

ANNUAL REPORT 2015-16

Executive Summary

Summary of projects

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During the Year
Plan	5	6	-
Externally Aided	2	10	3
TOTAL	7	19	3

Significant findings

1. Introduction:

A. Structure:

Arid Forest Research Institute, Jodhpur (Rajasthan), is one of the nine institutes of the Indian Council of Forestry Research & Education (ICFRE), an autonomous organization of the Ministry of Environment, Forests & Climate Change, Govt. of India. The goals 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 stakeholders working in forestry sector in Rajasthan, Gujarat, Dadra & Nagar Haveli and Daman & Diu (Fig. 1).

The major emphasis of research of the institute are on soil, water & nutrient management, technologies for afforestation of stress sites, management of plantations, growth and yield modeling, planting stock improvement and biotechnology, bio-



Fig 1. AFRI's mandated states & Union Territories

fertilizers and bio-pesticides, Agroforestry, JFM & extension, phytochemistry & non-timber forest products, integrated pest & disease management, biodiversity and climate change and forestry education and extension. ~~During 2014-15, 32 projects were executed including 11 externally funded projects from different funding agencies like Rajasthan Forest Department, Gujarat Forest Department, National Medicinal Plant Board, New Delhi, Department of Science and Technology, New Delhi and IIM, Udaipur, Rajasthan. During the year under report thirty new group C technical and non technical staff, namely, one junior hindi translator, one library information assistant, one research assistant grade I, thirteen technical assistant group C, six lower divisional clerks and 8 multy tasking staff were recruited in the Institute. Also, three scientists, three research officers, three research assistants grade I and one research assistants grade II were given promotion to next higher grade. One steno grade I was promoted to the grade of private secretary. Three officers from Indian Forest Service joined the Institute on deputation.~~

~~During the year eighteen new scientific equipment at total cost of lakhs were procured under one time grant (OTGS) of ICFRE for different divisions.~~

2. Managing Forest and Forest Products for Livelihood Support and Economics Growth

ICFRE PLAN ONGOING PROJECTS

Project: 1 Enhancing fodder productivity through silvipastoral system on degraded land of India (AFRI-02/NWFP/Int(ICFRE)AICP/2012-2017).

Principal Investigator: Dr. Ranjana Arya, Scientist G

C. mopane: C. ciliaris trial

In this trial *C. ciliaris* CAZRI 75 could be established on soil slope in the inter row spaces of *C. mopane* plantation to convert it to silvipastoral trial. Green grass growth for *C. ciliaris* CAZRI 75 was observed in 1m² quadrats. The height range was 30-107 cm, no of clumps 4-19 /m² and the green grass yield was ranging from 130 – 208g/m². However even after two years *C. ciliaris* variety CC 358, could not be established leading to the conclusion that this variety is not suitable for salty area.

Area is dominated by many other grasses dominated by *S. diander* with green yield 572-720g/m² which is more than three times the yield of *C. ciliaris* 75. Other grasses are *C. virgata* (244-270 g m²), *Cyperus* (sp200-250 g/m²), *D. indicum* (185-450 g/m²), *D. aegypticum* (170- 210 g/m²).

The annual tree growth data was recorded and the incremental growth was 11.3 % (Height), 14.4% (crown diameter) and 10.5 % for collar diameter in trees with grass treatment which is higher as compared to growth in control trees , 7.3% in height, 8.64% in crown diameter and 8.56% in collar diameter. However in the year 2014-15 the crown and collar diameter growth was high in control trees. The moisture status analyzed in Dec 2015 was less for control trees resulting in relatively lesser tree growth. Poorly distributed monsoon rain 173 mm in July, 88.9 mm in August and 19.5 mm in September may be the reason. (This rainfall data is provided by CAZRI Jodhpur; however there was no rain in September in the experimental area 50 km outside Jodhpur)



Fig. *C. mopane* plantation just after first rain



Fig. With *C. ciliaris* 75 and other grasses after monsoon

Soil analysis indicates that soil pH values were higher on soil slope 8.23 & 8.44 as compared to plant pit 7.97 & 8.31 for the 0-20 and 20-40 cm soil layer in Dec 2015. Soil EC values were in normal range but higher in the 0-20 cm layer 0.625 & 0.915 dSm⁻¹ as compared to 20-40 cm layer 0.377 & 0.43 dSm⁻¹ for soil structures and plant pit respectively

S. nudiflora: *C. tetragonoloba* trial

S. nudiflora established well. There was almost no change in the mean percent survival in October 2015 (70.5%) after 22 months to 71.3% in Oct 2014. Plants attained significant growth Height increment was 21.5 % over mean height (128 to 146.5 cm), 57.4% for in

crown diameter (81.3 to 128.0cm) and 137% in the mean collar diameter (20.3 to 48.12 mm) registering 34.4% increase over October values.

Two varieties, BS RGC 1003 & TFL RGC 1017 of *C. tetragonoloba* obtained from Agriculture Univ, Mandore were sown in the inter row spaces of *S. nudiflora* plantation in the first week of August 2015.

The crop attained upto 11 cm height for C 1017 and 10 cm for 1003 and 6-8 leaf stage in the salty patch but due to no rain afterwards it withered.

Vegetation status of the area was evaluated in September 2015. by laying quadrats of 1x1 m². A total of 17 plant species were recorded which is less than 22 last year in a better distributed rainfall year. Out of 17 species 8 were grasses one less (*Aristida* did not appear). The green biomass yield was ranging from 269.5 g m² to 387.1 g m² dominated by *Dactyloctenium aegypticum* and *Chloris* spp. grasses.



Fig . *S. nudiflora* on DRM after rain



Fig . Crop germination in the 3rd week of August 2016



Fig . Crop withered after monsoon failure

Soil analysis indicates that % soil moisture values were higher 0.86 to 0.70% and 1.58 to 1.50 % in plant pit as compared to at a distance of 1.50 m in 0-20 & 20-40 cm soil layer. Similar results were obtained for soil EC . Plant growth of a succulent halophyte is responsible for higher EC as leaf fall recycled the salt back to soil, however, there was no difference in soil pH values.

Project : 2 Quantification, value addition of NTFP and improved agricultural productivity to enhance livelihood opportunities in tribal belt of Sirohi District of Rajasthan (AFRI-03/ NWFP /Int (ICFRE)AICP/ 2012-2017).

Principal Investigator: Smt. Sangeeta Tripathi, Scientist B

Studies on market price spread in tribal dominated area of Abu Road in Sirohi district of Rajasthan reveals that NTFP collection at village level is not organized. Barter system exists in the village. NTFP collected by tribals are sold at minimum/very low rate to the village agent i.e. mostly owner of Grocery shop from where tribals barter the items for their day to day use in place of the NTFPs. Family labour is the key input in the collection and processing of NTFPs. *Butea monosperma* (Palash) also plays an important role in tribal livelihood. In February-March, the flowers grow in huge clusters on almost leaf-less branches. Fresh flowers are collected and sold by children @Rs.20/- per kg in local market. The shade dried flowers are also available in the market throughout the year Leaves are plucked and used for making Dona-pattal during societal functions of tribals like marriage, on occasion of child birth, meeting of their society as well as in deceased times like tehvi (thirteen day of deceased ones) .

Activity of NTFP collection is for very short duration but it is a year round activity. In March-April, *Diospyros melanoxylon* fruits are collected and sold in nearby Market @ Rs.15-Rs.20/- per kg. In May-June, Khajoor and Rayan fruits are collected and in June-July, *Anona squamosa* and *Syzygium cummuni* fruits are collected and sold. On the onset of monsoon collectors also earns good money by collection of *Momordica dioica* (Kankoda) fruits in the market which are sold @Rs.80/- per kg in the beginning of the season (July) and @ Rs.30/- per kg in the end of the season (September). In Nov.-Dec. the tribals gets involved in *Cassia tora* seed collection, cleaning and selling @ Rs. 10/- kg.



Fig. Selling of Fresh flowers of *Butea monosperma* by tribal child



Fig. Selling of dried and packed flowers of *Butea monosperma* by tribals



Stitching of *Butea monsperma* leaves for dona making



Dona of *Butea monsperma* leaves used by tribals

Project: 3 Carbon stock and soil classification mapping for Rajasthan forests (AFRI-115/FED/ ICFRE/ 2011-16).

Principal Investigator: Sh. N. Bala, Scientist F

Data base generated on forest carbon stock in all the five components (above ground, belowground biomass, litter, woody debris and soil), soil physicochemical characterization, nutrient status and soil classification are being presented in geo-referenced map using GIS in the project. District wise map of Rajasthan in shape file prepared for all the districts. This map was then overlapped on the forest type map of Rajasthan developed by the Forest Survey of India (FSI) and separated district maps prepared. Geo-referenced data points have been displayed in the maps and separate maps for all the 33 districts prepared. The process of linking the database with the geo-referenced data points has been established. The districts maps are prepared and displayed in two different methods. One with the use of forest type map of FSI using the TNT mips software and the other is using Google earth through TNT mips software. User can view the details of site characteristics, vegetation composition, carbon stock, soil nutrient status etc. by clicking the geo-referenced data points on the map.

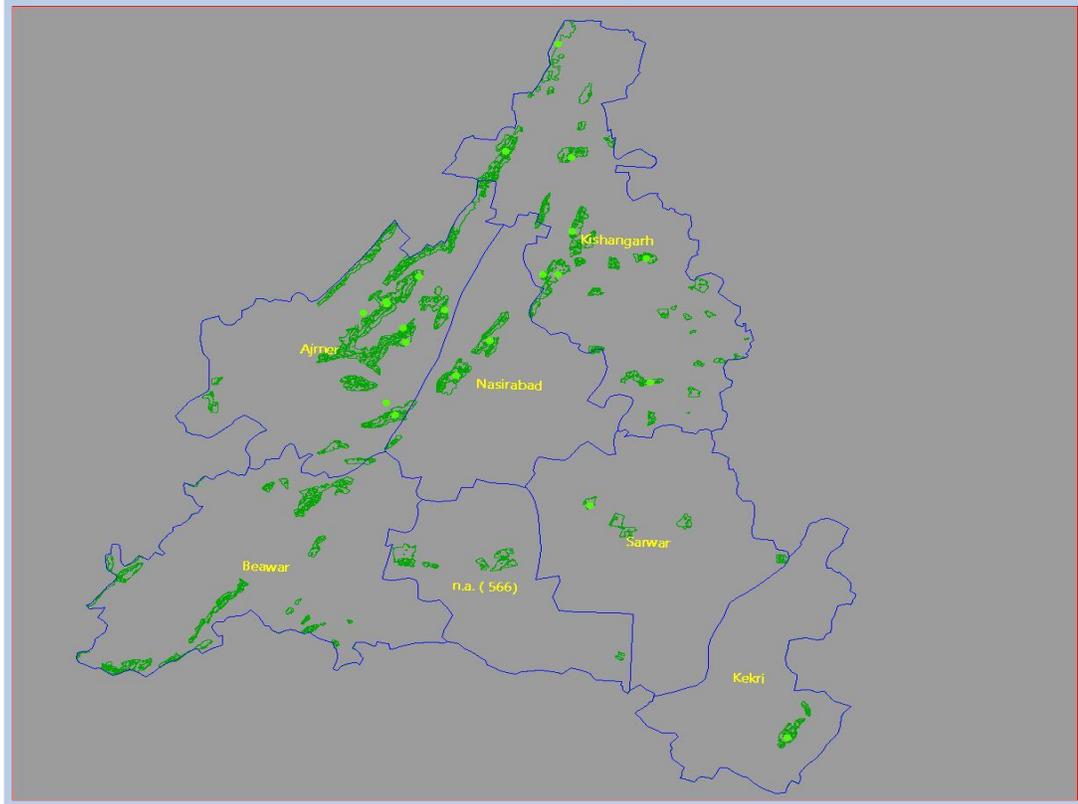


Fig. Map of Ajmer district generated over forest type map using TNT mips software

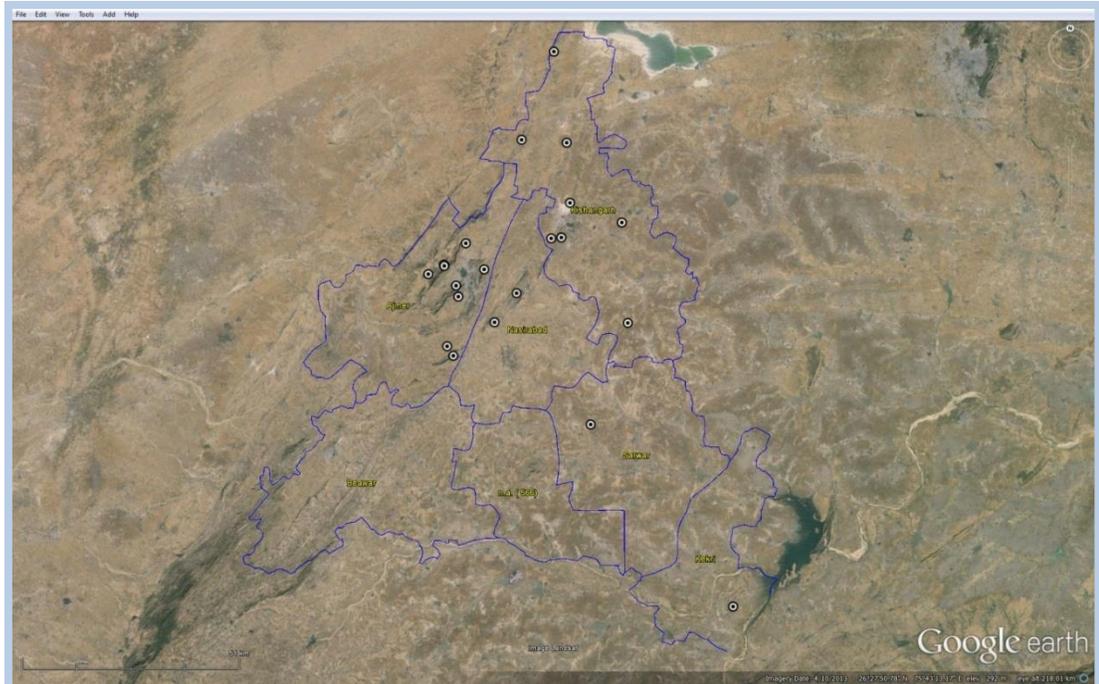


Fig. Map of Ajmer district generated over Google earth using TNT mips software



Fig. Attribute (site characteristics) attached to the geo-referenced data points

Project: 4 Productivity enhancement of Kair (*Capparis decidua*) fruit to generate livelihood in rural areas of Thar desert (AFRI-07/NWPF/Ext.(SFD, Raj.)/2013-16).

Principal Investigator: Dr. Ranjana Arya, Scientist G

EXPERIMENT 1 (GOGELAO BEED, NAGAU)

Field was selected in July 2013. All the plants were divided into three blocks. Fertilizer treatments with leaf compost (LCM), goat FYM (GM) and VAM in combination to different fertilizers SSP, SSP + K, K, Zn and SSP, K, + Zn and NPK etc were applied with irrigation in October 2013.

Three times flowering and fruiting was observed in the experimental shrubs. The annual fruit data analysis for the year 2015-16 indicate that in LCM block 14 plants (35%) fruited 3 times, 16 plants (40%) fruited 2 times and 8 (20%) plants fruited only 1 time. There were 2 plants (5%) one each in control and LCM only treatments, which did not fruit. T4 (LCM, SSP, K, Zn) is the best treatment with 2490.6 g total yield as compared to control (315.6 g) only.

In GM block 11 plants (27.5%) fruited 3 times, 9 plants (22.5%) fruited 2 times and 6 plants (15%) fruited only 1 time. There were 14 plants (35%) which did not fruit. Plants without fruiting distributed in all the treatments except T4 maximum 3 each in control and GM only treatment. T4 is the best treatment (Gm, SSP and K) is the best treatment with 2623.3g as compared to control 81.6 g

In VAM block 5 plants (14%) fruited 3 times, 9 plants (26%) fruited 2 times and 17 plants (48%) fruited only 1 time. There were 4 plants (11%) which did not fruit. Here no fruit plants were present one each in control and SSP1 and two plants in VAM + NPK treatment. T4 (VAM only) is the best treatment with 1602.4 g as total yield as compared to 494.15 g in control.

