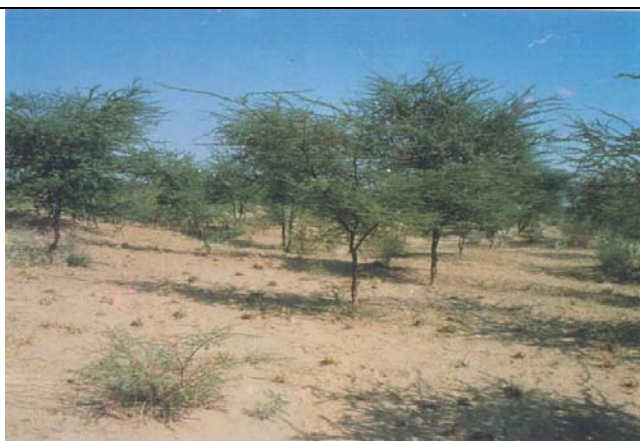
The main thrust areas of the institute are soil, water & nutrient management, technologies for afforestation of stress sites, management of plantations, growth and yield modeling, planting stock improvement, bio-fertilizers and bio-pesticides, Agroforestry, JFM & extension, phytochemistry & non-timber forest products, integrated pest & disease management and forestry education and extension. During 2009-10, twenty nine 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 IIRS, Dehradun.



The initiatives taken by the Institute in the mandated areas are as follows:

#### 1. Sand dune stabilization and sand drift control

Surface vegetation technologies for effective control of sand drift and sand dune stabilization has been developed using *Cassia angustifolia* as the surface vegetation together with tree or shrub species like *Acacia tortilis*, *Prosopis juliflora* and *Calligonum polygonoides*.



Sand dune stabilization through *Acacia tortilis* and *Cenchrus ciliaris*



A combination of *Calligonum polygoides* and *Cassia augustifolia* on sand dune

## 2. Land Productivity and carbon sequestration in Forests of Rajasthan

- A detailed study is going on to characterize and classify forest soils of Rajasthan, an untouched area so far for managing these forests.
- An extensive study is being made on above ground and below ground productivity and carbon sequestration in different forests types of Rajasthan for estimation of species to ecosystem level carbon stock.
- Water budgeting in tree species for their utilization in reclamation of water logged and /or saline area.
- A programme on Identification of indicator species based on parent material-soil-vegetation relations. Has been taken for managing land resources.



Soil survey work in Sri Ganganagar  
(desert dune scrub)



Mixed dry deciduous forest at Ratapani,  
Dungarpur  
( One of the 24 forest types of Rajasthan  
where the study of vegetation and carbon  
sequestration conducted )

### 3. Urban afforestation using waste water

Growing tree by using wastewater like municipal, textile and the acidic effluent released from iron-rolling mills was demonstrated to utilize these valuable resources, which are likely to increase in future, and provide environmental and esthetic benefits in sub-urban areas.



**Model Plantation on the roadside at urban area of Jodhpur, Rajasthan using sewerage water**

### 4. Resource conservation and biodiversity

Conservation of soil and water helps in improving floral diversity - number of species, which subsequently helps in controlling run-off losses and effective utilization of the soil resources like water and nutrients. The study conducted on resource conservation and biodiversity demonstrated that conserving biodiversity is an insurance of multifaceted benefits along with improvement in land productivity in future.

### 5. Biodrainage potential of some selected tree species

Studies on characteristic features pertaining to biodrainage potential of some selected tree species have been conducted. Performance of *Corymbia tessellaris*, *Eucalyptus camaldulensis*, *Eucalyptus fastigata* and *Eucalyptus rudis* in a canal side (Indira Gandhi Nahar Pariyojana) waterlogged area and their impact on ground water depletion and soil nutrients was studied. *E. rudis* performed the best among the tree species with respect to growth, biomass, transpiration rate and overall bio-drainage potential. Ground water level receded by 145 cm (from stagnant water of 20 cm to a depth of 125 cm) in *E. rudis* plot and by 90 cm, 70 cm and 60 cm in *C. tessellaris*, *E. camaldulensis* and *E. fastigata* plots, respectively.





