Annual Report

2019-2020

Arid Forest Research Institute

Jodhpur

CONTENTS

Overview

AFRI Institute has executed Plan Projects as well as Externally Funded Projects of different funding agencies of Government of India. During 2019-20, Five plan projects and two externally aided have been successfully completed, whereas 9 Plan Projects and 3 externally funded projects are ongoing. During this period, one new plan project was initiated.

Beside above, all the scientific activities and large number of trainings were organized, notably two trainings under Green Skill Development Programme of Government of India, One week compulsory training course for IFS Officers. Number of programmes were undertaken under PRAKRITI programme and a total 1290 visitors came to AFRI under various programme.

While documenting floral diversity in Raj Bhavan's areas of Jaipur and Mount Abu, a total 413 species were identified from both. These species belong to 75 families and 282 genera of plant kingdom.

Through CAMPA funding -All India Coordinated Research Projects (AICRP), ICFRE and its institutes have been sanctioned 31 major AICRP and other activities. AFRI has taken up a total 22 All AICRPs that willenhance productivity and help in restoration degradation of forests. Also under CAMPA funding, National Programme on Conservation and Development of Forest Genetic Resources (FGR) has also been initiated at AFRI, which is composed of 4 cells covering aspects of Documentation, Conservation, Seed collection and Germplasm Characterization.

AFRI has participated in The Thirteenth Session of the Conference of the Parties (COP-13) to the Convention on the Conservation of Migratory Species of Wild Animals held at Gandhi Nagar frpm 17 – 22 February 2020. AFRI also participated in Delhi NCR.

Summary of the projects

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During 2019-20	Projects Subsumed in AICRP
Plan	5	8	1	2
Externally Aided	2	3	0	-
Total	7	11	1	2

1. Introduction

1.1 New Initiatives

S.No.	Title of the Project	Principal Investigator	Remark
Theme 1 :Managing Forest and Forest Products for Livelihood Support and Economic Growth			
	NIL		
Theme 2 : Biodiversity Conservation and Ecological Security			
	NIL		
Thrust Area 3 : Forest and Climate Change			
	NIL		
Thrust Area 4 : Forest Genetic Resource management and Tree Improvement			
01	Cloning and Characterization of Salt Tolerance Conferring Vacuolar Na+/h+ Antiporter (*nhx*1) Genes From *Prosopisjuliflora* (Sw.) Dc. &*Salvadora persica* L. (ICFRE Funded)	Dr Tarun Kant, Scientist-F	

1.2 MoU Signed:

1. MoU for GIS Mapping of Luni riverscape under the scheme on development of DPR for rejuvenation of Luni River was signed between AFRI and CAZRI, Jodhpur on 25th July 2019.

Fig. 1: MoU on Luni River DPR being signed by Sh. M.R. Baloch, IFS, Director AFRI and Dr. O.P. Yadav, Director CAZRI, Jodhpur.

1.3 Vistit of Dignitaries

1. Justice A.K. Mathur, Chairman of 7th CPC, former Chief justice of Calcutta High Court, Justice of the Supreme Court of India.
2. Dr. O.P. Yadav, Director CAZRI (ICAR)
3. Sh. Khushveer Singh, M.L.A. Marwar Junction (Pali District), Rajasthan
4. Dr. B.R. Meghwal, IPS, Ex-ADGP & IG, BSF (Western Frontier), Jodhpur