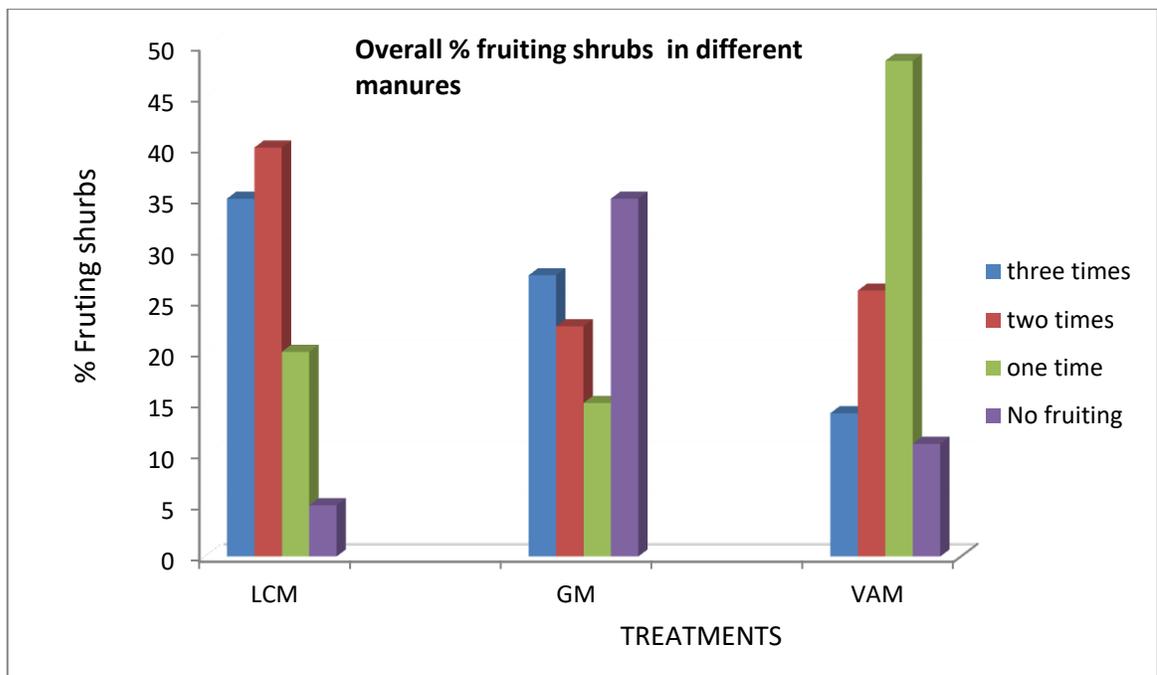


Fig: Percent fruiting frequency of shrubs in the year 2015 in different manures

Overall 26 % shrubs fruited three times, 29.5% two times , 26.9% one time and 17 % shrubs did not flower in the year 2015 as shown in the Fig 1 above.

In this year also the total fruit yield was higher in October 2015 as compared to April 2015 in LCM and VAM blocks only slightly less in GM block indicating the positive role of moisture conservation. Total fruit yield in 2015 (sum of all the three seasons) is maximum for LCM block (8148.6 g) which is 23% more than GM block (6628.0 g).

Thus out of three organic manures, **application of LCM in combination to various inorganic fertilizers has enhanced the no of fruiting plants and fruit yield significantly followed by VAM application.**

Plant growth increment also followed the same trend. The height increment is ranging from 3.96% in control to 35 % for T7 treatment, while the crown diameter increment was ranging from 6.17% in control to 73.4% in T4 treatment in LCM block. In GM block height increment



LCM treated plant 1 oct. 2015 (T4R3)



LCM treated plant 1 oct. 2015 (T4R3)



Control plant 1 oct.2015



GM treated plant 1 oct .15 (T4R1)



GM treated plant 1 oct .15 (T4R1)



Control plant 1 oct.2015



VAM treated plant oct.2015 (T4R4)



VAM treated plant oct.2015 (T4R4)



Control plant VAM

was 6.2% in control to 14.6 % in T7 and crown increment was 3.19% in control to 15.9 % in T5 treatment. In the VAM treated plants height and crown dia increment was 4.54 & 9.47 % in control however treated plants differ and max ht increment 23.13% in T4 and crown dia, 41.3 % in T2 treatment.

EXPERIMENT 2 KHARI KHURD JODHPUR

Growth data were recorded, the mean height and crown diameter were ranging from 248 to 314 cm and 275cm to 378 cm respectively in LCM treated plants registering 6.0 to 27.4% and 8.0 to 35.8 % growth increment respectively.

In goat manure treated plants the height was ranging as 197.5 to 332.5 cm and crown diameter was 261.5 to 410.0 cm registering 2.6 to 17.6% and 4.3 to 33.9% respectively. Incremental growth was relatively less in GM plants as compared to LCM plants with no effect of other treatments.

Due to poor monsoon flowering and fruiting was less almost insignificant in October in both LCM and GM blocks ranging from 0-40% in treated plants with 0 % in control plants for both the blocks.

The flower colour was mainly orange and red for most of the plants .Two types of fruit shapes were also noticed round and elongated. in few fruits In few trees fruits with penta lobular shape (rudraksh type) are also noticed.

Soil analysis was undertaken the mean soil pH values were slightly higher and was ranging from 7.83 for the 0-20 cm soil layer compared to 7.72 for the 20-40 cm soil layer while the mean EC values were similar 0.11 dS-1 for both layers.

Two irrigation were provided in Dec 15 and Jan 16 after which significant flowering initiation took place in March 2016. The flowering initiation took place in 2 week itself and 50 to 100% plants flowered and fruited in both the blocks with 100% flowering in T₁ (LCM, SSP, K Zn) and T₅ (GM + SSP) .

Project: 5 Documentation of important research findings and technologies for application to forestry in Rajasthan (AFRI-08/FE/Ext(SFD)Raj/2013-15).

Principal Investigator: Dr. G. Singh, Scientist G

Project '**Documentation of Important Research Findings and Technologies for Applications to Forestry in Rajasthan**' was sanctioned by State Forest Department, Government of Rajasthan with total outlay of Rs. 11.66 Lakhs to develop a book in the form of manual based on existing knowledge in the region and abroad. As per the action plan we have developed the book encompassing a complete guideline to restore dry lands, to combat desertification and to improve people livelihoods by way of forestry applications. Book entitled '**A manual for Dry land Afforestation and Management**' includes a total of 15 chapters. This book deals with physiographic feature of Rajasthan describing climatic conditions and changes therein

that influence bioclimatic regions, dynamics in both human and livestock population and operational land holding in **Chapter 1**. **Chapter 2** describes ecological aspects of drylands, a home of 36% of the global human population, key natural resources, and varieties of habitats and soils, supporting diversity and sustaining people livelihoods. **Chapter 3** describes desertification as the greatest environmental challenges throughout the world, definitions, and the various processes by which it has reached in global agendas, linkages among desertification, land degradation and drought in terms of threats to the ecosystems health and human living. Pattern of losses due to land degradation, its various environmental, social and economic impacts, their economic evaluation and suggestive measures to cope with these challenges have been covered in **Chapter 4**. In **Chapter 5**, strategies, methods and approaches for restoring degraded drylands covering historical approaches of community to landscape level have been dealt with. **Chapter 6** describes different methods of sand drift and wind erosion control, suitable vegetation species for sand dunes, interdunes and sandy plains, plantation and post planting care and making the sand dune stabilization more remunerative and beneficial. Likewise, **Chapter 7** deals with extent and distribution of salt affected, water logged and effluent or wastewater affected soils, their characteristics together with reclamation by selecting appropriate vegetations of varying tolerance levels toward salinity, alkalinity, water-logging and effluent quality.

Chapter 8 describes criteria of selecting trees and developing seed production areas, methods of seed collection and storage, testing seed germination and its improvement methods, soil mixture used in beds or containers, time of seed sowing, seed sowing, enhancing seedling quality together with control of diseases and pests. **Chapter 9** provides the essence of genetic improvement, methodologies used for provenance, progeny and clonal trials and establishment of SPA, SSO, CSO, VMG etc. **Chapter 10** describes plant production of suitable tree and shrub species using vegetative means, quality planting materials and plantation techniques. Various kinds of *ex situ* and *in situ* rain water harvesting and conservation structures for their judicious utilization in restoration and rehabilitation of degraded lands, ensuring improvements in vegetation covers, adaptation to climatic abrasions and thus enhanced livelihoods have been described in chapter 11. Assisted natural regeneration, directs sowing, planting and a mix of these in restoring the degraded lands have been described in chapter 12. Similarly, chapter 13 describes varying types of pests and diseases in the tree species most common in tropical dry areas particularly in India and suggest effective measures to control them. **Chapter 14** describes growth and biomass related factors for enhanced production and various equation and models to interrelate growth variables among themselves or their use in predicting tree/stand volume and biomass in view of sustainable forest management and climate change mitigation. **Chapter 15** highlights the people's perception, participation and management of forest resources with a view to improve overall forest cover and ecological services they provide.

Likewise Hindi version of this book has also been prepared. There are different policies and programmes at international, national and regional levels to curb the problem of

desertification, land degradation and drought, but the problem remain same. There are need to conserve the existing biological diversity and natural resources and enhance biomass productivity to maintain functional behaviour of the drylands ecosystem and enhance people livelihood. These all can only be achieved by involving local people and making the programme beneficial to both human beings and the environment.

Project: 6 Standardization of non-destructive harvesting practices of *Commiphora wightii* gum Oleogum resin (AFRI-11/FGTB/Ext (NMPB) /2014-2017).

Principal Investigator: Dr. U.K. Tomar, Scientist F

In Rajasthan, Kumatia (*Acacia senegal*) enclosure in Kailana hills of Jodhpur district and Ler and Mathal sites of Bhuj forest division in Gujarat were selected for conducting tapping experiments. The guggul plants were selected and marked with proper labelling at both the sites and growth data including height, crown size, girth size and GPS positions were recorded for each selected plant.

The experiment including treatments of cuts of four different sizes and three different patterns were designed. A total of 234 treatments at Kailana hills, Jodhpur (Rajasthan) and 180 treatments at Ler, Bhuj (Gujarat) (Fig. 1) were applied on the selected plants. The extracted gum from each treatment was collected in zip lock bags and recorded for statistical analysis.

Initial results of gum collected from treatments at kailana hills revealed that there is significant difference in the average gum production by different sizes of cuts (1 cm- 0.45 gm, 2 cm- 0.69 gm, 3 cm- 0.76 gm, 4 cm- 0.88 gm; F- 7.436; Sig.- 0.000) and also in different pattern of cuts (Horizontal- 0.81 gm, Oblique- 0.73 gm, Vertical- 0.53 gm; F- 6.338; Sig.- 0.002). The gum production was also found to be proportional to the girth size (Fig. 2). The tapped plants were monitored for any casualties and all the plants were healthy and there is no casualties in any plant even after one year.

The study of seasonal variation was started and the cuts were applied on the plants in the month of September which includes tapping in 2nd week of every month of a year and horizontal cut of 8 cm at the angle of 60°. The extracted gum was collected for further study.



Fig. Guggul gum tapping at ‘Ler’ site of Bhuj forest division in Gujarat

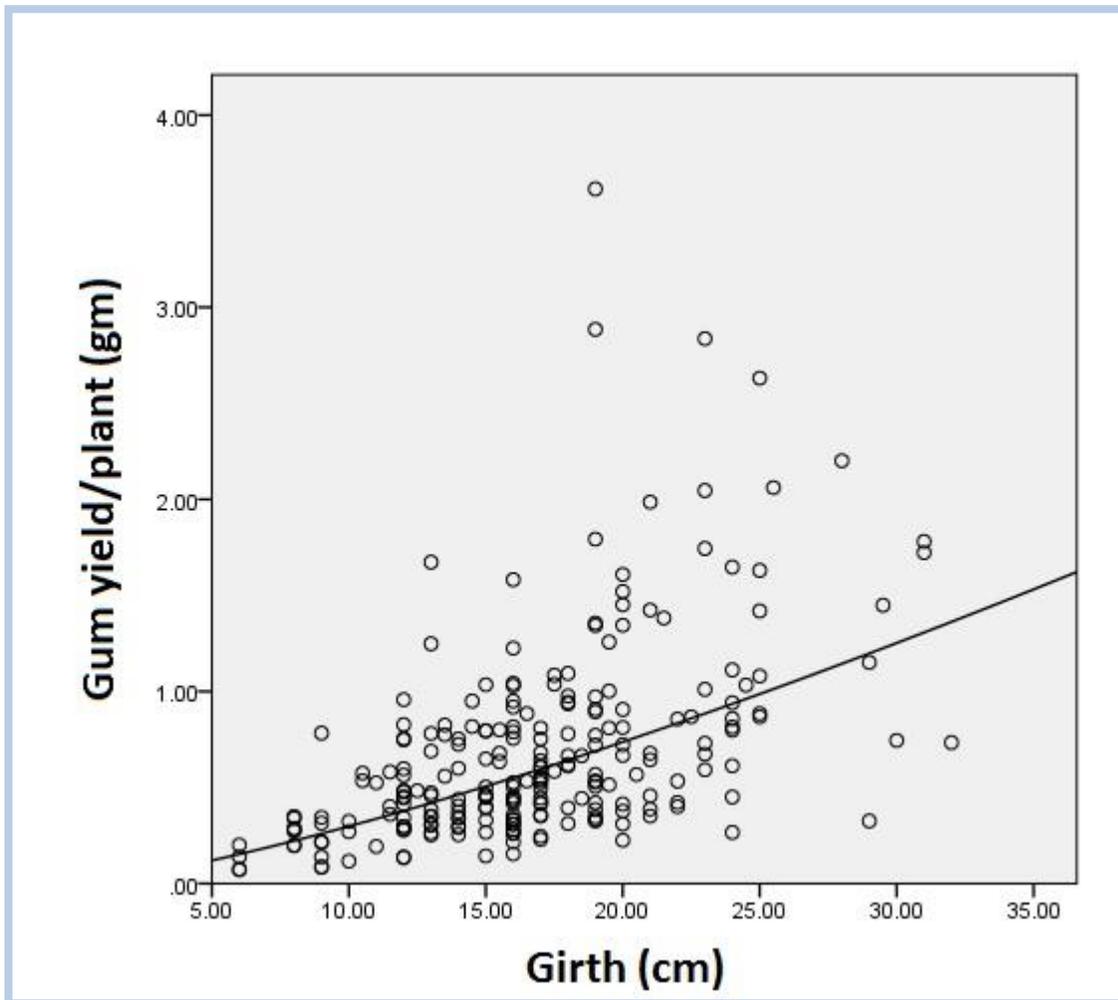


Fig. : Regression curve (power) between Girth and Gum yield

Project: 7 Studies on post-harvest technologies of *Azadirachta indica* and *Acacia Senegal*—as alternative timber species for handicraft industries (AFRI-14/NWFP/Ext (DST)/ 2014-17).

Principal Investigator: Dr. Ranjana Arya, Scientist G

Wood of *A. indica* and *A. senegal* obtained and process of wood conversion to sawn wood for Neem & *A. Senegal* wood is completed with the help of Sun Art Export, Jodhpur Treatment of Neem wood with the process used by Sun Art Export, Jodhpur is initiated

To find out an alternative to Chromium and Arsenic in Copper Chrome Arsenic complex mixture IWST Bangalore has worked upon a alternative mixture replacing Chromium with Potassium dichromate and Arsenic with *P. juliflora* bark extract under laboratory conditions.

We want to check it at industrial level.

Therefore, *P. juliflora* bark was collected; air dried in shade and pulverised to powder it. The dried bark powder was extracted in soxhlet apparatus with methanol exhaustively.

The extract was distilled to recover the methanol and collected as bark extract.

Preparation of complex mixture of Copper sulphate, Potassium dichromate and *P. juliflora* bark extract initiated.

Method for preparation of complex mixture- Copper sulphate, Potassium dichromate and *P. juliflora* bark extract were weighed in the ratio of 3:4:1 separately. The *P. juliflora* extract were dissolved in methanol in acidic medium and mixed with Copper sulphate and Potassium dichromate in aqueous medium and the resulted mixture is refluxed for 2 hrs at 60°C.