*Raised mound plantation in Waterlogged Area*

#### 6. **Managing khejri mortality for socio-economic upliftment**

In view of the Khejri mortality problem encountered in western Rajasthan a comprehensive project on *"Integrated management of Khejri (P. cineraria) mortality for socio-economic upliftment in Rajasthan"* has been taken up in order to identify biotic and abiotic factors affecting the large-scale Khejri mortality and devising control measures to save the tree in favour of local people, who have association with the tree since time immortal for multiple benefits provided by the this species. An integrated approach starting from genetic improvement to the control of insects and pests has been taken up in the project.



**Dead Khejri trees in Rajasthan**

## 7. Biological control of *Acacia Nilotica Indica*

A project in collaboration with Australia has been taken up to find out suitable enemies/biological control agents, of *Acacia nilotica* that can lead to the destruction of the tree, since the tree is weed of national significance in Australia and the origin of the tree is India. The dense thorny forest has occupied millions of hectares of land that could be otherwise used for Agricultural purpose.



**Rust (*Ravenalia* sp.) on *Acacia nilotica***

## 8. Systemic acquired resistance in rohida (*Tecomella undulata*) against stem canker

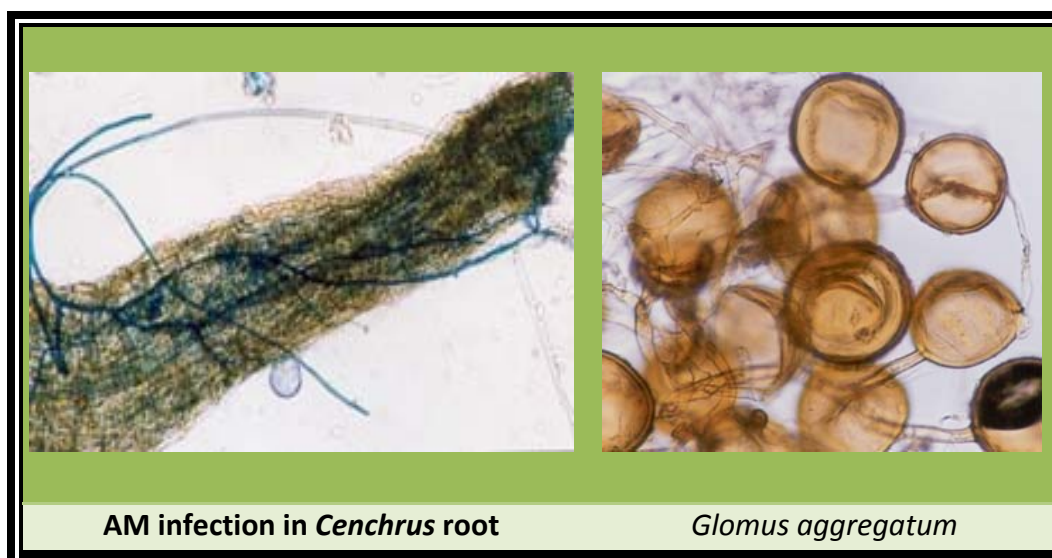
Rohida is a source of timber and stem canker poses a threat in production of quality timber. Systemic acquired resistance is an important component of the disease-resistance response of plants, and is associated with an enhanced capability for activating defense responses upon pathogen attack or chemical treatment. This technique will be used in rohida for production of quality timber and reduction of economic loss.



**Stem canker in rohida**

**9. Selection of efficient strains of AM fungi & *Rhizobium* for *Acacia nilotica* and *Ailanthus excelsa* in western Rajasthan**

Selection of efficient strains of AM fungi & *Rhizobium* for *Acacia nilotica* and *Ailanthus excelsa* in western Rajasthan would help to establish *A. nilotica* and *A. excelsa* plants under arid and semiarid areas of Rajasthan. The mycorrhizal inoculated saplings may hold the key for successful plantation survival and would be of great importance for production of planting material, to conserve the species and to offset the pressure on the natural population.