1.4 Recruitment and Promotions during the year:

अवधि 01.04.2019 से 31.03.2020

नवनियुक्त / कार्यभार ग्रहण / सेवा विस्तार

1. श्री जुगल किशोर गौर ने दिनांक 30.05.2019 (पूर्वाह्न) को वन रक्षक(फॉरेस्ट गार्ड) के पद पर कार्यभार ग्रहण किया।
2. श्री लक्ष्मण सिंह भाटी ने दिनांक 31.05.2019 (पूर्वाह्न) को वन रक्षक(फॉरेस्ट गार्ड) के पद पर कार्यभार ग्रहण किया।
3. श्री गोविन्द शर्मा ने दिनांक 06.06.2019 (पूर्वाह्न) को वनपाल (फारेस्टर) के पद पर कार्यभार ग्रहण किया।
4. श्री गौरव गुर्जर ने दिनांक 17.06.2019 (पूर्वाह्न) को अवर श्रेणी लिपिक के पद पर कार्यभार ग्रहण किया।
5. श्री राजू सिंह ने दिनांक 18.06.2019 (पूर्वाह्न) को मल्टी टास्कीग स्टाफ(एम.टी.एस.) के पद पर कार्यभार ग्रहण किया।
6. श्री प्रेम प्रकाश ने दिनांक 09.07.2019 (पूर्वाह्न) को अवर श्रेणी लिपिक के पद पर कार्यभार ग्रहण किया।
7. श्री सचिन तंवर ने दिनांक 20.08.2019 (पूर्वाह्न) को एम.टी.एस. के पद पर कार्यभार ग्रहण किया।
8. श्री नरेन्द्र कुमार श्रंगी को लेखा अधिकारी पद पर दिनांक 20.02.2020 से 19.02.2020 तक प्रतिनियुक्ति अवधि का विस्तार दिया गया ।
9. कुमारी पूजा शर्मा ने दिनांक 26.02.2020 को पूर्वान्ह में वैज्ञानिक–बी पद पर कार्यभार ग्रहण किया ।

पदोन्नति

1. श्री कुलदीप शर्मा, तकनीशियन को माह अक्टूबर, 2019 में तकनीकी सेवा नियम–2013 के अंतर्गत असेस्मेंट प्रमोशन (Assessment Promotion) के अंतर्गत दिनांक 05.09.2019 से वरिष्ठ तकनीशियन के पद पर पदोन्नत किया गया।
2. श्रीमती मीता सिंह तोमर, तकनीशियन को माह अक्टूबर, 2019 में तकनीकी सेवा नियम–2013 के अंतर्गत असेस्मेंट प्रमोशन (Assessment Promotion) के अंतर्गत दिनांक 25.07.2019 से वरिष्ठ तकनीशियन के पद पर पदोन्नत किया गया।
3. श्री अशोक परमाऱ, तकनीशियन को माह अक्टूबर, 2019 में तकनीकी सेवा नियम–2013 के अंतर्गत असेस्मेंट प्रमोशन (Assessment Promotion) के अंतर्गत दिनांक 01.07.2019 से वरिष्ठ तकनीशियन के पद पर पदोन्नत किया गया।
4. श्री सोहन लाल गर्ग़, तकनीशियन को माह अक्टूबर, 2019 में तकनीकी सेवा नियम–2013 के अंतर्गत असेस्मेंट प्रमोशन (Assessment Promotion) के अंतर्गत दिनांक 30.06.2019 से वरिष्ठ तकनीशियन के पद पर पदोन्नत किया गया।
5. श्री राजेश मीणा़, तकनीशियन को माह अक्टूबर, 2019 में तकनीकी सेवा नियम–2013 के अंतर्गत असेस्मेंट प्रमोशन (Assessment Promotion) के अंतर्गत दिनांक 23.06.2019 से वरिष्ठ तकनीशियन के पद पर पदोन्नत किया गया।
6. श्री शैलेन्द्र सिंह राठौड़, तकनीशियन को माह अक्टूबर, 2019 में तकनीकी सेवा नियम–2013 के अंतर्गत असेस्मेंट प्रमोशन (Assessment Promotion) के अंतर्गत दिनांक 05.06.2019 से वरिष्ठ तकनीशियन के पद पर पदोन्नत किया गया।
7. श्री बुन्देश कुमार, तकनीशियन को माह अक्टूबर, 2019 में तकनीकी सेवा नियम–2013 के अंतर्गत असेस्मेंट प्रमोशन (Assessment Promotion) के अंतर्गत दिनांक 30.05.2019 से वरिष्ठ तकनीशियन के पद पर पदोन्नत किया गया।
8. संस्थान में कार्यरत सहायक मुख्य तकनीकी अधिकारी डॉ0 बिलास सिंह,श्रीमती संगीता त्रिपाठी, डॉ0 नीलम वर्मा, डॉ0 शिवेश कुमार राजपूत, श्री ए. दुरई, श्री करना राम चौधरी व श्री राजेश कुमार गुप्ताको माह जुलाई, 2019 में तकनीकी सेवा नियम–2013 के अंतर्गत असेस्मेंट प्रमोशन (Assessment Promotion) के अंतर्गत मुख्य तकनीकी अधिकारी पद पर दिनांक 18.12.2018 से पदोन्नत किया गया।
9. संस्थान में कार्यरत वरिष्ठ तकनीकी अधिकारी सर्व/श्री चन्द्र शेखर व्यास,नरेन्द्र कुमार लिम्बा, प्रेम राज नागौरा, सरज लाल मीणा, शिव लाल चौहान व कृपा चन्द जेदिया को माह जुलाई, 2019 में तकनीकी सेवा नियम–2013 के अंतर्गत असेस्मेंट प्रमोशन (Assessment Promotion) के अंतर्गत सहायक मुख्य तकनीकी अधिकारी पद परदिनांक 18.12.2018 से पदोन्नत किया गया।