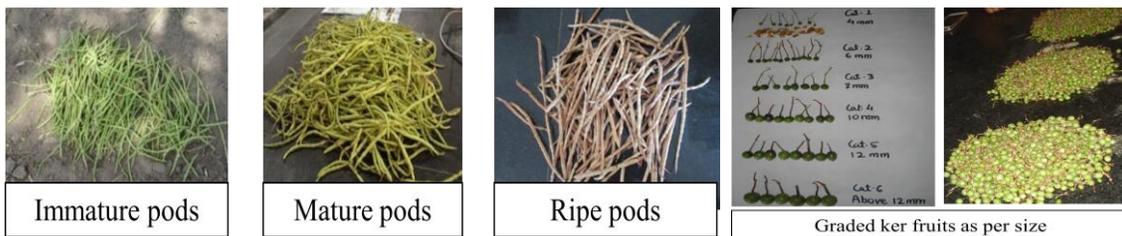
Project: 8 Optimization of processing methods for *Prosopis cineraria* and *Capparis deciduas* fruits for their improved utilization in Western Rajasthan. (AFRI-15/NWFP/Ext(DST) / 2014-17).

Principal Investigator: Dr. Mala Rathorei, Scientist D

Collection of Ker fruits was done in April-May, Jun-Jul, & Oct-Dec 2015. Diameter of the fruits was found to vary from 3.84-21.32mm (Apr-May), 3.52-17.88mm (Jun-Jul) & 4.8- 20.58 mm

(Oct-Dec). Khejri pods collected at intervals of 2-3 days from the day of appearance of edible pods. Initial flowering in Ker was observed in last week of Feb 2016 and fruiting was found to initiate in mid March 2016. Flowering in Khejri trees initiated in early March to early April 2016. Ker fruits were graded using custom-fabricated sieves of different sizes viz. <4mm, <6mm, <8mm, <10mm, <12mm, >12mm. Khejri pods were categorised on the basis of their thickness. Moisture content of Ker fruits was found from 65-78% (April-May) ,63-78% (June-July) & 67-73% (Oct-Dec). Moisture content of Khejri pods was 66-74%.

Sugar content in Ker fruits was found to range from 10-11% in marked trees from Jodhpur. After 3 months, fruits preserved at -22 °C showed very slight decrease in sugar content (9-10%). Sugar evaluation in traditionally processed fruits showed that there was very slight change in sugar content after 10 days of soaking in buttermilk (9-11%). Hence this appears to be the best treatment as far as processing in different solutions viz. Salt solution, lime, buttermilk is concerned. Ash and protein content in green and treated ker was found to range from 1-2% and 12.5-31.3 % on DW basis respectively. With storage both ash and protein content was found to overall decrease with time. On soaking the ker fruits in different solutions, both ash & protein was found to remain almost constant upto 8 days of treatment and after that their value decreased. Pre heated solar drying was found to be best among all the other methods for ash content. Maximum protein was found in Cat 4 & 5. Preserved ker fruits and sangri pods in refrigerator, deep freezer (-22° C), brine and vinegar, are in good condition after 10 months of storage.



Project: 9 Documentation of Neem Products and their role in socio-economic upliftment of rural livelihood in Rajasthan and Gujarat (AFRI-16/NWFP/Ext. (DST) /2014/17).

Principal Investigator: Smt. Sangeeta Tripathi, Scientist B

Visited 28 industries dealing with neem products in Sojat city of Pali. Findings reveal that there is no organized market for selling of neem leaves. Farmers bring neem leaves in Krishi Upaj Mandi along with other agriculture products. There is fluctuation in prices of neem leaves as there is no governing body deciding the rates for neem products. There is a variation in the selling of neem products viz. neem leaves are tax free where as there is 5 % Tax on the neem powder.

Knowledge regarding marketing channel of neem products is very limited right from farmer to the industries at village/ district level. Further, facilities like collection, drying and trading/ exporting etc. are also not available.

For export of various neem products there is no inspection, verification, testing and certification unit in Rajasthan. There is a single certification Unit i.e. SGS (Société Générale de Surveillance) with its offices at Ahmedabad, Chennai, Mumbai, Bangalore, Orissa etc. Therefore, neem leaves or powder exported from Rajasthan to various European and Gulf countries is returned back if it does not meet their quality standard even after obtaining certificate from SGS. The testing charges are also borne by the exporters which are quite high i.e. approximately @ Rs.3000/- per tonne. In addition they have to bear ware house charges if there is any delay in shipment etc.



Fig. Quantification of Neem leaves and fuelwood in Seh waj village of Sojat (Pali District)



Fig .Collection and Selling of neem leaves in Herbal Industry at Sojat from Sehwasj Village



Fig .Interactive meeting of Dr. Rashmi Sharma, Sc-E and National Coordinator, DST, New Delhi with farmers at Sonai Manji Village

ICFRE PLAN COMPLETED PROJECT

Project: 10 Refinement of modern nursery practices for raising quality seedlings of selected important forest tree species and arid and semi arid areas. (AFRI-109 /Silvi/ICFRE/2011- 2016).

Principal Investigator: Dr. N.K. Bohra, Scientist B

In the Project "Refinement of modern nursery practices for raising quality seedlings of selected important forest tree species of arid and semi arid areas" seedlings of three species *Prosopis cineraria*, *Tecomella undulata* and *Azadirachta indica* were raised in different sized polybags viz. long polybags (24x19 cm), middle sized polybags (19x18 cm) and small polybags (20x13 cm) as well as in two sized root trainers 150cc and 250 cc. In manure compost, Vermicompost, Gobar manure, leaf compost and goat manure were used. These seedlings were filled with different potting mixture ratio of soil: sand: manure viz. C₁/G₁/M₁/V₁/L₁ (1:1:1), C₂/G₂/M₂/V₂/L₂ (1:1:2), C₃/G₃/M₃/V₃/L₃ (1:1:3), and C₄/G₄/M₄/V₄/L₄ (1:2:1) respectively. Growth parameters of all these species were recorded at 2 months intervals during the project first three years. On the basis of growth parameters performance the treatments were treated with 5 types of biofertilizers viz. PSB, Azospirillum, Azotobactor, Trichoderma and VAM. Controls without biofertilizers were also kept for comparisons. Out of these best treatments were maintained for field trial.

Best treatments from *Prosopis cineraria*, *Azadirachta indica* and *Tecomella undulata* were planted based on the potting mixture ratio and container size with treatment of Biofertilizer. Initial growth data of planted seedlings were recorded after plantations.

Plantation was given irrigation and application of fungicide and other for disease resistance and healthy growth.

On the basis of initial data and subsequently data taken at the end of 9 month period, it was found that in *Azadirachta indica* seedlings with compost and Vermicompost perform better in comparison to other treatments. Leaf compost seedlings and Magni khad treatment seedlings also perform better than the normal control treatment of gobar compost with 1:1:1 ratio. Average ht of control was increase from 74 cm to 140 cm while in compost it was increase to 246 cm from 115 cm. In Vermicompost average ht was increased from 130cm to 270 cm in 9 month interval while in leaf manure it changed from 112 to 192cm. In Magni khad treatments average ht was increased from 99 cm to 157 cm in 9 month.

Average girth of control was increase from 8.74 mm to 18.14mm cm while in compost it was increase to 33.71mm from 11.66 mm. In Vermicompost average girth was increased from 14.78 mm to 36.31 mm in 9 month interval while in leaf manure it changed from 12.35 mm to 29.66 mm. In Magni khad treatments average ht was increased from 10.96 mm to 24.31 mm in 9 month.

In *Tecomella undulata* Vermicompost and compost treatments have average ht of 20 and 25 cm at initial stage which increase to 31 cm and 35 cm after 9 month period while in control it increases from 14 cm to 19 cm in 9 month period. Similarly in average girth data it was found that in Vermicompost it increases from 2.98 mm to 4.71 mm while in compost it changes from 2.14 mm to 4.21 mm where as in Control it increases from 1.93 to 2.33 mm.

In *Prosopis cineraria*, compost treatment average ht changes from 56 cm to 68 cm while it changes from 38 cm to 49 cm in control. Avergae girth was increase from 4.42 to 7.4 mm in compost while it was changed from 3.41 mm to 5.8 mm in control treatment.



Fig . Khejri Trial



Fig . Neem Trial



Fig . Rohida Trial

Project: 11 Tapping the potential of some selected indigenous lesser known wild edible plants for food and nutrition in arid and semi arid region. (AFRI-110 /NWFPD/ICFRE/2011- 2016).

Principal Investigator: Dr. Mala Rathore, Scientist D

Ash content determination in samples (2014.) showed : *Cassia tora* (7.33-14.7%), *Grewia tenax* (3.7-4.2%), *Ceropegia bulbosa* (5.9-10.9%), *Cordia gharaf* (5.9-9.33%) *Calligonum polygonoides* (8.84-9.68%), *Leptadenia reticulata* (5.39-7.40%), *Haloxylon salicornicum* (14.09-53.65%). Sugar content in samples 2014 was as follows : *Cassia tora* 3.3- 5.3% (Bali), *Grewia tenax* (24.7-34.1%), *Ceropegia bulbosa* (15.1-22.7%), *Cordia gharaf* (39.1-47.7%) , *Calligonum polygonoides* (6.3-7.3%), *L. reticulata* (6.7-12.2%), *H. salicornicum* (2.8-7.8%). Phosphorus determination showed maximum content in *Grewia tenax* (Jodhpur) 21.62 mg/100gm, *Ceropegia bulbosa* (Bali) - 4.46 mg/100gm, *Cordia gharaf* (Jodhpur) - 24.65 mg/100gm, *Haloxylon salicornicum* (lathi, Jaisalmer) - 20.79 mg/100gm, *Calligonum polygonoides* (Bikaner) - 9.36 mg/100gm, *Leptadenia reticulata* (Bali) - 21.13 mg/100gm, *L. pyrotechnica* (Nagaur), 24.85mg/100gm, *Cassia tora* (Bali) 42.73 mg/100gm.

Gamma irradiation (5Gky) of *Grewia tenax* and *Cordia gharaf* fruits in Defence laboratory, DRDO, Jodhpur, so as to prolong their shelf life, showed delay in fungal infestation in irradiated samples. *Cordia gharaf* fruits stored in freezer of refrigerator were preserved for more than a year. Cut and dried pieces of *L. reticulata* pods were preserved 3 months. Among all the planted species *Cordia gharaf* & *Grewia tenax* performed best. Flowering & fruiting was observed in *Haloxylon salicornicum* plants.



Fig .Cut & dried *L. reticulata* pods



Fig .*Cordia gharaf* fruits under refrigeration



Fig .*Haloxylon salicornicum* fruiting branches

Project: 12 Managing Resources to enhance productivity of agroforestry system in Dry Areas of Rajasthan. : (AFRI-01/AEFD/Int. (ICFRE) AICP/2012-2016)

Principal Investigator: Dr. Bilas Singh

Hardwickia binata and *Colophospermum mopane* trees based agroforestry experiment were established in 2012-13 at AFRI, Jodhpur was continued. The four treatment comprises for each species viz. Intact tree (T_1), Tree branch removal only (70% of total tree height) (T_2), root barrier treatment (T_3) and both tree branched removal and root barrier

treatment (T₄). *C. tetragonoloba* crop grown with *H. binata*. The grain production of *C. tetragonoloba* crop was not produced due to very less rainfall in the crop growing period in the region. Integrated *C. ciliaris* grass with *C. mopane* trees was maintained. Clump number and diameter and production of *C. ciliaris* grass were significantly higher in control as compared to the treatment plots. These were also varied with distance from tree trunk.

Photo active radiation (PAR) was significantly high in sole grass plots as compared to different treatments. PAR was the highest in T₂ and T₄ treatment whereas it was the lowest with T₁ treatment in *C. mopane* tree. PAR varied significantly among the distances from tree trunk. SWC was significantly ($P < 0.05$) higher in T₄ treatment as compared to T₁ treatment in *C. ciliaris* grass with *C. mopane* trees plots. It was also the highest with increasing soil depth and distances. Tree root density was not differed among the treatment in the both species. pH, Ec, soil organic carbon of soil were analysed which were not differed among the treatments.

Project has completed in March 2016. Analysis works of soil are under process. Project concluding report will be submitted as early as possible.

EXTERNALLY AIDED ONGOING PROJECT

Project: 13 Identification of extent of forest land in forest fringe village (AFRI/FED/NRAA/2011-15).

Principal Investigator: Sh. S.R. Baloch, Scientist C

The project 'Identification of extent of forest land in forest fringe villages' was started to gather information on forest dependency and socio-economic conditions of the surrounding inhabitants and the root causes of the destabilization and shrinkage of the forest land in selected forest fringe villages of Rajasthan and Gujarat. Ecological survey and vegetation studies done in Jamnagar, Panchmahal, Surat, Vadodra, Valsad, Dahod, Kauchh, Narmada, Sabarkantha, Banaskantha and Dang districts in Gujarat, Pali, and Sirohi districts in Rajasthan. The information so collected were entered simultaneously through online web portal and further reports on floristic and socioeconomic status of forest fringe areas were prepared and sent to FRI, Dehradun. Data collected from forest fringe villages of Valsad district in Gujarat indicates that the area was dominated by teak. Floristic diversity varies from undisturbed forest where *Tectona grandis*, *Anacardium occidentale* (Cashew), *Carrisa carandus*, *Terminalia tomentosa*, *Diospyros melanoxylon*, *Butea monosperma*, *Eucalyptus camaldulensis*, *Acacia catechu*, *Syzygium cumini* and *Lagerstroemia parviflora* etc. were found as common associate of teak.

The IVI of Teak (71.94) is higher followed by *Terminalia tomentosa* *Anacardium occidentale*, *Carrisa carandus* and *Diospyros melanoxylon* with diversity index of 0.34, 0.16, 0.19, 0.14 and 0.11. Due to continuous hacking or clearing of tree for cultivation and uncontrolled grazing the natural regeneration of Teak is low, whereas regenerations of Tandu patta (*Diospyros melanoxylon*) and *Butea monosperma* were relatively better. High frequency of 31.2% and 20.3% was observed for *Cassia tora* and *Lantana camara* respectively, in Valsad district. As per socio-economic survey, majority of the population in Udaipur, Pali and Sirohi districts of Rajasthan was tribal and have small and marginal land holdings. The irrigation facilities are poor therefore the farmers have to depend on Kharif crops. The dominant tribal castes in the area was Bheel, Meena and Garasia are

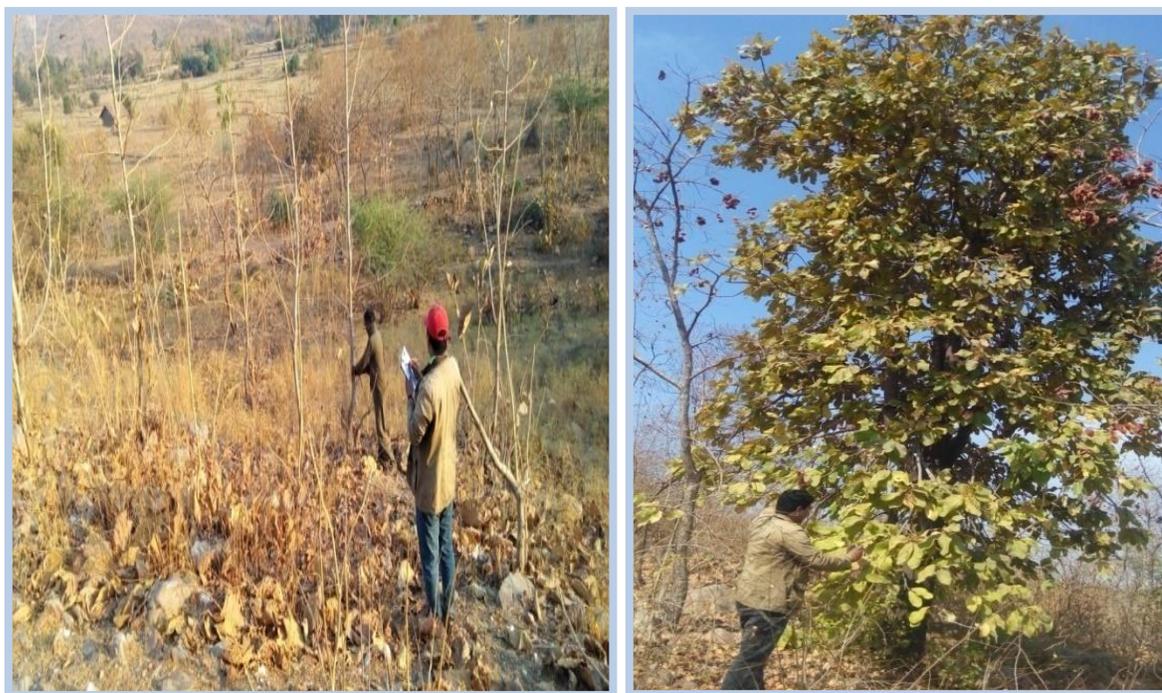


Fig . Recording growth data in Valsad (Gujarat)

EXTERNALLY AIDED COMPLETED PROJECTS

Project: 14 Study cum Survey to Assess the Demand and Supply of Medicinal Plants in India. (ICFRE Coordinated Project)

Principal Investigator: Sh. S.R. Baloch, Scientist C

This project is funded under AYUSH Govt. of India (NMPB) Coordinated by ICFRE, Dehradun, AFRI, Jodhpur has been implemented in Rajasthan, Gujarat, Goa, M.P. Diu states for Assess the Demand and Supply of Medicinal Plants by traders, folk healers, local people, cultivators, industries mandi and markets. The basic objectives of the projects are (i) Survey for cultivation of medicinal plants in Rajasthan, Gujarat (ii) Rural household/ folk healer survey in the villages listed below as per random sampling design by ICFRE and (iii) Survey of Raw Drug Markets. Thirty villages were selected for field survey and data collection. Four types of questionnaires were developed, i.e. related to village profile data collection; Raw drugs Consumption at the level of manufacturing Unit; and Raw drugs Consumption at folk healers level. 450 households were surveyed and interactions made with people. Interactions with the local people (i) villagers experiences of traditional knowledge of medicinal plants; (ii) folk healers; (iii) people use to collect raw drugs materials from forest area within few days and store it for use for medicine (iv) pharmaceutical industries use to raw drugs materials for medicine to cure disease. People of Rajasthan Gujarat and M.P. have cultivated Ashwagandha, Isabgol, Senna, Castor, Aloe and Amla in agriculture land.