**10. Improvement in biofuel plant- *Jatropha curcas* for future energy**

Clonal accessions of *Jatropha curcas* collected from 185 sources from the country has been raised and evaluated through clonal and seedling seed orchards to enhance the productivity/seed yield/ oil yield of the species in arid and semi arid regions

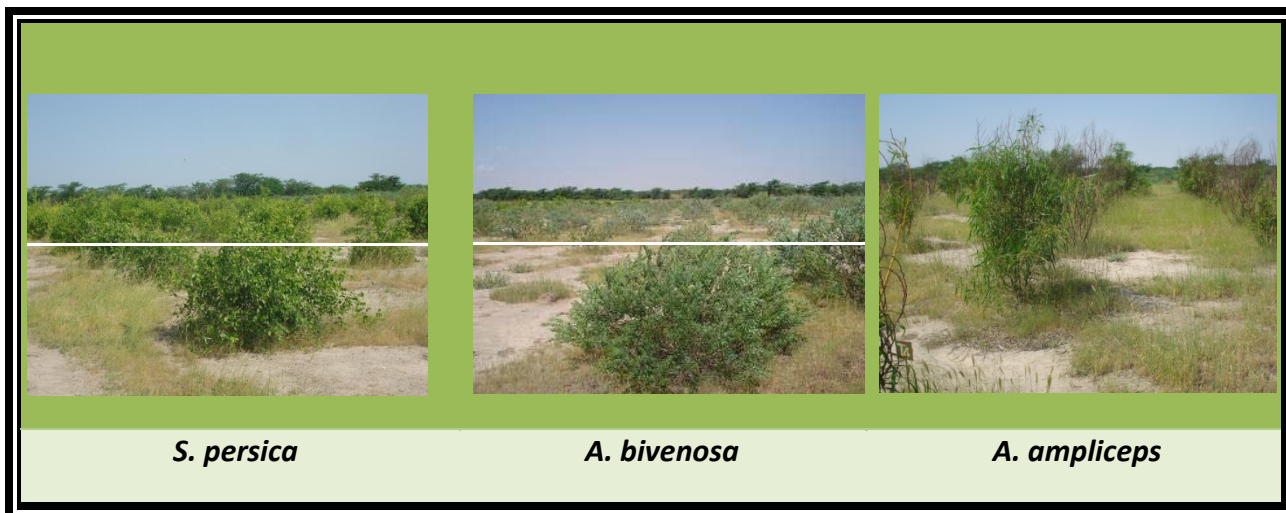


Field Plantation of the clonal accessions of  
*Jatropha curcas*



### 11. Afforestation techniques for highly saline soil in the little rann of Kachchh

A research trial has been taken up with *Acacia ampliceps*, *Acacia bivenosa* and *Salvadora persica* species at Kordha, Sami Range in Gujarat in the fringe of Wild Ass Sanctuary with appropriate planting practice. During the study it was found that *S. persica* proved to be most hardy plant surviving the extremely harsh conditions of high salinity, heat stress and drought conditions. *A. bivenosa* was at second place with 84.1% survival in 24 months.



### 12. Guggul Germplasm Assessment

In view of the apomixis, polyembryony and autonomous endosperm development in Guggul plant (*Commiphora wightii*) and high variability in seed germination (some cases it is below 10% and some cases it is above 60%), the study of genetic diversity of different locations and its relationship with population density and male female sex ratio is being taken up to find out causes on tremendous difference in seed germination behavior of this species. So that desired information can be used in conservation aspects and developing future seed production areas.

### 13. Growing Bamboo raised through tissue culture

Demonstration trials of *Bambusa bambos* and *Dendrocalamus strictus* plant raised through tissue culture were established in degraded soils of Rajasthan and Gujarat in 2006 with view to take up it at large scale in the benefits of tribal people living in the area as well as conserving soil and water resources in these degraded lands. These trials are encouraging with highest rate of survival and growth and demonstrate that it can be replication in similar areas.