10. संस्थान में कार्यरत तकनीकी अधिकारी सर्व/श्री रतना राम,धाना राम, महीपाल बिश्नोई, गंगा राम चौधरी, प्रेम सिंह सांखला,अनिल सिंह चौहान व श्रीमती कुसुमलता परिहार को माह जुलाई, 2019 में तकनीकी सेवा नियम–2013 के अंतर्गत असेस्मेंटप्रमोशन (Assessment Promotion) के अंतर्गत वरिष्ठ तकनीकी अधिकारीपद परदिनांक 18.12.2018 से पदोन्नत किया गया।
11. श्री चमन लाल, सहायक ने दिनांक 21.08.2019(पूर्वाह्न) से पदोन्नति पर अनुभाग अधिकारी के पद पर कार्यभार ग्रहण किया।

स्थानान्तरण/कार्य–मुक्त/सेवानिवृत्त

1. कुमारी सुप्रिया तिग्गा, अवर श्रेणी लिपिक को दिनांक 03.09.2019 (अपराह्न) को अवर श्रेणी लिपिक पद से स्पमद पर कार्यमुक्त किया गया।
2. श्री लक्ष्मण सिंह भाटी को दिनांक 23.08.2019 (अपराह्न) को वन रक्षक (फॉरेस्ट गार्ड) पद से कार्यमुक्त किया गया।
3. प्रतिनियुक्ति पर कार्यरत श्री उमा राम चौधरी, वन संरक्षक को प्रत्यावर्तन पर दिनांक 07.08.2019 को वन संरक्षक पद से कार्यमुक्त किया गया।
4. प्रतिनियुक्ति पर कार्यरत श्री बेगा राम जाट, उप वन संरक्षक को समय पूर्व प्रत्यावर्तन पर दिनांक 31.07.2019 को उप वन संरक्षक पद से कार्यमुक्त किया गया।
5. श्री आर.पी. नायक, कार्यालय परिचारक अधिवर्षिता आयु पर दिनांक 31.05.2019 को सेवा निवृत्त हुए।
6. डॉ0 माला राठौड़, वैज्ञानिक–ई का वन अनुसंधान संस्थान, देहरादून में स्थानान्तरण होने पर दिनांक 02.05. 2019 (अपराह्न) से कार्यमुक्त किया गया।

1.5All India Coordinated Research Projects:

(A) AICRP

Sr.	Code	Title of project, name of NPC, lead Institute	Duration (years)	PI & Co- PI (AFRI)
1	**AICRP 1**	Increasing farm income through selection and deployment of highyielding clones and seed sources of *Casuarina* for different planting environments and end use applications. Dr A Nicodemus / IFGTB	5	Sh. A. Durai
2	**AICRP 2**	All India coordinated research project on bamboo. Dr H.S. Ginwal / FRI	5	Dr.Sarita Arya
3	**AICRP 3**	Conservation, improvement, management and promotion of sandalwood (*Santalum album*) cultivation in India. Dr ModhumitaDasgupta/IWST	5	Dr. M. T. Hegde, Dr. N. K. Bohra
4	**AICRP 4**	Genetic improvement of *Eucalyptus*. Dr V Shiv Kumar/ IFGTB	5	Dr. N. K. Bohra
5	**AICRP 7**	Assessment and monitoring of invasive alien plant species in India and formulation of strategies for management of key species in different regions of the country. Dr. A. Rajasekaran / IFGTB	5	Smt. Seema Kumar, Sh. B.V. Jayant
6	**AICRP 8**	Conservation and productivity improvement of Red Sanders (*Pterocarpussantalinus*). Dr. S Pattanaik / IFB	5	Dr. M. T. Hegde, Sh. B.V. Jayant
7	**AICRP 9**	Quality teak production: Capitalizing on cloning. Dr.Yashodha / IFGTB	5	Dr. Bilas Singh
8	**AICRP 10**	Developing seed testing, seed storage protocols and nursery techniques of selected forestry species from diverse types. Dr Manisha Thapliyal /FRI	5	Dr. N. K. Bohra
9	**AICRP 11**	All India coordinated research project on *Dalbergiasissoo*. Dr. Amit Pandey / FRI	5	Dr.Sangeeta Singh, Dr. S. K. Rajput, Dr. Neelam Verma
10	**AICRP 12**	Assessment of demand and supply of timber, fuel-wood and fodder in India. Sh.Girish chandra / ICFRE	3	Dr. S.K. Rajput