Fig . Inception Workshop for execution NMPB project at ICFRE



Fig . Interaction with house holder in Sirahi district



Fig. Interaction with Vedh in his herba garden Fig. gathered from whole sealer Ayurvedic medicine shop

Project: 15 Productivity studies and modeling growth and yield in teak plantations in Gujarat State (AFRI-96/Silvi/JBIC/2009-15)

Principal Investigator: Sh. P.H. Chawhaan, Scientist F

Growth measurement viz. diameter at breast height, total height of trees, total No. of trees and area of sample plots etc were recorded. from 13 sample plots at Diviya, Sagarama, Sajara, Mazada, Piplod, Rajendrapur, Galkund, Taklipada, Chikhali

Similarly, five trees each from surrounding area of sample plots at Diviya, Sajara, Gulwani, Galkund, Taklipada, were felled in four forest Divisions for volume estimation. The recorded growth data entered, compiled and basic analysis of data was done.

Volume equations were developed.

3. Biodiversity Conservation and Ecological Security

ICFRE PLAN ONGOING PROJECTS

Project 16: A coordinated project on integrated management of khejri mortality for socio-economic upliftment in Rajasthan (AFRI-99 /FPD/ICFRE/2010- 2015). Extended Till 2017.

Principal Investigator: Dr. K.K. Srivastava, Scientist F

Component I - Forest Protection Studies

Co-PIs: Dr. Sangeeta Singh, Sci D and Dr. Shiwani Bhatnagar, Sci. C

The effect of mechanical ploughing on the natural regeneration of Khejri was recorded in the oran, gochar land, and undulated terrains and in the mechanically ploughed farmers field in Nagaur, Sikar, Jhunjhunu and Churu. observations revealed that tractorization do not play direct role in mortality of Khejri but reduces the population of Khejri by damaging the new

sprouts and lateral roots of the tree which play significant role in invasion of pathogen. Pathogenicity test of *Ganoderma* has been established and confirmed as major biotic factor for khejri mortality. So far *Acanthoporous serraticornis* larvae, 18th instar has been completed and larvae still not pupated. A systemic survey was carried out in AFRI campus to assess the status of *Prosopis cineraria* regarding pest and problems and it was found that out of 197 trees surveyed, 27% were found infected with termites, 13% affected from gall formation, 6 trees were found partially infected with *Ganoderma* root rot disease and 11 trees were found dead. No borer attack was detected. Bio-gents like *Trichoderma spp*, against *Ganoderma* and *metarrizium sp*, *Beauvaria sp* against root borer has been tested against *Acanthoporous serraticornis*. No entomo-pathogen so far tested showed positive effect against root borer. Neem, balanites and calotropis leaves showed antecedent effect against root borer. About 26 different botanicals from root, leaf and fruit extracts of Datura, Ardu, Jatropha, Juliflora, Hingota, etc has been screened *in vitro* against the pathogen so that it can be applied in field condition in nursery. About thirty two (32) progenies of *P.cineraria* are being maintained for screening against *Ganoderma* root rot disease and *Acanthoporous serraticornis*.



Fig . Gall infestation in Khejri



Fig . Close-up of Inflorescence gall due to mites



Fig . *Ganoderma* root rot in Khejri

Component II - Genetics

Genetics: Co-Principal Investigator: Sh. P.H.Chawaan, Scientist-F

Progeny trials established with 30 families and at AFRI genetics field and 52 families at Samaspur were maintained. Mortality replacement of seedlings has been done at jodhpur trial.

Growth data on individual from Jodhpur trial and analyzed. Highly significant variation was observed for collar diameter as well as height amongst families.

Survival percent in Jodhpur trial is 78 percent. Data has been analyzed. Analysis of variance reveals highly significant differences for height and color girth with respect to current year data. Ten parents namely JL-2, LB-2, LM-1, MTD-4, JL-5, JRM-2, T-1, K-1, RT-11, and MTD-2 exhibited positive values of general combining ability

Component III - Biotechnology

Co- Investigator: Dr. Tarun Kant, Scientist-E

Overview

Fresh experiments for shoot multiplication were initiated. Since Rooting is the biggest impediment in the development of the *in vitro regeneration* protocol for Khejri, the primary emphasis was on rooting experiments. Experiments with chronic auxin application (IBA and NAA used alone and in combination from 1.0 to 15 μ M supplemented in Whites medium for extended periods (4 +4 weeks) as well as acute auxin application (dipping in 5 and 10 mM IBA and NAA for 20 sec (Pulsing) followed by culture establishment was carried out. The second treatment gave better results, but the explants did not survive. Modifications to this pulse treatment are being tried out further.

Material for DNA extraction was collected from 16 Khejri trees (13 selected + diseased). DNA extraction, purification and quantification was completed. ISSR Marker Screening was completed.

Achievements

- Pulse treatment with IBA (5.0 mM) followed by transfer to hormone free medium gave better root initiation response compared to chronic treatment
- Material from 16 trees from different locations was collected in Rajasthan were collected and DNA extraction, purification and quantification was completed for DNA fingerprinting.

Component IV - Ecological Component

Co- Investigator: Dr. Abha Rani Gupta, Scientist-E

For abiotic stresses meteorological data viz. Maximum and Minimum temperature, relative humidity, rain fall evaporation and wind speed of Jodhpur district were collected for the month of April 2015 to March 2016. In Jodhpur district maximum rainfall was recorded in the month of July i.e. 173 mm and minimum i.e. 0.0 mm in the months of October 2015 to March 2016. Maximum temperature was recorded in the month of May i.e. 42.2 $^{\circ}$ C and minimum in December 2015 i.e. 10.2 $^{\circ}$ C. Maximum evaporation was recorded in the month

of May i.e. 14.2 mm and minimum in January 2016 i.e.3.5 mm. Highest wind speed was recorded in the month of June i.e. 8.1 Km/h and minimum in December i.e. 1.9 Km/h.

Ground water data (pre and post monsoon) of all 5 districts viz. Jodhpur, Nagaur, Churu, Jhunjhunu and Sikar were collected for the year 2014. The water depth was measured by piezometer (PZ) and dug well (DW). In Jodhpur district, (Phalodi block, Mokheri village) water level pre monsoon (141.30 m), post monsoon (145.30 m) and change in water level (-4.30 m) at maximum depth 275 m followed by Nagaur district (Jayal district, Bhawla village) water level pre monsoon (77.20 m), post monsoon (80.60 m) and change in water level (-3.45m) at 200 m depth, Jhunjhunu (Buhana block, Kalakhari village) water level pre monsoon (85.30 m), post monsoon (85.45 m) and change in water level (-0.15 m) at 150 m depth and Churu district (Sujangarh block, Gewarsar village)) water level pre monsoon (112.15 m), at 145 m depth were recorded. In Sikar district (Piprali district, Katrathal village) water level pre monsoon (75.98 m), post monsoon (77.28 m) and change in water level (-1.30 m), were recorded at minimum depth 138 m. In all the 5 districts change in water was in negative. Ground water data demonstrate the annual status of amount of rainfall occurred and rainfall recharge in the ground level.

Component V - Biochemical Studies

Co-Principal Investigator: Dr.Mala Rathore, Scientist-D and

Dr. Sangeeta Singh, Scientist-D

Data in nursery experiment to see the efficacy of Salicylic acid and Jasmonic against *Ganoderma* has been collected and analysis work in progress.

Analysis of bark and root samples of infected and healthy trees of *Prosopis cineraria* (Khejri) from different districts as identified by the protection Division experts was done for studying the variation for proline contents. In bark samples average proline content was less in healthy trees (1.08µmoles/gm) and higher in infected trees (5.15 µmoles/gm). This trend was same in root samples (4.99 µmoles/gm in healthy and 7.76 µmoles/gm in infected trees). Phenol determination of bark samples of infected and healthy trees of *Prosopis cineraria* (Khejri) from different districts was carried out. Phenol content of bark was higher in infected trees (6.1 mg/g) and lower in healthy trees (3.76 mg/g).

Component VI - Socio-Economic Component:

Co-Principal Investigator: Smt. Sangeeta Tripathi, RO

To assess the effect of khejri mortality on rural livelihood detailed socio-economic survey was carried out in 60, 75,86,85 and 76 villages, of Jodhpur, Churu Nagour, sikar and Jhunjhunu districts respectively in 2013. The No. of respondents in each village was 10. The fields which were selected in 2005 again revisited in 2013 for quantification of fuelwood and fodder. The loss of fuelwood and fodder quantified in each district (2005-13) is as under-

Jodhpur District : The analysis of data reveals that average family size is 7.04 with average family income per annum of Rs.79, 444/- .The average landholdings of the sampled households is 9.48 ha.

Fuelwood: During eight years (2005-2013) on an average, 27.46 kg/tree loss of fuel wood is recorded. Per tree, a total loss of Rs. 137/- is calculated at the prevailing rate of Rs. 5.00 per kg. due to infection in Khejri trees during past eight years in Jodhpur district.

Fodder (Loong): Similarly, total loss of fodder from 2005-2013 is recorded as 22394 kg. (25.47 kg./tree). Rs. 178/- monetary loss per tree @Rs.7/- per kg is recorded from fodder in Jodhpur district during 2005-2013. Data analysis for pod yield is under process.

Churu District: The analysis of data reveals that average family size is 7.58 with average family income per annum of Rs.73,800/- The average landholdings of the sampled households is 4.98 ha.

Fuelwood: The fields which were selected in 2005 again revisited in 2013 for quantification of fuelwood, fodder and pods. During eight years (2005-2013), a total loss in fuel wood is calculated as 35312 kg. On an average, 24.17 kg/tree loss of fuel wood is recorded. Per tree, a total loss of Rs. 121/- is calculated in lopped fuel wood at the prevailing rate of Rs. 5.00 per kg. due to infection in Khejri trees during past eight years in Jodhpur district.

Fodder (Loong): Similarly, total loss of fodder from 2005-2013 is recorded as 33189 kg. (22.72 kg./tree). Rs. 159/- monetary loss per tree @Rs.7/- per kg is recorded from fodder in Churu district during 2005-2013. Data analysis for pod yield is under process.

Nagour District : The analysis of data reveals that average family size is 10 with average family income per annum of Rs.71,877/- .The average landholdings of the sampled households is 19.8 ha.

Fuelwood: During eight years (2005-2013) on an average, 26.45 kg/tree loss of fuel wood is recorded. Total loss of Rs. 132/- is calculated at the prevailing rate of Rs. 5.00 per kg. due to infection in Khejri trees .

Fodder (Loong): Similarly, total loss of fodder from 2005-2013 is recorded as 30477 kg. (24.92 kg./tree). Rs. 174/- monitory loss per tree @Rs.7/- per kg was recorded.

Sikar District: The analysis of data reveals that average family size is 7.8 with average family income per annum of Rs. 72,262/-. The average landholdings of the sampled households is 19.0 ha.

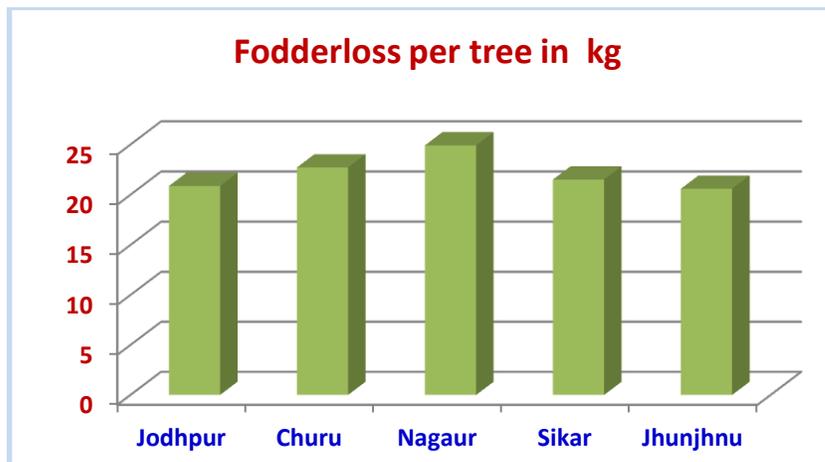
Fuelwood: During eight years (2005-2013), a total loss in fuel wood is calculated as 74739 kg. On an average, 25.38 kg/tree loss of fuel wood is recorded. Per tree, a total loss of Rs. 127/- is calculated in lopped fuel wood at the prevailing rate of Rs. 5.00 per kg.

Fodder (Loong): Similarly, total loss of fodder from 2005-2013 is recorded as 63353kg. (21.51 kg./tree). Rs. 151/- monitory loss per tree @Rs.7/- per kg was recorded.

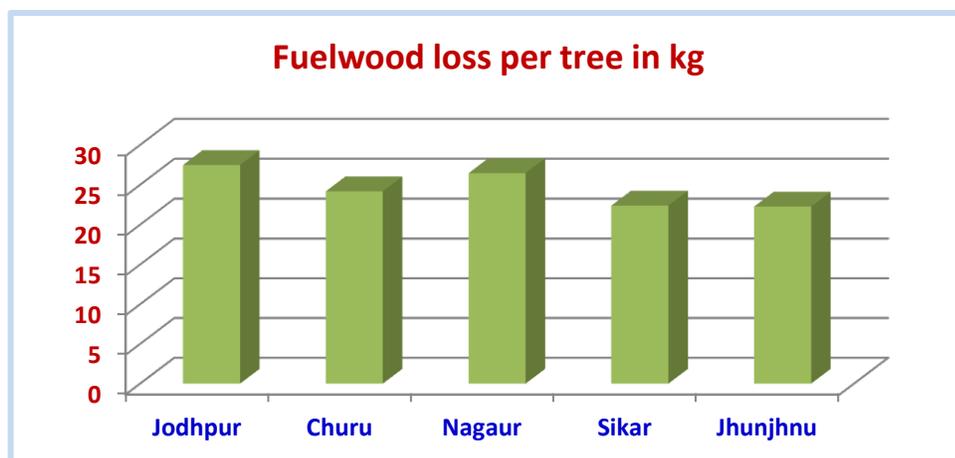
Jhunjhunu District: The analysis of data reveals that average family size is 7.2 with average family income per annum of Rs. 1,08,657/- respectively . The average landholdings of the sampled households is 23.8 ha.