**Demonstration of Tissue Culture Plants of *Dendrocalamus strictus* at District Dahod, Gujarat**

#### 14. Protocols for in-vitro multiplication and hardening of *Commiphora wightii* (Guggul) and *Balanites aegyptiaca* (Hingota)

A protocol for *in vitro* multiplication of *Commiphora wightii* (Guggul), an endangered medicinal plant of the arid region through somatic embryogenesis has been developed. Like wise a way to predict the correct stage of hardening for transplanting tissue culture raised *Balanites aegyptiaca* (Hingota) plants has been developed using stomatal frequency, size of stomata and chlorophyll content as a set of marker traits.

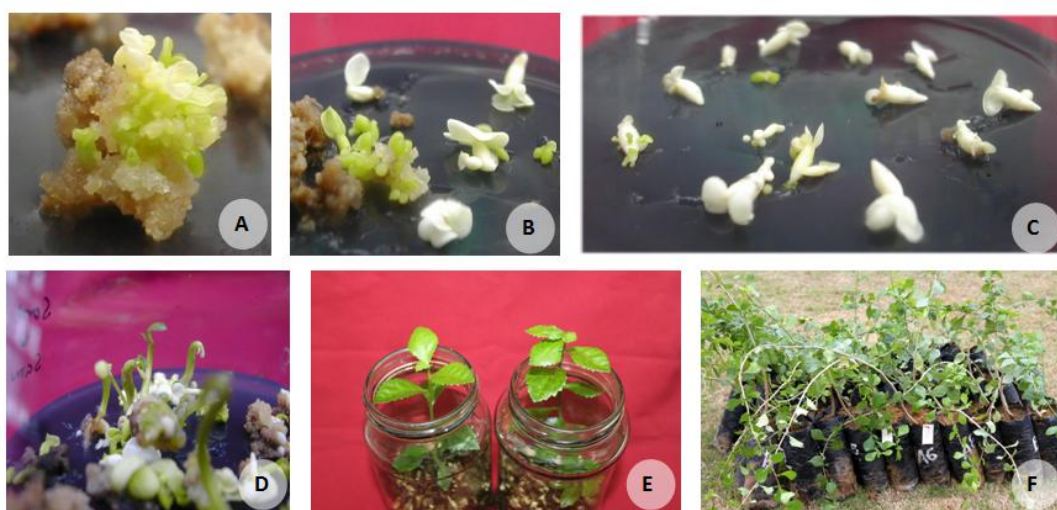


Fig. (A-F) *In vitro* plant regeneration in *Commiphora wightii* (guggul) via somatic embryogenesis. A. embryogenic callus, B. multiplication of somatic embryos (SE), C. maturation of SEs, D. Germination of SEs, E. SE-derived plantlets undergoing hardening, F. hardened guggul plants ready for field plantation