11	**AICRP 13**	Valuation of forests for GDP, Green GDP and payment of eco-sysyem goods and services. Sh Rajiv Panday	4	Sh R K Gupta PI
12	**AICRP 16**	Bio-prospecting for industrial utilization of lesser known forest plants. Dr. V. K. Varshney / FRI	5	Dr. Hemant Sharma, Smt. Sangeeta Tripathi
13	**AICRP 17**	Enhancement of fodder availability and quality to reduce unsustainable grazing in the forests. Dr. Dinesh Kumar / FRI	5	Sh. S. R. Baloch, Sh. G.R. Choudhary
14	**AICRP 18**	Silvicultural interventions for productivity enhancement and carbon sequestration in plantations of important tree species. Dr C Buvneswaran / IFGTB	5	Sh. A. Durai
15	**AICRP 19**	Assessment of water requirement of different forest tree species and its impact on sub soil moisture. Dr Rajeev Tiwari / ICFRE	4	Sh. S. R. Baloch, Sh. N.K. Limba
16	**AICRP 20**	Development of bio-pesticide products /formulations from extracts of tree borne oil seeds and different tissues of wild plants for management of insect pests. Dr A Balu / IFGTB	5	Dr.Shiwani Bhatnagar, Dr. Hemant Sharma, Smt Seema Kumar, Dr Sangeeta Singh
17	**AICRP 21**	Development of superior bio-fertilizer products for enhanced plant productivity. Dr V Mohan / IFGTB	5	Dr.Sangeeta Singh, Dr.Neelam Verma
18	**AICRP 22**	Preparation of forest soil health cards under different forest vegetations in all the forest divisions of India, Director FRI /Dr V Panwar / FRI	3	Smt. Bhawana Sharma
19	**AICRP 24**	Combating desertification by enhancing vegetation cover and people livelihoods in degraded drylands and deserts of India. Dr. G. Singh/ AFRI Jodhpur	5	**Dr. G. Singh-PI,** Smt. Bhawana Sharma, Sh. S. R. Baloch, Dr. Bilas Singh, Sh.K.R. Choudhary
20	**AICRP 26**	Genetic improvement of *Azadirachtaindica* A. Juss. (Neem). Dr. U. K .Tomar/ AFRI Jodhpur	5	Dr.Tarun Kant, Smt. Desha Meena
21	**AICRP 29**	Sustainable management of NTFPs through conservation and value addition. Ms Neelu Singh/ FRI Dehradun	5	Smt. Sangeeta Tripathi, Dr. Hemant Sharma
22	**AICRP 31**	Study of climate driven effects on Indian forests through long term monitoring. Dr N Bala/ FRI Dehradun	5	Sh. S. R. Baloch, Dr. G. Singh, Dr.Sangeeta Singh, Dr.Shiwani Bhatnagar

(B) National Programme for Conservation and Development of FGR

Regional Coordinator: Dr Tarun Kant, Scientist F & Head GTI Division

Sr.	Code	Title of FGR Component	Duration (years)	PI & Co- PI (AFRI)
1	FGR 1	Documentation Cell	5	PI: S. R Baloch Dr. G. Singh Mrs. Bhawana Sharma
2	FGR 2	Seed Cell	5	PI: Dr. N. K Bohra Dr. Sarita Arya
3	FGR 3	Characterization cell	5	PI: Dr.Tarun Kant
4	FGR 4	Conservation Cell	5	PI: Dr. M.T Hegde