Fuelwood: During eight years (2005-2013), a total loss in fuel wood is calculated as 23210 kg. On an average, 22.25 kg/tree loss of fuel wood is recorded. Per tree, a total loss of Rs. 111/- is calculated in lopped fuel wood.

Fodder (Loong): Similarly, total loss of fodder from 2005-2013 is recorded as 21488kg. (20.60 kg./tree). Rs. 144/- monitory loss per tree @Rs.7/- per kg was recorded.



Fig



Fig

Component VII - Extension Component:

Co-Principal Investigator: Mrs. Bhawana Shrama, Scientist-C

Khejri mortality problem and its management was demonstrated in various Kisan Melas through display board for public awareness. Pamphlets about management of Khejri mortality problem were also distributed to Farmers during these Melas.

Various groups of farmers came to visit institute from khejri mortality affected area therefore problem of Khejri mortality and its management was discussed and pamphlets were also distributed to them during their visit.

EXTERNALLY AIDED ONGOING PROJECTS

Project: 17 Phytoremediation of soil for productivity enhancement during land disposal of effluent (AFRI-113/FED/SFD-Raj/ 2011-16).

Principal Investigator: Dr. Abha Rani Gupta, Scientist E



Fig . Lysimeter experiment

An experiment was established utilizing the lysimeter tanks (Non-weighing type) during September 2012 in factorial completely randomized block design consisting of two factors namely irrigation and tree species. Under irrigation there were four levels namely i) normal water at $\frac{1}{2}$ ET (Control) ii) effluent water at $\frac{1}{2}$ ET, iii) effluent water at $\frac{3}{4}$ ET and iv) effluent water at 1.00 ET. For second factor there were seven (7) species namely *Azadirachta indica*, *Eucalyptus camaldulensis*, *Prosopis cineraria*, *P. juliflora*, *Tamarix aphylla*, *Salvadora persica* and *Salvadora oleoides*. Both the factors were combined together in all possible arrangement. Each treatment combination was repeated thrice thus there were 84 Nos. of plots *i.e.* lysimeter tanks. Data on growth parameters was recorded from September 2013 to March 2016 after start of irrigation treatment (effluent water and control) as per experimental setup. Quarterly data from March 2015- 2016 was subjected to analysis of variance using SPSS. Analysis of variance revealed that the tested tree species showed highly significant differences ($P=0.000$) for parameters *viz.* Height, collar diameter and crown diameter for all 5 intervals of growth. Analysis of variance for Irrigation level did not show significant differences for height for all 5 intervals, however crown diameter showed highly significant differences ($P= <0.01$) for all 5 intervals of growth. Analysis of variance for interaction between species and Irrigation showed non-significant differences for all the above three parameters of growth.

Followed by analysis of variance, the differences between the mean of species and irrigation for all the 3 parameters were tested using Duncan Multiple Range. In the present report only latest data of March 2016 for species and data of 2015 and 2016 in case irrigation is discussed. Amongst the species *Eucalyptus camaldulensis* exhibited maximum

height of 467.25 cm followed by *Azadirachta indica* (409.17 cm) and *Prosopis juliflora* (356.83cm) and were statistically different from each other. Height of *Salvadora persica* was recorded to be 225.92 cm which was at par with the height of *Tamarix aphylla* (203.92 cm) and *Prosopis cineraria* (200.25 cm). Height of *Salvadora oleoides* was recorded lowest (170.25 cm) which was at par with the height of *Prosopis cineraria* (200.25 cm) and *Tamarix aphylla* (203.92 cm). Similarly for collar diameter *Prosopis juliflora* was recorded maximum value (71.42 mm) and it was at par with the height of *Azadirachta indica* (71.03 mm) and significantly different than other species. *Salvadora oleoides* (39.17mm) and *Prosopis cineraria* (35.70 mm) exhibited lowest collar diameters and found to be at par. Similarly for crown diameter is concerned *Prosopis juliflora* ranked first with value of 355.20 cm followed by *Azadirachta indica* 260.20 cm and *Salvadora persica*- 226.04 cm and were statistically different from each other. Crown diameter of *Eucalyptus camaldulensis* was found lowest (182.5 cm) which was at par with the with *Prosopis cineraria* (197.08 cm), *Tamarix aphylla*- (186.87 cm) and *Salvadora oleoides* (185.42 cm).

As far as irrigation levels are concerned maximum height, collar diameter and crown diameter were recorded with Irrigation with Effluent water 3/4 ET which was at par with the irrigation with effluent water 1 ET and effluent water with 1/2 ET. Irrigation in Control 1/2 ET was found lowest height, collar diameter and crown diameter which was at par with irrigation with effluent water 1/2 ET with respect to Dec. 2015 data. However, March 2016 data Effluent water 3/4 ET shows maximum height which was at par with the irrigation with effluent water 1 ET, effluent water 1/2 ET and Control 1/2 ET. For collar diameter irrigation with effluent water 1ET was found maximum (58.74 mm) which was at par with the irrigation with effluent water 3/4 ET and Effluent water 1/2 ET. In control (Normal water at 1/2 ET) minimum collar diameter (50.38 mm) was recorded which was as par with the irrigation with effluent water 1/2 ET (53.62 mm) and effluent water 3/4 ET (58.74 mm). For crown diameter irrigation with effluent water 3/4 ET was found 248 cm which was at par with the irrigation with effluent water 1 ET (234 cm). Irrigation with effluent water 1 ET was at par with irrigation with effluent water 1/2 ET. In control irrigation 1/2 ET minimum crown diameter (205.11 cm) was recorded which was as par with the irrigation with effluent water 1/2 ET (223.69 cm).

Soil samples from lysimeter tanks were collected at 4 different depths (0-15 cm, 15-30 cm, 30-45 cm and 45-60 cm) and analyzed for physico-chemical parameters viz. pH, EC, available ammonical nitrogen, available nitrate nitrogen, available phosphorous, available potassium. In soil sample analysis no definite pattern was found. Effluent water given for irrigation was also analysed for quality water parameters.

Field experiment:

A field experiment was established in Forest Ecology field, AFRI, Jodhpur during September 2013. In field experiment 480 plant seedlings of ten forestry tree species viz. *Acacia nilotica*, *Ailanthus excelsa*, *Azadirachta indica*, *Eucalyptus camaldulensis*, *Prosopis cineraria*, *Prosopis juliflora*, *Tamarix aphylla*, *Tecomella undulate*, *Salvadora oleoide* and *S. persica* at the spacing 3 x 4 m² were planted in

Split Plot Design with three replications, consisting of irrigation as main plot and tree species as sub plot. Under irrigation there were 4 levels namely 1. Effluent water ½ ET, b. Effluent water 3/4 ET, c. Control ½ ET and d. Control ¾ ET.

In a subplot there were 10 species namely *Acacia nilotica*, *Ailanthus excelsa*, *Azadirachta indica*, *Eucalyptus camaldulensis*, *Prosopis cineraria*, *P. juliflora*, *Tamarix aphylla*, *Salvadora persica*, *Salvadora oleoides* and *Tecomella undulata*.. Data on growth parameters viz. height, collar diameter were recorded after start of treatment (effluent and control) as per the field experimental design. Data for crown diameter was recorded from Nov. 2015. Data from 2013-2015 were subjected to analysis of variance on yearly basis. Analysis of variance revealed that the tested tree species showed highly significant differences (P=0.000) for all the three growth parameters viz. Height and collar diameter and crown diameter.

In 2014 and 2015 Irrigation level showed highly significant differences for height and collar diameter at < 1% level except crown diameter at < 5% level like the lysimeter experiment Interaction variance between species and Irrigation did not show significant differences for height, collar diameter and crown diameter for all intervals of growth. Followed by analysis of variance, the differences between the species and irrigation using Nov. 2015 data for all the 3 parameters were tested using Duncan Multiple Range. The results indicated that, *Azadirachta indica* exhibited highest height growth (253.13cm) followed by *Eucalyptus camaldulensis* (218.14 cm) and these means were statistically significant. Height of *Acacia nilotica* (192.70 cm) was at par with the height *Prosopis juliflora* (178.88 cm). Height of *Tamarix aphylla* was recorded 136.16 cm which was at par with the height of *Ailanthus excelsa* (122.50 cm). Height of *Salvadora persica* was recorded to be 112.45 cm, which was at par with the height of *Ailanthus excelsa* (122.50 cm). *Salvadora oleoides* (57.53 cm) and *Prosopis cineraria* (60.88 cm) exhibited lowest height and found to be at par with each other. Similarly *Azadirachta indica* exhibited maximum collar dia. 33.29 mm which was at par with the collar dia. of *Ailanthus excelsa* (30.42mm). *Salvadora oleoides* (6.02 mm), *Prosopis cineraria* (8.76 mm) and *Tecomella undulata* (9.17 mm) exhibited lowest collar diameter and found to be at par. As far as crown diameter is concerned *Prosopis juliflora* (256.42 cm) outperformed other species. *Azadirachta indica* (152.62 cm) and *Acacia nilotica*

(139.37 cm) were found in similar group. *Ailanthus excelsa* (48.67 cm), *Prosopis cineraria* (54.31 cm) and *Tecomella undulata* (63.94 cm) exhibited lowest crown diameter and found to be at par.

On the basis of December 2015 data, maximum height (148.17 cm) were recorded in Irrigation with Effluent water 1/2 ET which was at par with the irrigation with control 3/4 ET (144.10 cm) and effluent water 3/4 ET (142.72 cm) but different than Control Irrigation at 1/2 ET (123.93 cm). For collar diameter irrigation with effluent water 1/2 ET exhibited maximum mean (21.09 mm) which was at par with that of irrigation with effluent water 3/4 ET and control 3/4 ET. Control 1/2 ET treatment showed minimum collar diameters (17.64 mm). For crown diameter irrigation with effluent water 1/2 ET was found to be best (118.42 cm) which was at par with the irrigation with effluent water 3/4 ET (115.86 cm) and control 3/4 ET (116.73 cm). Control irrigation with 1/2 ET though exhibited lowest mean it was at par with other irrigation treatments except effluent water 1/2 ET treatment.

From the results it was prejudiced that all the three growth parameters viz. height, Collar diameter and crown diameter is affected by species but not by irrigation levels. However both these factors influenced the growth independently as the interaction variance between them was found to be non significant. The results also indicated that as expected species has greater influence on growth parameters regardless of irrigation with effluent water. It is very interesting that in field experiment, maximum height and crown diameter was produced with irrigation effluent water 1ET while collar diameter was produced with irrigation effluent water 3/4 ET. Growth in these species indicates that they can be utilized to produce biomass utilizing effluent water.



Fig. Field experiment

Irrigation level data 2014 and 2015 showed highly significant differences for parameter height and collar diameter at < 1% level except crown diameter at < 5% level (P=.021). Interaction variance between species and Irrigation did not show significant differences for height, collar diameter and crown diameter for all intervals of growth. In field experiment all the mean of height, crown diameter and collar diameter for species and irrigation were analyzed using Duncan Multiple Range Test. On the basis of Nov. 2015 analysis *Azadirachta indica* exhibited highest height (253.13cm) followed by *Eucalyptus camaldulensis* (218.14 cm). Height of *Acacia nilotica* (192.70 cm) was at par with the height *Prosopis juliflora* (178.88 cm). Height of *Tamarix aphylla* was recorded 136.16 cm which was at par with the height of *Ailanthus excelsa* (122.50 cm). Height of *Salvadora persica* was recorded 112.45 cm, which was at par with the height of *Ailanthus excelsa* (122.50 cm). *Salvadora oleoides* (57.53 cm) and *Prosopis cineraria* (60.88 cm) exhibited lowest height and found to be at par. Similarly *Azadirachta indica* exhibited maximum collar dia. 33.29 mm which was at par with the collar dia. of *Ailanthus excelsa* (30.42mm). *Salvadora oleoides* (6.02 mm), *Prosopis cineraria* (8.76 mm) and *Tecomella undulata* (9.17 mm) exhibited lowest collar diameter and found to be at par. As far as crown diameter is concerned *Prosopis juliflora* (256.42 cm) outperformed other species. *Azadirachta indica* (152.62 cm) and *Acacia nilotica* (139.37 cm) were found in similar group. *Ailanthus excelsa* (48.67 cm), *Prosopis cineraria* (54.31 cm) and *Tecomella undulata* (63.94 cm) exhibited lowest crown diameter and found to be at par.

From the results it was prejudiced that height is affected by species but not by irrigation levels. Collar diameter is affected by species but not by irrigation levels. Crown diameter is affected by species as well as irrigation levels. The results therefore indicated that species has greater influence on growth parameters regardless of irrigation with effluent water.

Project: 18 Development of package for integrated management of insect pest and diseases (IPDM) and improvement of planting stock material of neem in (*Azadirachta indica*) through biofertilizers (AFRI- 12/FP/EXT(DST)/2014-17).

Principal Investigator: Dr. Sangeeta Singh, Scientist-D

Approximately 20 forest nurseries of Jodhpur, Barmer, Jaisalmer and Jalore district of Rajasthan were visited to study different diseases and insect pest infestation on neem seedlings. Samples of diseases and insect pests were collected and identified. Pathogens like *Fusarium*, *colletotrichum*, *phytophthora* and *macrophomina* were identified, and the loss

caused by them was approximately 3-5%. Among insect pests, scale insects, termites and myllocerus were observed but the major loss was caused by two mollusk species which was approx. 10-40%. Different sets of experiments were planned for management of these mollusks including botanicals, chemicals fungicides and bioagents and the work is in process. It was observed that extract of dhatura reduces the population of the mollusk to only 20%. Other botanicals are being tested.



Fig. Isabgol plants in field

Fig. Harvested isabgol husk and seeds

Project: 19 Species evaluation for landscaping and restoration of degraded Arravali Hills at IIM Udiaipur (AFRI- 13/FE/EXT(IIM, Udaipur)/2014-17).

Principal Investigator: Sh. N. Bala, Scientist-F

The project has been initiated during August 2014 with the aim to evaluate different tree & shrub species for their suitability in restoration of degraded hills. Survey of the site has been done and experimental details finalized with layout of the experiment. Suitable species selected depending on the site parameters. Arrangement has been made for the planting stock in collaboration with the forest department Advance soil working has been initiated with the help of state forest department involving Village Forest Protection and Management Committee (VFPMC). Plantation has been done along the boundary wall with 130 saplings of *Dendrocalamus strictus* and *Terminalia bellerica* in September 2014. Two thousand two hundred (2200) running m contour trench made in the experimental area. Two hundred sixty (260) notches of size 20 x 30 x 20 cm prepared for seed sowing. Nine hundred (900) seedlings of different species viz. *Terminalia bellerica*, *Ficus bengalensis*,

Dendrocalamus strictus, *Tamarindus indica*, *Wrightia tinctoria*, *Acacia catechu*, *Sterculia urens*, *Emblica officinalis*, *Mangifera indica*, *Ficus religiosa*, *Thespesia populnea* and *Anogeissus pendula* were planted in different blocks as per soil and land characteristics. Stump planting of *Boswellia serrata* has been done. Life saving irrigation provided. To protect the plants from browsing by Blue bull brushwood fencing made for individual plants. Seeds of different species were sown on the mounds of contour trench. Available trees, tree saplings and shrubs in the plantation area were pruned to give better shape.



Fig. Marking contour line



Fig. Sapling and stump planting at the site

ICFRE PLAN COMPLETED PROJECTS

Project: 20 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/ICFRE/2010- 2015).

Principal Investigator: Smt. Seema Kumar, Scientist-E

Check list of trees both exotic and indigenous species, shrubs, grasses and climbers species associated with *P. juliflora* in seven different agroclimatic zones prepared. Three species of Coleoptera (*Myloccerus* sp.) four species of Odonata, two species of Orthoptera, three species of Hemiptera, ten species of Hymenoptera, three species of Lepidoptera, two species of Mantodea and four species of Arachnida, found in association with *Prosopis juliflora* identified. One species of Hymenoptera: Formicidae (ant) is recorded for the first time from Rajasthan from Rajsamand district. *P. juliflora* is reported for the first time as new host for all insect species reported during the year. One lepidopteran and one coleopteran borer also reared from the seeds of Amaltash. Studies revealed that *P. juliflora* is utilized mainly as fuel

wood and source of energy. It is also largely utilized as biological fencing and dry thorny fencing in agriculture fields. Data Analysis and final writing of Project Completion Report is in progress.