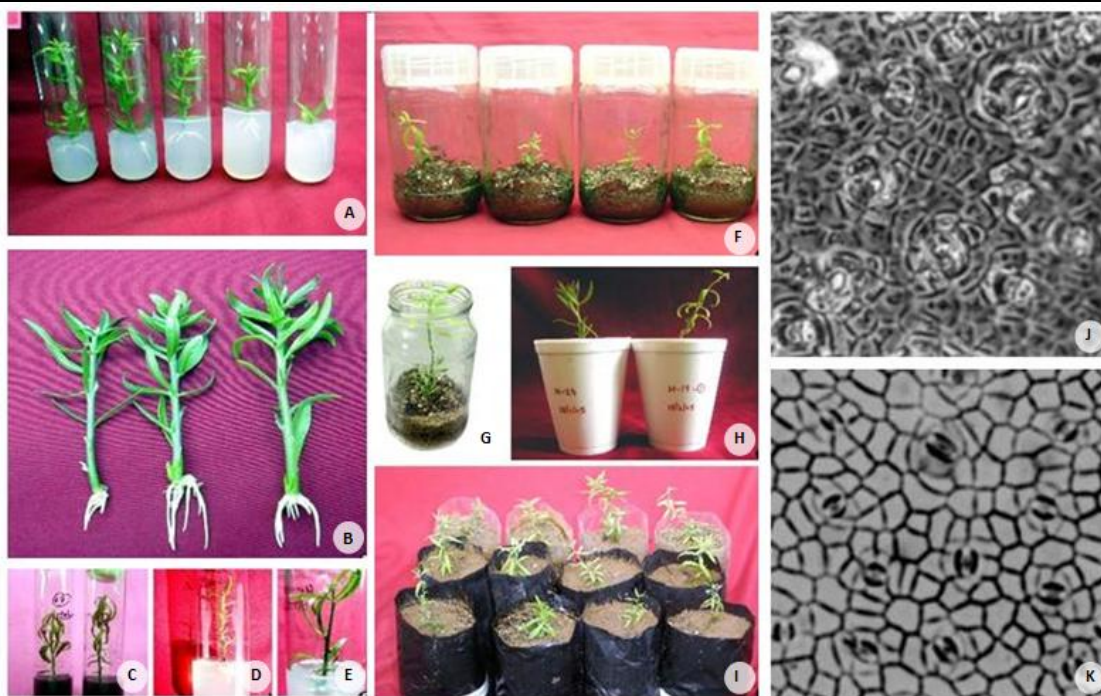


Figure 2 (A-J) Tissue culture of *Balanites aegyptiaca*: A. In vitro raised microshoots from axillary bud, B. *in vitro* rooting, C-E. various rooting trials, F-H hardening, I hardened plants, J. stomata on leaf lamina from *in vitro* growing plantlet (300X), K. stomata on leaf lamina from hardened plant (300X)

### 15. Establishment of Van Vigyan Kendras in Rajasthan and Gujarat

Van Vigyan Kendras (VVK) have been established in Beechwal, Bikaner in Rajasthan and Chhipardi Veedi, Rajkot in Gujarat with a view to demonstrate proven technologies developed through research in different institutes working on forestry aspects. The strategies will be to show these demonstrations to the forest managers and farmers through field tours, discussion and training.



Renovated Polyhouse at Bicchwal nursery, Bikaner



Renovated Agroshed house at Bicchwal nursery, Bikaner



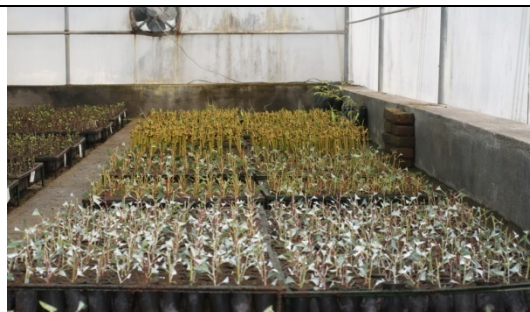
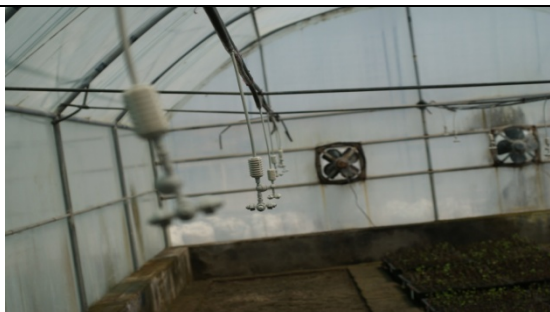
**Constructed Compost Chamber at  
Bicchwal nursery, Bikaner**



**Farmers/Forest Field functionaries training at  
Kishan Bhawan , Bikaner**



**Farmers/Field functionaries training & field visit at GFRI, Gandhinagar between 27-29 Nov 09**



**Fitting of microfogger and Vegetative propagation of Eucalyptus hybrid at R&D Centre,  
Rajkot**

## **Contact Details**

Director,

Arid Forest Research Institute,

P.O. Krishi Upaz Mandi,

New Pali Road, Jodhpur, 342005

TelePhone : 0291-2742549

FAX : 0291-2722764

Email : **[dir\\_afri@icfre.org](mailto:dir_afri@icfre.org)**