(C) CAMPA : Extension component-

Sr.	Extension Activities
1	Kishan Mela : Cancelled due to COVID 19
2	Short film making : Cancelled due to COVID 19

1. Introduction

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, Government of India. The goals of the institute are to carry out scientific research in forestry & allied fields to enhance the productivity and vegetative cover, to conserve the biodiversity and to develop the technologies for the stakeholders working in forestry sector in Rajasthan, Gujarat, Dadra & Nagar Havelli and Daman & Diu (Fig. 2). Major emphasis of research at 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-fertilizers and bio-pesticides; Agroforestry & extension; phytochemistry & non-timber forest products; integrated pest and disease management; biodiversity and climate change; and forestry education and extension.

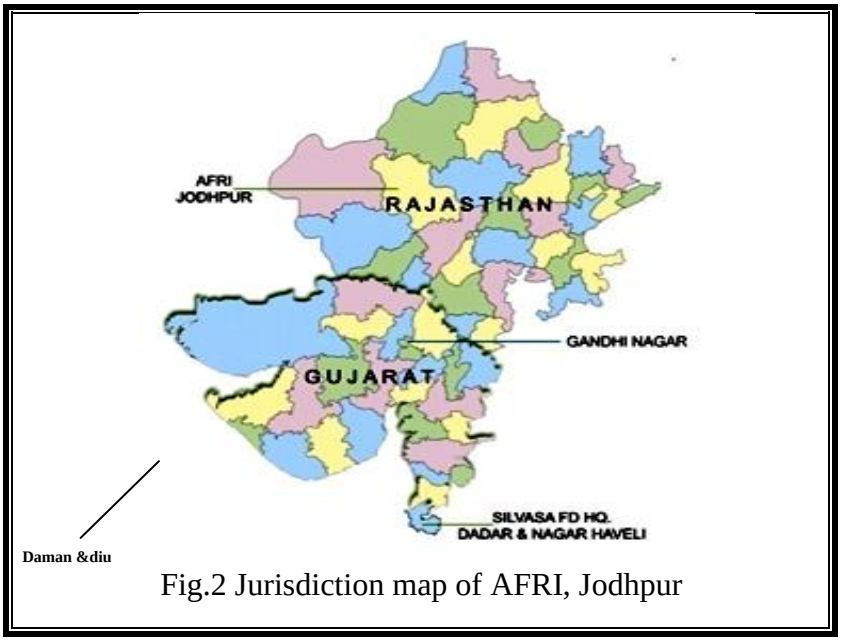


Fig.2 Jurisdiction map of AFRI, Jodhpur

2. Research Highlights

2.1 Ecosystem Conservation and Management

2.1.1 Overview

While documenting floral diversity in Rajbhavans areas of Jaipur and Mount Abu, a total 413 species were identified from both the Rajbhavans areas, i.e. Jaipur and Mount Abu. These species belongs to 75 families and 282 genera of plant kingdom. Among these 98 are tree species, 114 are shrub species, 113 are herbaceous species, 46 are grass species, 34 are climbers, 6 are sedge and two are ferns indicating highest contribution of shrub species followed by herbs (Fig. 1). Seventy eight species are common to both the Rajbhavan areas. Alpha (α) diversity of Jaipur and Mount Abu Ranjabahvan area are 215 and 293, respectively. Beta (β) diversity is 335, whereas γ (gama) diversity is 413.

2.1.1.1 Project under the theme

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During 2019-20
Plan	-	0	0
Externally Aided	-	1	0
Total	-	1	0

2.1.2 Climate Change : Nil

2.1.3 Ecology and Environment : Nil

2.1.4 Biodiversity

1. Study of Flora and Fauna of Raj Bhavans of Rajasthan (2018-21)

P.I.: Dr. G. Singh, Scientist-G

Rajbhawans of Rajasthan are situated at Jaipur and Mount Abu both. These areas have lush green lawn with variety of tall trees and flower beds blooming with seasonal flowers and are attractive places in terms of biological diversity. Raj Bhavan of Mt. Abu is situated in foothill of Gurushikhar, the highest peak of Mt. Abu and supports a wide variety of flora ranging from xeromorphic to subtropical evergreen species. Because of luxurious vegetation many birds and other fauna are also visible there. Available biodiversity make these places points of attraction to many visitors. This project was planned to monitor biodiversity and enlisting flora and fauna in the form of a coffee table book and offering possibilities to improve this urban habitat. The objectives of the project were:(i) **s**urvey, identification and enlisting of flora and fauna of Raj Bhawan at Jaipur and Mount Abu area of Rajasthan; (ii) preparation of pictorial information of flora and Fauna of both Raj Bhawans; (iii) develop appropriate signages for the important flora and fauna of both Raj Bhawans; and (iv) publish a coffee table book with photographs and illustration of important species available in these areas.