EXTERNALLY AIDED COMPLETED PROJECTS: NIL

EXTERNALLY AIDED NEW ONGOING PROJECTS

Project: 21 Value additions of plants of agricultural and horticultural importance by application of root endophyte and nitrogen fixing prokaryote *Azotobacter* spp. 2015-2017

Principal Investigator: *PI:* Dr.Sangeeta Singh, Scientist-D

*Piriformospora indica*_a root endophyte known for its ability to promote growth in many plant species was tested along with a plant growth promoting bacteria in combination and alone on 4 different species of plant in nursery viz. neem (*Azadirachta indica*) and Khejri (*Prosopis cineraria*), senna (*Cassia angustifolia*) and isabgol (*Plantago ovata*). The formulations of bacteria and fungus and its consortia was provided by Amity university, Noida. Different parameters that were recorded included, flowering status, Percentage germination, collar diameter, shoot length, root length, number of leaves, biomass (wet and dry), Sturdiness quotient, Quality index and vigour index. On an average Treatment number T1 which consisted of *P. indica* alone showed better result and is at par to T2 consisting of combination of bacteria and fungus as compared to control and *Azotobacter* alone.

4. Forest and Climate Change

ICFRE PLAN ONGOING PROJECTS -Nil

EXTERNALLY AIDED ONGOING PROJECTS - Nil

ICFRE PLAN COMPLETED PROJECTS - Nil

EXTERNALLY AIDED COMPLETED PROJECTS - Nil

5. Forest Genetics Resource Management and Tree Improvement

ICFRE PLAN ONGOING PROJECT

Project: 22 Assessment of variability, improvement and refinement of cloning techniques of *Tecomella undulata* (sm.) Seem.(AFRI-04/FGTB /Int(ICFRE)Reg/2012-2017).

Principal Investigator: Km. Desha Meena, RO

Achievements:

To assess the genetic diversity in *Tecomella undulata*, leaf samples were collected from the identified trees and genomic DNA was extracted using the modified 2% CTAB method. Standardization of ISSR-PCR protocol and preliminary screening of 50 ISSR primers was completed. Data analysed for further finalisation of the primers.

Project: 23 All India Co-ordinated project for genetic improvement of *Melia composite* AFRI/10/Silva/Int(ICFRE) AICP/2012-17

Principal Investigator: P.H. Chawhaan, Scientist F

Multi-location progeny trials established at Godiwara (Jhunjhunu) Bassi (Jaipur), Jodhpur, Gandhinagar and Deesa were maintained. Collected individual tree data was compiled.

Replacement of mortality was done at Baasi and Ghodiwada trial. Enough seedlings were not available for replacement at Gandhinagar and Deessa. Data from five progeny trials was collected, compiled and tabulated. Analysis of New trials at bassi and Ghodiwada performed.

Differences amongst the families were found to be highly significant in both the trials for height as well as collar girth. Heritability in narrow sense in Bassi was 70 and 71 percent for height and 20 and 33 percent for collar girth at individual and family levels. These estimates for Ghodiwada were 18 & 37 and 28 & 51 respectively.

EXTERNALLY AIDED ONGOING PROJECT

Project: 24 Utilization of biotechnological tools for clonal propagation and supply of genetically superior trees of Neem, Ardu And Bamboo's (AFRI-06/FGTB/Ext(SFD-Guj) 2013- 2016). (Request for Extension)

Principal Investigator: Dr. I.D. Arya, Scientist G

Micropropagation protocol developed for Neem and Bamboo's were transferred to State Forest Department , Gujarat. Training imparted to SFD staff for handling tissue culture technology and using the protocol developed to produce tissue culture bamboo plants. Nearly 5000, in vitro shoots were supplied and these were further multiplied at SFD-Gujarat.

Macropropagation technique for neem developed. Neem, cuttings were treated with different concentration of IBA. 40% rooting was achieved in neem cuttings treated with 500 ppm IBA in case of mature, semi mature and mini cuttings.

EXTERNALLY AIDED NEW ONGOING PROJECT

Project: 25 Induction, evaluation and development of polyploides in *Azadirachta indica*.

Principal Investigator: P. H. Chawhaan, Scientist F

Reconnaissance surveys were conducted in Jodhpur area of Rajasthan and Palanpur Gujarat. Nineteen Nos. of phenotypically superior trees were marked and fruits were collected.

Collected fruits were de pulped and seed were extracted. In addition to this, seed were also collected from four seed sources. 22 kg of seeds from individual trees of good source and 37 kg seed of four seed sources in total were provided to FRI for onward supply to IFFCO. Seeds from these trees and seed sources were also germinated in nursery and seedlings are being raised.

Survey was conducted to identify the existing production populations. Five populations including three progeny trials have been identified. Details of these trials have been obtained for further work. Data from one provenance trial has been collected.

Seedlings from 16 phenotypically superior trees were raised and maintained.

Productivity studies and modelling growth & yield in Teak plantations in Gujarat State

Growth measurement viz. diameter at breast height, total height of trees, total No. of trees and area of sample plots etc were recorded. from 13 sample plots at Diviya, Sagarama, Sajara, Mazada, Piplod, Rajendrapur, Galkund, Taklipada, Chikhali

Similarly, five trees each from surrounding area of sample plots at Diviya, Sajara, Gulwani, Galkund, Taklipada, were felled in four forest Divisions for volume estimation. The recorded growth data entered, compiled and basic analysis of data was done.

Volume equations were developed.

ICFRE PLAN COMPLETED PROJECT

Project: 26 Development of technologies for multiplication of economically important desert plant – *Capparis decidua* (AFRI-105/FGTB/ICFRE/2010-2015).

Principal Investigator: Dr. Sarita Arya, Scientist F

Capparis decidua tissue culture protocol developed starting from axillary bud culture, in vitro shoot multiplication, in vitro rooting of in vitro shoots. Tissue culture raised plants were hardened in mist chamber and kept in shade house for acclimatization.

EXTERNALLY AIDED COMPLETED PROJECT – Nil

6. Forestry Education and Policy Research to Meet Emerging Challenges

6.1 Improving Formal Forestry Education

6.1.1 FRI University (Applicable for FRI, Dehradun only)

6.2 Accreditation of Universities

-NA-

6.3 Networking Forestry Education with research and extension

6.3.1 Participation in Seminar/Symposia/Workshop/Trainings

- **Dr. G. Singh** participated in GEF National workshop and taken part in discussion for formulation of PIF during 12-13th May 2015 organized by MoEFCC, New Delhi.
- **Dr. Abha Rani & S. R. Baloch** participated in two days National Seminar on Recent Innovation in Technical Terminology and Biodiversity organized by Commission for Scientific and Technical Terminology organized, Human Resources and Development Ministry at ZSI, Jodhpur Rajasthan from 11th to 12th August 2015.
- **S. R. Baloch** participated in National consultation on draft report of ICFRE coordinated project “Study –cum survey to assess the demand and supply of medicinal plants in India” at ICFRE, Dehradun from 23rd March 2016.
- **Dr. G. Singh** participated and presented view in Stakeholder dialogue on 'Environmental Governance in the Context of Sustainable Development in India organized on 14-15th July 2015 by TERI, New Delhi.
Dr. Bilas Singh, Research Officer attended national seminar on “Conservation Biotechnology and DNA Barcoding” at Gujarat Forest research Institute, Gandhinagar on 18th May 2015. The Seminar was organized by Gujarat Biodiversity Gene Bank, Gujarat State Biotechnology Mission, DST, Government of Gujarat.
- **Seema Kumar** attended two days National workshop on *Jaiv vividhta avum takniki shabdavali mei naveentam navachar* organized by Commission for Scientific & Technical Terminology and Desert Regional Centre, Zoological Survey of India from 11-12 August, 2015 held at DRC, ZSI, Jodhpur.
- **Seema Kumar** attended two days National workshop on *Vigyan avum engineering shabdavali mei naveentam navachar* organized by Commission for Scientific & Technical Terminology and Chartered

Institute of Technology (CIT) from 09-11 December, 2015 held at Abu Road, Sirohi.

- **Dr Tarun Kant** attended and gave a talk at the “International Conference on Biotechnology and Nanotechnology” (ICBN-2016), January 20-February 1, 2016 at The IIS University, Jaipur
- Dr Tarun Kant attended and gave a talk at the **103rd Annual Session of the Indian Science Congress Association (ISCA)**, January 2016 held at Mysore University, Mysore (Karnataka) India
- **Dr Tarun Kant** attended and gave a talk at the “National Seminar on Advances in Natural Science For Indigenous Development in India” organized by **Indian Science Congress Association’s Jaipur Chapter** and Department of Botany University of Rajasthan, Jaipur from 30th September – 2nd October 2015.
- **Dr Tarun Kant** attended and gave a talk at the “National Conference Recent Advances in Biological Sciences, Biotechnology and Sustainable Development“ from 18-19 March 2016 at MLS University, Udaipur”
- **Shri Uma Ram Choudhary** HOD, AF & Ext Division, attended the meeting of “Innovation platform meeting for the CGIAR Research Program on dry land systems” at Central arid Zone Research Institute, Jodhpur on 18th May 2015.
- **Shri Uma Ram Choudhary** HOD, AF&E Division, participated in District level World Environment Day celebration organized by Forest Department Jodhpur on 5th June 2015 and delivered a lecture to create awareness on environmental issues.
- **Shri Uma Ram Choudhary** HOD,AF&E,Division & **Shri Mahipal R.A.II** participated in Kharif Kisan Sammellan at Village Bawarli ,Panchayat Samiti Balesar,(Jodhpur), organized by Krishi Vigyan Kendra,(KVK),Central Arid Zone Research Institute,Jodhpur On 20th July,2015.Developed Technologies & research activities were displayed in the sammellan & a lecture was also delivered by Shri Choudhary to create awareness on environmental issues , importance of trees & raising of trees along with the agriculture.
- **Shri Uma Ram Choudhary** HOD and **Dr. Bilas Singh**, Scientist – B, AF & E Division participated in the Zonal Research and Extension Advisory Committee at Agriculture Research Station, Mondore on 1st September 2015. AFRI officials were also interacted with them and emphasized coordination with VVK’s for extension activities.

- AFRI, participated in “Jan Suchana Abhiyan” organized by Press Information Bureau, Jodhpur at Ummedpur village of Ahore Panchayat Samiti in District Jalore from 2nd September to 4th September, 2015. Developed technologies were displayed in the mela to create awareness on environmental issues and agro forestry. Shri. Uma Ram Choudhary, HOD, AF& E Division also delivered a lecture.
- **Shri Uma Ram Choudhary**, HOD, AF&E Division participated in Ozone layer Conservation Day on 16.09.2015 at Khejarali Kalan, Jodhpur and He addressed the people to create awareness.
- **Shri Uma Ram Choudhary**, HOD, AF&E Division participated in the Vanmahotsav at Sikarpura, Jodhpur on 20.09.2015 which was organized by Rajasthan Forest Department and He also delivered a lecture.
- AFRI participated in Kishan Mela at Central Arid Zone Research Institute Jodhpur on 24th September 2015. Developed technologies were displayed in the mela to create awareness on environmental issues and agro forestry.
- **Shri Uma Ram Choudhary**, IFS, Head, AF&ED delivered a lecture on “Agro Forestry” at “Amukhikaran Prashikan” workshop (batch-I) for newly elected Sarpanches of Jodhpur district organized by Zila Parishad, Jodhpur at Gram Sewak Prashikan Kendra Mandore, Jodhpur on 28/10/2015.
- Head, AF&E Division delivered a lecture on “Agro Forestry” at “Amukhikaran Prashikshan” workshop (batch-II) for newly elected Sarpanches of Jodhpur district organized by Zila Parishad, Jodhpur at Gram Sewak Prashikshan Kendra Mandore, Jodhpur on 04/11/2015.
- **Shri Uma Ram Choudhary**, Head, AF&E Division and **Dr. Bilas Singh**, Scientist-B participated in One day Workshop on “Agricultural Development for Western Dry Region” at CAZRI, Jodhpur. on 06/11/2015. Contributing in the discussion over issues of Agroforestry & Environment, Shri Choudhary emphasized inclusion of activities related to trees and Agroforestry in KVK activities.
- **Shri Uma Ram Choudhary**, Head, AF&E Division and **Dr. Bilas Singh** Scientist-B participated in “Crop Germplasm Field Day” at National Bureau of Plant Genetics Resources, Regional Station, CAZRI Campus, Jodhpur on 4/11/2015 and visited conserved crop germplasm area. Shri Choudhary delivered a lecture on the occasion.
- **Shri Uma Ram Choudhary**, IFS, Head, AF&E Division and **Dr. Bilas Singh** Scientist-B participated in district level “Science Exhibition” at Govt. Sr. Secondary School,

Chainpura, Jodhpur on 19/11/2015 and delivered lectures on the occasion. Developed technologies of AFRI were also displayed.

- AFRI participated in the Paschimi Rajasthan Udhog Hastshilp Utsav 2016 ,organized in Jodhpur under the aegis of District Industries Center, District administration, Jodhpur and Industries Association from 7.01.2016 to 17.01.2016., by putting a stall in the utsav. Developed technologies and research activities were demonstrated through posters, along with distribution of related brochures, folders and leaflets at the stall. Different forest products, seeds of forestry and grass species, different types of soils and seedlings of tree species raised by experimental nursery of institute, were also demonstrated. During the Utsav HOD AF & E division **Shri Uma Ram Choudhary** represented AFRI in the seminar on the subject, “Problems and Solutions for the Growth and Development of Pharmaceutical, Herbal Medicine and Medical Device Industries in Rajasthan”, on 13-01-2016. Shri choudhary celebrated on the research carried out in the medicinal plants & emphasized the need of growing these plants in Agro-Forestry.
- AFRI participated in the Arogyam – 2016 Mela organized by Ayurveda Department, Jodhpur, at Jodhpur from 28.01.2016 to 31.01.2016. HOD AF & E division **Shri Uma Ram Choudhary** I.F.S. & Shri Ratana Ram Lohra R.A.-I & Shri Mahipal Bishnoi R.A.-II represented AFRI in the Mela. Developed Technologies and Research activities of AFRI were demonstrated through posters along with forest products by putting a stall. Seedlings raised at AFRI nursery specially desert & medicinal species were demonstrated. Folders & leaflets related to medicinal plants were also distributed.
- **Shri Uma Ram Chaudhary**, HOD AF & E division and Dr. Bilas Singh Scientist- B represented AFRI in the Field Day on Mustard Production organized by Krishi Vigyan Kendra, CAZRI on 14.01.2016, Jodhpur at Lavera-kala Village of Panchayat Samiti, Bavdi under National Mission on Oilseeds and Oilpalm, in which around 300 farmers participated..Shri choudhary delivered a lecture on direct & indirect benefits from trees & their importance in reference to the global warming & conservation of environments & emphasized the need of Agro-Forestry. Dr. Bilas Singh celebrated upon various species for Agro-Forestry, enhancement in soil fertility due to Agro-Forestry & its other benefits. Developed technologies and research activities of AFRI were demonstrated through posters. Seedlings raised in AFRI nursery were demonstrated. Information booklet regarding research activities of AFRI & folders on other subjects were also distributed.
- **Shri Uma Ram Chaudhary** Head, Agroforestry & Extension division, participated in the Zonal Research and Extension Advisory Committee meeting of Zone IIb for KHARIF-2016 held at ARS Mandore on 29/12/16 & 1/3/16. On 1/3/16 Shri Chaudhary

gave a presentation about research activities, findings and extension activities of AFRI. Shri Chaudhary also celebrated on importance of trees like Khejri in Agroforestry with reference to climate change etc. Shri Chaudhary also emphasized for networking /linkage with KVK's.

6.3.2 Visits Abroad

-NIL-

6.4 Capacity Building Scientific and Management Cadre (Training Organized)

- Dr. G. Singh, Scientist G organized five days refresher training course for IFS officers as a course director on "**Integrated approach for sustainable development of fragile desert eco-system**" during 14-18th December 2015 at AFRI, Jodhpur.