A total 410 species were identified from both the Rajbhavans areas, i.e. Jaipur and Mount Abu. These species belongs to 81 families and 287 genera of plant kingdom. Among these 99 are tree species, 110 are shrub species, 113 are herbaceous species, 45 are grass species, 35 are climbers, 6 are sedge and two are ferns indicating highest contribution of herbs species followed by sherbs (Fig. 3). Seventy eight species are common to both the Rajbhavan areas. Alpha (α) diversity of Jaipur and Mount Abu Ranjabahvan area are 204 and 293, respectively. Beta (β) diversity is 345, whereas γ (gama) diversity is 410.

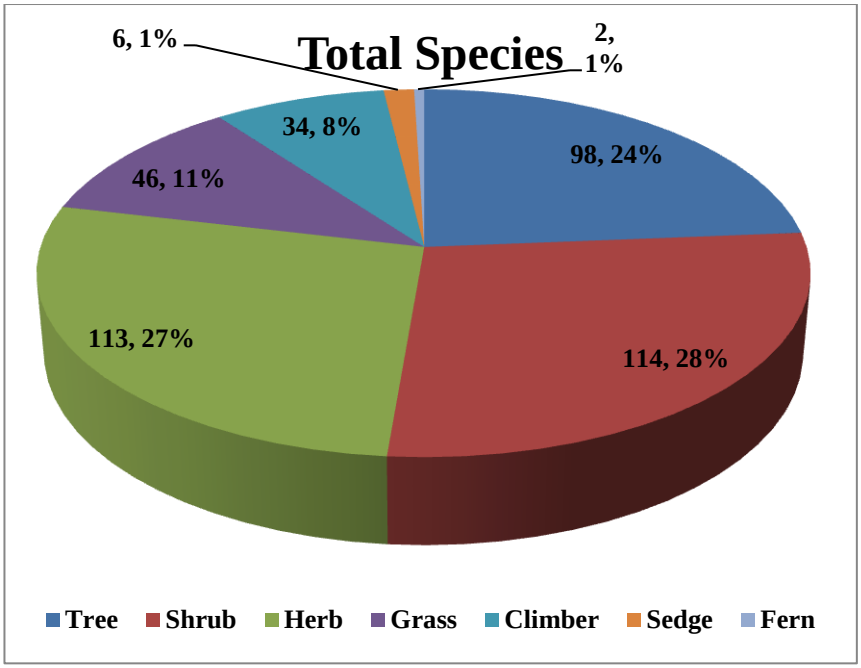


Fig 3. Number and percent contributions of different plant forms in Rajbhavan areas of Rajasthan.

At Jaipur, 205 numbers of plant species belong to 63 families and 156 genera.In this, 68 are trees, 87 are shrubs, 16 are climbers, 29 are herbs, 14 are grass and 2 are sedge species (Fig. 4a). 1413 plants were enumerated and measured in 10 different blocks delineated in Rajabhavan Jaipur area. In Mount Abu, 293 belong to 70 families and 214 genera. There are 59 tree species, 70 shrub species, 27 climbers, 94 herbaceous species, 36 are grass species, 5 are sedge species and two are ferns (Fig. 4b). Two thousands four hundred and thirty eight plants (mostly trees and shrubs) were enumerated and measured in 11 different blocks. Most dominant family in number of species are Poaceae followed by Fabaceae at both the places.