7. Forestry Extension for Taking Research to people

7.1 Collection, Compilation and Publication of forestry reports/journals

7.1.1 Research Publications

National/International Journals

- B, Kamal, I.D. Arya, V. Sharma, and V.S. Jadon, (2016). In vitro Enhanced multiplication and molecular validation of Eucalyptus F 1 hybrids. *Plant Cell Biotechnology and Molecular Biology* 17(3&4): 167-175.
- Babita Rani, T.S. Rathore and Tarun Kant. Amplification of an ortholog of a vacuolar anion transporter gene (*AtCLC-c*) from *Lepidium sativum* L. *J. Phytol. Res.* 26(1&2): 59-66 (2013)-Note: *Journal published in 2015*
- G. Singh and T.R. Rathod, (2016). Productivity of *Cyamopsis tetragonoloba* in *Prosopis cineraria* and *Tecomella undulata* based agroforestry systems in Western arid region of India. *Scientia Agriculturae*, 13(2): 103-112.

- G. Singh, and B. Singh (2015). Rooting pattern and equations for estimating biomasses of *Hardwickia binata* and *Colophospermum mopane* trees in agroforestry system in Indian desert. *Research & Reviews: Journal of Botanical Sciences*, 4(1): 30-40.
- I.D. Arya and S. Arya (2015). In vitro shoot proliferation and somatic embryogenesis: Means of rapid bamboo multiplication. 10th World Bamboo Congress, Korea.
- K. Singh and G. Singh (2015). Roadside vegetation diversity of Jodhpur district and its role in carbon sequestration and climate change mitigation. *Advances in Forestry Sciences Cuiabá*, 2(2): 23-33.
- M, Choudhary, S, Jaiswal. R. Singh. I.D. Arya. and S. Arya (2015). A micropropagation protocol for mass multiplication of *Terminalia arjuna*- a valuable medicinal tree. *Advances in Forestry Science*, pp:1-6 Cuiabá, 2(1): Brazil.
- M. Choudhary, I. D. Arya. and S. Arya (2015). Effect of Sucrose, pH and agar on in vitro shoot multiplication of *Terminalia arjuna*- a cardiogenic tree. *J. Phytol. Res* 26(1&2): 27-30.
- Mala Rathore and Hemant Kumar (2016). '*Cordia gharaf*- A species of Medicinal and Nutritional Importance in Arid and Semi Arid Regions', Abstract in National Seminar on "Agriculture Resource Management for Sustainability and Eco-Restoration" at ICAR-Central Institute for Arid Horticulture, Bikaner, March 11-13, pp.3-4.
- Meeta Sharma, Noopur Sharma, K.K. Srivastava, and Ashok Parmar, (2016). Population dynamics of major insect pests on *Ailanthus excelsa* Roxb. and their management in arid and semi-arid areas of Rajasthan and Gujarat. *Indian Forester* (Communicated).
- N.K. Vasu and G. Singh (2015). Grasslands of Kaziranga National Park: problems and approaches for management. In: *Ecology and management of Grassland Habitats in India*, *Envis Bulletin*, 105-113.
- Neelam Verma, J.C. Tarafdar and K.K. Srivastava (2016). Effect of seasonal variation and site factors on AM population associated with *Prosopis cineraria* (L.) Druce. *International Journal of Advanced Research in Biological Sciences*, 3(2): 231-234, Available online at www.ijarbs.com.
- Neelam Verma, J.C. Tarafdar and K.K. Srivastava and Bhawana Sharma (2016). Arbuscular Mycorrhizal (AM) Diversity in *Acacia nilotica* subsp. *indica* (Benth.) Brenan under Arid Agroecosystems of Western Rajasthan. *International Journal of Advanced Research in Biological Sciences*. 3(3): 134-143, Available online at www.ijarbs.com
- Neelam Verma, J.C. Tarafdar and K.K. Srivastava and Bhawana Sharma (2016). Correlation of soil Physico-chemical factors with AM fungal diversity in *Ailanthus*

- excelsa* Roxb. under different Agroecological zones of Western Rajasthan. *International Journal of Life-Sciences Scientific Research (in press)*.
- Neelam Verma, J.C. Tarafdar and K.K. Srivastava, Bhawana Sharma and Rama Parmar (2016). Diversity of Arbuscular Mycorrhizal (AM) Species in *Acacia nilotica* subsp. *cupressiformis* (J.L.Stewart) Ali & Faruqi. under Arid Agroecosystems of western Rajasthan. *International Journal of Plant, Animal and Environmental Sciences*. 6(2):28-34, Available online at www.ijpaes.com
 - R. Neelima, S. Arya and I.D. Arya. (2015). Micropropagation protocol for mass multiplication of *Stevia rebaudiana* Bertoni: A Natural Sweetener. *RR Jour. of Biotechnology*.ISSN:2347-7245, volume 5(1):28-34.
 - R. Singh, S. Arya, K. Arora, , M. Choudhary and I.D. Arya (2015). Micropropagation of *Barleria prionitis* var. *Dicantha* : an ethnomedicinal plant. *Advances in Forestry Science*, 2(4) : 73-78. Brazil.
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Technologies published

7.1.2 National Forest Library and Information Centre (NFLIC) (Applicable for FRI, Dehradun only)

-NA-

7.1.3 Environmental Information System (ENVIS) (Applicable for FRI, Dehradun only)

7.2 Dissemination of developed technologies

7.2.1 Van Vigyan Kendras (VVKs) and Demo Villages (DVs)

Budget was not allotted under VVK-DV in the progress year. Hence, any activities were not taken.

7.2.2 Direct to Consumer Scheme

7.2.3 Technologies transferred

- NIL -

Technology developed

7.3 Evolving and coordinating comprehensive extension strategies in forestry research

7.3.1 SLEM/UNCCD

NIL

7.3.2 Seminars/Symposia/Workshops organized

Dr. G. Singh participated in GEF National workshop and taken part in discussion for formulation of PIF during 12-13th May 2015 organized by MoEFCC, New Delhi.

Dr. G. Singh participated and presented view in Stakeholder dialogue on 'Environmental Governance in the Context of Sustainable Development in India organized on 14-15th July 2015 by TERI, New Delhi.

Dr. Abha Rani & S. R. Baloch participated in two days National Seminar on Recent Innovation in Technical Terminology and Biodiversity organized by Commission for Scientific and Technical Terminology organized, Human Resources and Development Ministry at ZSI, Jodhpur Rajasthan from 11th to 12th August 2015.

S. R. Baloch participated in National consultation on draft report of ICFRE coordinated project "Study –cum survey to assess the demand and supply of medicinal plants in India" at ICFRE, Dehradun from 23rd March 2016.

7.3.3 Special Activities (Such as Van Mahotsava, Forestry Day and Other Occasions)

I. International Biodiversity Day on 22nd May 2014

International Biodiversity Day celebrated at AFRI Conference Hall on 22nd May 2015.. AFRI staff & Forest officials from State Forest Department were present on this occasion. Shri N. K. Vasu Director AFRI said that Biodiversity Day should be celebrated like a festival and every citizen must try to conserve & enhance the biodiversity in his own field. He emphasized that vegetation existing in nature has got its own importance and no plant and animal is useless, everything has got its own importance in eco-system. Shri Vasu, also delivered a detailed lecture about his own experience of wildlife conservation in Kaziranga National Park, Assam.



Fig.

On this occasion senior scientist Dr. G. Singh in his celebration on biodiversity delivered a lecture on different plants existing in desert area. He presented data on biodiversity while expressing his views on sustainable development by biodiversity & mutual relationship of different plants with another plants. Dr. Ranjana Arya scientist AFRI, also delivered a lecturer on plantation and biodiversity in salty soils. She deliberated in detail about different types of plants existing in saline areas.



Fig .

Shri B. R. Bhadu, Group Coordinator Research and Shri Uma Ram Choudhry, Head, Agroforestry & Extension, Division, also expressed their views on biodiversity. Shri Mahendra

Singh Rathore, DCF (wildlife), Jodhpur delivered a lecture about development of Machia Biological Park ,Jodhpur and biodiversity whereas Shri R.K. Singh, DCF, Jodhpur delivered a lecture about biodiversity of Thar Desert and its conservation in future. Shri B. R. Bhadu Group Coordinator Research, AFRI gave vote of thanks.

Programme at AFRI Experimental Nursery to conclude the rally organized by Forest Division, Jodhpur on the occasion of Biodiversity day

On this occasion, in the morning, Forest Division Jodhpur, organized a rally for creating awareness in public about International Biodiversity Day. Rally started from Tagore Secondary School. Students of Tagore Secondary school, Madhuban Housing Board, Jodhpur and staff of Forest Division ,Jodhpur participated in the rally. Rally was concluded at AFRI Experimental Nursery. On reaching at nursery, participants of rally visited the high tech nursery and Shri Uma Ram Choudhry, Head Agroforestry & Extension, Division, explained the appropriate methods for raising the seedlings. During their visit Shri Sadul Ram Devra also helped in imparting knowledge of nursery technique. Then in the concluding programme importance of International Biodiversity Day and various features of biodiversity conservation were highlighted by different speakers. Sh. R.K. Singh, DCF, Jodhpur narrated different features of biodiversity conservation to students and others present. Sh. Praveen Chawhaan, Head ,Silviculture Division deliberated on plant biodiversity. Sh. V. S. Dave, ACF, Jodhpur gave thanks to all.



Fig.....

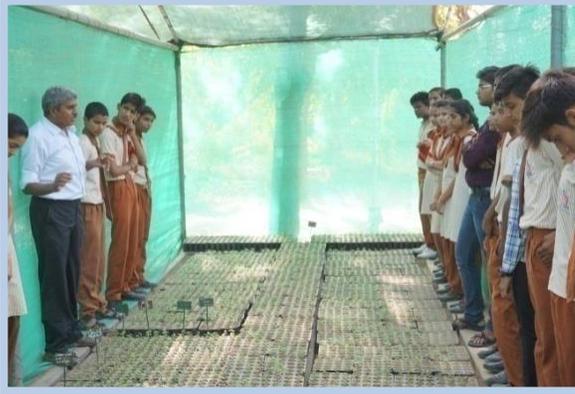


Fig.....



Fig.....

II. World Environment Day (5th June 2014)

World Environment Day was celebrated at Arid Forest Research Institute (AFRI), Jodhpur on 5th June 2015. Shri N.K. Vasu, Director AFRI addressed the issue of the vulnerability of human existence due increasing environment degradation and the role and responsibility of every citizen toward sustainable use of existing resources.

The theme of this year's World Environment Day was 'Seven Billion Dreams. One Planet. Consume with Care'. In the programme, views based on facts and presentations were invited in context of "Consume with care", water, energy and food resources of Rajasthan, Gujarat and Dadra and Nagar Haveli. Dr. Tarun Kant, Scientist – E, and Shri Mahendra Singh Rathore, DFO (WL), Jodhpur delivered lectures on the occasion. Initially Shri Uma Ram Choudhary, HOD, AF&E Division, briefed about the programme. A Cleaning campaign by AFRI Officials was also organized to clean campus of AFRI.



Fig.....



Fig.....



Fig.....



Fig.....

III. Combating Desertification Day (17th June 2014)

Maru Prasar Rok Divas (Combating Desertification Day) was celebrated on 17th June 2015 at AFRI Campus. Shri N.K. Vasu, Director, AFRI addressed the immense contribution of indigeneous lifestyle of People living in deserts from centuries in the conservation and sustainable use of the resources and environment conservation in desert. HOD AF & E Shri Uma Ram Chuadhary presented the outline of the programme along with the deliberation on the land conservation traditions and the need of land conservation for food security.

Dr. G. Singh, Scientist – F presented the data on the land degradation in context of Rajasthan, Gujarat and Dadra and nagar Haveli. and Shri R.K. Singh, DFO, Jodhpur stressed the need of holistic approach in drafting of the Agroforestry models. A discussion was also organized on the theme of this years celebration, “Attainment of Food Security for All, Through Sustainable Food Systems”. A plantation campaign by AFRI Officials was also organized at AFRI campus and seedlings of different species were planted.



Fig.....



Fig.....



Fig.....



Fig.....

IV. Van Mahotsav (19th July 2014)

Van Mahotsava was organized in AFRI jodhpur on 7th August 2015 in the Arboratum of the institute. The chief guest of the celebration Chief Forest Conservator, Jodhpur Dr. G. S. Bharadwaj (IFS). He said in his address on the occasion that, "Trees are the ornaments of the earth and the existence of human life is not possible without trees." He also enlisted the direct and indirect gains from the forest and the evolution of new species through them. In his presidential address Director AFRI, shri N.K. Vasu (IFS) stressed the need of keeping the whole ecosystem clean, along the tree plantation and their conservation, so that we could provide our future generation with the legacy of a healthy and hygienic atmosphere. He said that there is a proper place for each and every organism in the ecosystem and environment conservation can be done by their maintaining the delicate balance of their dynamic interactions.

Group Coordinater Research Shri. B.R.Bhadu (IFS) elaborated the sacrifices by Amrita devi and other 363 other people to protect Khejri and evoked all people to protect environment

and forest in their own individual ways. On this occasion Mandal Forest Officer, R.K.Singh, Dr. G. Singh, Dr. Ranjana Arya and HOD Agroforestry and Extension shri Uma Ram Chaudhary (IFS) also presented their views on the forest conservation.

Plantation of Different species was also done in the Arboratum on this occasion.



Fig.....



Fig.....



Fig.....



Fig.....

Other extension activities

Other Extension Activities - Total 1475 visitors from various background visited AFRI and its Interpretation and Extension Centre during 2015-16. Total 683 students from different universities, colleges, schools, 6 IAS officers, 60 IFS, 4 IES, 60 SFS 109 Forest Rangers, 7 reporters, 120 farmers and 11 other persons were included in these diverse group of visitors.

V. Participation in Kisan Mela/Exhibition/Trade fair etc:

VII. Vigilance Awareness Week

शुष्क वन अनुसंधान संस्थान, जोधपुर में सतर्कता जागरूकता सप्ताह दिनांक 26.10.2015 से 31.10.2015 का आयोजन किया गया। सप्ताह की शुरुआत में दिनांक 26.10.2015 को महानिदेशक, भारतीय वानिकी अनुसंधान एवं शिक्षा परिषद, डॉ. अश्विनी कुमार की उपस्थिति में आफरी निदेशक श्री एन.के.वासु ने संस्थान के समस्त अधिकारियों एवं कर्मचारियों को सतर्कता संबंधी शपथ दिलाई। इसी क्रम में दिनांक 27.10.2015 को पोस्टर प्रतियोगिता “सुशासन में निवारक सतर्कता” विषय पर आयोजित की गई। दिनांक 28.10.2015 को “प्रभावी सतर्कता एवं सुशासन में इसकी भूमिका” विषय पर निबन्ध प्रतियोगिता का आयोजन किया गया। दिनांक 29.10.2015 को नारा प्रतियोगिता “प्रभावी सतर्कता” विषय पर आयोजित की गई।



दिनांक 30.10.2015 को “सुशासन में निवारक सतर्कता का योगदान” विषय पर व्याख्यान रखा गया। कार्यक्रम के दौरान सतर्कता अधिकारी डा.जी.सिंह ने सतर्कता संबंधी नियमों, क्रियाकलापों एवं दिशा निर्देशों के बारे में विस्तृत जानकारी देते हुए इस संबंध में समय समय पर विभिन्न जानकारियों के प्रेषण एवं पारदर्शिता तथा सुशासन संबंधी जानकारी प्रदान की। श्री बलदेव राम चौधरी, निदेशक, राजस्थान न्यायिक अकादमी, जोधपुर जो कि कार्यक्रम

के मुख्य अतिथि थे द्वारा सतर्कता एवं जागरूकता पर संस्थान के अधिकारियों एवं कर्मचारियों को संबोधित किया गया तथा यह बताया कि सरकारी कार्यप्रणाली में किस प्रकार से सतर्क एवं जागरूक रहने की आवश्यकता है। उन्होंने इस विषय पर कई कानूनी पहलुओं से भी अवगत करवाया। इस अवसर पर संस्थान के निदेशक श्री एन.के.वासु ने भी संस्थान के अधिकारियों एवं कर्मचारियों को संबोधित किया एवं अपील की कि सभी अपना कार्य पूर्ण, मेहनत, लगन व निष्ठा से करें एवं प्रत्येक कार्य में सतर्क एवं जागरूक रहे।

इसी क्रम में विभिन्न प्रतियोगिताओं में भाग लेने वाले कर्मचारियों एवं अधिकारियों को स्मृति चिन्ह एवं प्रमाण पत्र प्रदान कर सम्मानित किया गया।



सप्ताह के अंतिम दिन यानि दिनांक 31.10.2015 को पोस्टर प्रतियोगिता के समस्त पोस्टरों को संस्थान के डिस्पले बोर्ड पर लगाया गया ताकि अधिक से अधिक लोग इन्हे देखे व इससे लाभान्वित हो सके ।

7.4 Consultancy Services

- Analysis of soil samples from different parts of Rajasthan using standard methods for the World Forestry Center (ICRAF), South Asia Regional Office, NASC Complex, New Delhi.
- Analysis of soil samples from different parts of Rajasthan was done for total C & N, P, K, Ca, Mg, CEC, exchangeable bases, exchangeable Al content and pH using standard methods. The report has been communicated electronically.
- Project entitled 'Suitability of High TDS Effluent Water for Growth of Forestry Tree Species' funded by Jasol Water Pollution Control and Treatment Trust, Jasol and Balotra Water Pollution Control and Research Foundation Trust, Balotra, District Barmer, Rajasthan. Provided technical guidance and submitted a report for suitability of using high TDS Effluent waste water for growing tree species.



Fig. CETP Balotra



Fig. Dead *Prosopis juliflora* & *Acacia nilotica* tree species at Balotra HRTS

7.5 Activities of Rajbhasha

राजभाषायी गतिविधियाँ 2014-2015

2015-16 के दौरान संस्थान का हिन्दी पत्राचार **80.00** फीसदी रहा तथा फाइलों में लक्ष्य से अधिक टिप्पणियाँ हिन्दी में लिखी गई। निर्धारित चार तिमाही बैठकें राजभाषा विभाग के निर्देशानुसार आयोजित हुईं। नराकास की नियमित बैठकों में भाग लिया गया तथा संस्थान की हिन्दी प्रगति से उन्हें अवगत कराया गया। नवनियुक्त लिपिकों को हिन्दी टंकण का सारांश सॉफ्टवेयर पर प्रशिक्षण दिलाया गया। संस्थान की वेबसाइट को द्विभाषी किया गया। राजभाषा विभाग के निर्धारित लक्ष्यों की प्राप्ति हेतु आवश्यक कदम उठाए गए। संस्थान के अधिकांश कर्मचारी हिन्दी में प्रवीण हैं तथा हिन्दी में कार्य करते हैं। शीर्षस्थ प्रशासनिक बैठकों में वार्तालाप/कार्यवाहियाँ पूरी तरह हिन्दी में हुईं। विस्तार गतिविधियों के अंतर्गत हितग्राहियों, प्रशिक्षुओं, विद्यार्थियों आदि को शोध आधारित जानकारी हिन्दी तथा मिली-जुली भाषा में दी गई। दिनांक 14 से 28 सितम्बर 2015 के दौरान संस्थान में **हिन्दी पखवाड़ा** आयोजित किया गया जिसमें प्रश्नोत्तरी, टंकण, निबंध, अनुवाद, सामान्य प्रशासनिक

ज्ञान प्रतियोगिता, सामान्य कार्यालयीन ज्ञान प्रतियोगिता व स्व-रचित कविता पाठ प्रतियोगिताओं का आयोजन किया गया। हिन्दी पखवाड़ा के दौरान हिन्दी में वैज्ञानिक व्याख्यानमाला व नव-नियुक्त कर्मचारियों के लिए हिन्दी कार्यशाला का भी आयोजन किया गया जिसमें राजभाषा नीति एवं नियमों की जानकारी प्रदान की गई।



हिन्दी पखवाड़ा के दौरान संस्थान के कर्मियों को संबोधित करते हुए निदेशक

7.6 Awards and Honours

Dr Tarun Kant received the “**B.P. Pal Memorial Gold Medal**” by the Honorable Prime Minister Shri Narendra Modi during the 103rd Annual Session of the Indian Science Congress at Mysore University on 3rd January 2016

8. Administration and Information Technology

8.1 Information Technology

The existing IT infrastructure was maintained properly with the help of annual maintenance contract of network. The leased line provided by the National Knowledge Network (NKN) was maintained and 24 x 7 internet connectivity was provided to the users. Several video conferencing sessions were organized during the year. The Hindi and English website of the institute was shifted to the ICFRE web server and updated regularly throughout the year. The reports of the important events held at the institute were

uploaded on the institutes as well as on the ICFRE websites. The PIMS and Payroll modules of IFRIS were run successfully throughout the year. The annual report, RPC presentations and other important documents of the institute were prepared. Other tasks related to the Information Technology were performed during the year.

8.2 Sevottam:

8.2.1 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, AFRI has identified its thrust areas based on the inputs and active participation of different stake holders. The 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,
2. Development of technologies for afforestation of stress sites,
3. Seed handling, nursery, plantation techniques and management,
4. Planting stock improvement and biotechnology,
5. Biofertilizers and biopesticides,
6. Phytochemistry; non-wood forest products,
7. Biodiversity conservation and climate change,
8. Agroforestry and JFM,
9. Forestry education & extension.

Procedures have been formulated for identifying the research problems of the arid region; developing the projects based on the problems and dissemination of the research results and technologies to the users. In order to identify the research problem, stakeholders meeting are organized in the two states viz. Rajasthan and Gujarat falling under the jurisdiction area of the institute. Officials from SFD's, progressive farmers, scientists and NGO's participate in the stakeholders meeting and express the problems on which the research is required.

Based on the research problems given by the stakeholders, in house discussions are made amongst the scientists of the institute and the research projects are formulated by the scientists after the thorough review of scientific literature.

The projects are sent to the external experts for evaluation and their suggestions. After incorporating the suggestions/modifications, the projects are presented before the Research Advisory Group (RAG) Meeting. After including suggestion of RAG members if any, revised projects are prepared and progress of the ongoing projects presented in the Research Policy Committee (RPC) meeting for approval. After the approval of projects, the funds are allotted for the projects and the projects are executed by the scientists.

The technologies developed through the projects are extended/demonstrated to the end users with the help of demonstration trails, extension trainings, Van Vigyan Kendras, Demovillage, printed material, radio talk, workshops, conferences and publications upload to the website of the institute.

8.2.2 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, and 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 on 20th August 2014 and at Forest Training Research Center, Gandhinagar on 19th September, 2014. RAG Meeting of AFRI was held on 13-14th November, 2014. New project proposals of various divisions were presented by the PIs. RAG Meeting was chaired by Director, AFRI. Projects approved by RAG were sent to ICFRE for the RPC approval

Several extension trainings were held during the year for dissemination of research results of the various projects executed in the institute. Two issues of the AFRI darpan (quarterly magazine) of AFRI were published in order to apprise the public about the research findings of the institute. The research results of the projects, the technologies developed by the institute and the events held at the institute were continuously updated on the website of the institute.

In addition to these, environmental awareness programs were organized by the institute in the form of World Environment Day, Biodiversity Day, Combating Desertification Day and Van Mohotsava, the details of which have been mentioned above.

8.2.3 Details of Training Programmes, Workshops, etc. held for proper implementation of Charter: Mentioned above under point No. 6.4 & 7.3.2

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

8.2.5 Details if internal and external evaluation of implementation of Charter in the Organization and assessment of the level of satisfaction among Citizen/Clients:

All the new projects and progress of the ongoing research projects were presented to the internal and external experts of the Research Advisory Group, who gave their comments on the quality of the new projects and the progress of the ongoing projects. The experts prioritized the new projects and expressed their satisfaction on the progress of the ongoing projects.

8.3 Welfare measures for the SC/ST/Backward /Minority communities

To promote the general interest of SC/ST/OBC employees and to work for their collective betterment, development and upliftment, AFRI SC/ST/OBC Employees Welfare Association was formed on 20th September, 2012 by formulating the BYLAWS and electing the Executive Committee of twelve members. As per the DOPT's guidelines for various social groups, Liaison Officers had been nominated during 2012-13 as below:

- Sh. P.H. Chawhan, Scientist F, Chief Liason Officer
- Sh. N.Bala, Scientist E, Liaison Officer, SC
- Sh. S.L. Meena, RO, Gr-I, Liaison Officer, ST
- Sh. A.S. Chouhan, RA-II, Liaison Officer, OBC

For promotion/recruitment process, roaster has been maintained in AFRI, Jodhpur as per guidelines of the GOI. The roaster usually checked by the liaison officer at the time of considering promotion/recruitment for SC/ST/OBC. The roaster has been signed by the concerned liaison officers.

To spread the message of equality and harmony among the various sections of the society the SC/ST/OBC Employees Welfare Association of A.F.R.I made their efforts to celebrate the Dr. Ambedkar Jayanti on 14th April 2015 to commemorate the birthday of Baba Saheb Ambedkar. Mr. N.K. Vasu Director,

A.F.R.I presided over the program to pay homage to Baba Saheb Ambedkar on his 124th Birth anniversary. Dr. Ranjana Arya Scientist-G, Dr. U.K. Tomar, Scientist-F Sh. K.C. Gupta Hindi Officer and Sh. K.S. Parmar P.S. also addressed the gathering on the ideals of Dr. Bhim Rao Ambedkar and his teacher Jyotiba Fule. Sh. P.H. Chawaan, Scientist-F and Chief Liason Officer of the AFRI Cell and Sh. S.R. Baloch, Scientist-C and Secretary SC/ST/OBCs Employees Welfare Association addressed about the immense contribution of Dr. Bheem Rao Ambedkar for the down trodden people of India. Scientist/Officers/Staff of AFRI had assembled for the program.



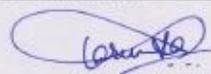
10 Annexure

Annexure 1 -RTI

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

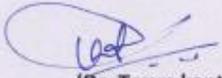
Headquarters / Institutes	Appellate Authorities	Public Information Officers	Subject matter(s) allocated
Arid Forest Research Institute	N.K. Vasu, Director, AFRI 0291-2722764 Email: dir_afri@icfre.org Phone : 0291-2742549 FAX : 0291-2722764	Dr. Tarun Kant, E, FGTB Division, AFRI Email: tkant@icfre.org Phone : 0291-2729143 FAX : 0291-2722764	All matters related to AFRI, Jodhpur

Annexure 1-A (April to June 2015) Quarterly Returns:

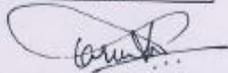
RTI Annual Return Information System													
Quarterly Return Form													
Public authority : Ministry of Environment & Forests													
Quarter – IV (April to June ,2015)													
Year: 2015-16													
Mode Insert :				Status : New Return									
Progress during the month													
	Opening Balance as on beginning of qtr.-III	No. of applications received as transfer from other PA's U/S 6 (3)	Received during the Quarter (including cases transferred to other Public Authority)	No. of cases transferred to other PA's U/S 6 (3)	Decision where requests/ appeals rejected.	Decision where requests/ appeals accepted							
Requests	Nil	04	09	Nil	Nil	09							
First Appeals	Nil	Nil	Nil	Nil	Nil	Nil							
No. of CAPIOs designated		No. of CPIOs designated		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 fees collected (in Rs.) U/s 7(3)	Penalties 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)									
50/-	06	Nil		Nil									
Block III (Details of various provisions & 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 sec.25(5)	Where action is initiated to comply with recommendation of Commission .				Details thereof (Max. 250 chars.)							
		-Select-											
		-Select-											
		-Select-											
		-Select-											
If the public authority made any changes in regard to its rules/regulations/procedure 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 website 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 IT-Cell of the Institute								
 (Dr. Tarun Kant) Public Information Officer, AFRI, Jodhpur.													

Annexure 1-B (July to September 2015) Quarterly Returns:

RTI Annual Return Information System													
Quarterly Return Form													
Public authority : Ministry of Environment & Forests													
Quarter – II (July to Sept. ,2015)													
Year: 2015-16													
Mode Insert :				Status : New Return									
Progress during the month													
	Opening Balance as on beginning of qtr.-III	No.of applications received as transfer from other PA's U/S 6 (3)	Received during the Quarter (including cases transferred to other Public Authority)	No. of cases transferred to other PA's U/S 6 (3)	Decision where requests/ appeals rejected.	Decision where requests/ appeals accepted							
Requests	Nil	02	Nil	Nil	Nil	02							
First Appeals	Nil	Nil	Nil	Nil	Nil	Nil							
No. of CAPIOs designated		No. of CPIOs designated		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 fees collected (in Rs.) U/s 7(3)	Penalties 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)									
Nil	Nil	Nil		Nil									
Block III (Details of various provisions & 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 sec.25(5)		Where action is initiated to comply with recommendation of Commission .				Details thereof (Max. 250 chars.)						
			-Select-										
			-Select-										
			-Select-										
			-Select-										
If the public authority made any changes in regard to its rules/regulations/procedure 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 website 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 IT-Cell of the Institute						


(Dr. Tarun Kant)
 Public Information Officer,
 AFRI, Jodhpur.

Annexure 1-C (October to December 2015) Quarterly Returns:

RTI Annual Return Information System													
Quarterly Return Form													
Public authority : Ministry of Environment & Forests													
Quarter – III (Oct.,2015 to Dec., 2015)													
Year: 2015-16													
Mode Insert : Status : New Return													
Progress during the month													
	Opening Balance as on beginning of qtr.-III	No.of applications received as transfer from other PA's U/S 6 (3)	Received during the Quarter (including cases transferred to other Public Authority)	No. of cases transferred to other PA's U/S 6 (3)	Decision where requests/ appeals rejected.	Decision where requests/ appeals accepted							
Requests	Nil	02	Nil	Nil	Nil	02							
First Appeals	Nil	Nil	Nil	Nil	Nil	Nil							
No. of CPIOs designated				No. of CPIOs designated				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 fees collected (in Rs.) U/s 7(3)	Penalties 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)								
Nil	Nil	Nil			Nil								
Block III (Details of various provisions & 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 sec.25(5)	Where action is initiated to comply with recommendation of Commission .				Details thereof (Max. 250 chars.)							
		-Select-											
		-Select-											
		-Select-											
		-Select-											
If the public authority made any changes in regard to its rules/regulations/procedure 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 website 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 IT-Cell of the Institute					
 (Dr. Tarun Kant) Public Information Officer, AFRI, Jodhpur.													

Annexure 1-C (January 2016 to March 2016) Quarterly Returns:

**RTI Annual Return Information System
Quarterly Return Form**

Public authority : Ministry of Environment & Forests
 Quarter – IV (January, 2016 to March, 2016)
 Year: 2015-16
 Mode Insert : Status : New Return

Progress during the month						
	Opening Balance as on beginning of qtr.-III	No. of applications received as transfer from other PA's U/s 6 (3)	Received during the Quarter (including cases transferred to other Public Authority)	No. of cases transferred to other PA's U/S 6 (3)	Decision where requests/ appeals rejected.	Decision where requests/ appeals accepted
Requests	Nil	02	Nil	04	Nil	06
First Appeals	Nil	Nil	Nil	Nil	Nil	Nil

No. of CAPIOs designated	No. of CPIOs designated	No. of AA's designated
01	01	01

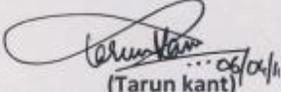
Block II (Details about fees collected, Penalty imposed and disciplinary action taken)			
Registration Fee collected (in Rs.) U/s 7(1)	Additional fees collected (in Rs.) U/s 7(3)	Penalties Amount recovered (in Rs.) as directed by CIC U/s 20(1)	No. of cases where disciplinary action taken against any officer U/s 20(2)
40/-	180/-	Nil	Nil

Block III (Details of various provisions & 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 sec.25(5)	Where action is initiated to comply with recommendation of Commission .	Details thereof (Max. 250 chars.)
		-Select-	

If the public authority made any changes in regard to its rules/regulations/procedure 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 website 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 IT-Cell of the Institute


(Tarun Kant)
 Public Information Officer,
 AFRI, Jodhpur.

Annexure 2 Email and Postal Address

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

Annexure 3 Intellectual Property

a. Patent Property – NIL

3.2 Others – NIL