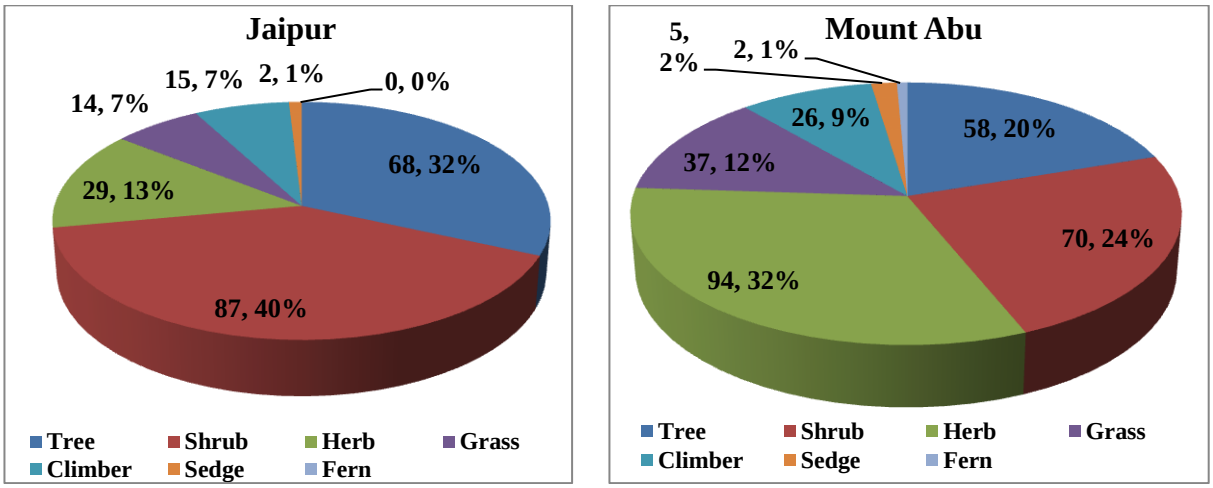


Figure 4(a & b). Number and percent contributions of different plant forms in Rajbhavan areas of Jaipur, Rajasthan

Species richness ranged from 5-18 for tree, 2 to15 for shrub and 4 to 25 for herbaceous at Jaipur, whereas it varied from 5 to 10 for tree, 9 to 18 for shrubs and 24 to 62 for herbaceous species at Mount Abu. Shannon-Weiner Diversity index (H') –an indicator of species diversity, varied from 1.39 to 2.68, from 0.69 to 2.18, and from 0.20 to 2.20 at Jaipur, and from 1.33 to 2.39, 1.56 to 2.58 and negligible to 2.77 at Mount Abu for trees, shrubs and herbaceous species respectively. Simpson dominance index varied from 0.09 to 0.31 for tree, 0.15 to 0.59 for shrubs and from 0.15 to 0.67 for herbaceous species at Jaipur, and from 0.10 to 0.31 for tree, 0.10 to 0.32 for shrub, and 0.10 to 0.26 for herbaceous species at Mount Abu,Variations in **s**pecies evenness at Jaipur was from 0.81 to 0.96 for trees, 0.52 to 1.00 for shrubs and 0.14 to 0.75 for herbaceous species, whereas at Mount Abu its variation was from 0.82 to 0.98 for tree species, 0.18 to 0.89 for shrubs

and from 0.59 to 0.71 for herbaceous species. This indicates that Rajbhavan area of Mt Abu is more diverse in shrubs and herbaceous vegetation, whereas Jaipur is more diverse in tree species. Low value of species evenness at Mt Abu indicates uneven distribution of some of the shrub species. Tree species richness found related with shrub species and herbaceous species richness by quadratic relationships, where herbaceous species richness attained a maxima and shrub species richness a minima at tree species richness of 9 at Jaipur. At Mt Abu, the relationships between herbaceous and tree species richness appeared positive, but in case of shrubs, it is similar to that at Jaipur (Fig. 5).

Seasonal observations recorded in different quarters indicate varying phenological behaviour of different species. Flowering and fruiting were in 26 and 12 species during winter season of December, 26 and 15 species in March, 23 and 7 species in May and 24 and 8 species in August at Jaipur. *Abutilon theophrastii*, *Clerodendrum inerme* etc., showed extended period of flowering from August to December. At Mount Abu, about 35 species flowered and 21 species fruited during winter season of January. Flowering and fruiting were observed in 19 and 12 species during April, 18 and 14 species in June, and 30 and 4 species September. *Cestrum diurnum*, *Caesalpinia decapetala* etc., showed extended period of flowering from monsoon to winter season.

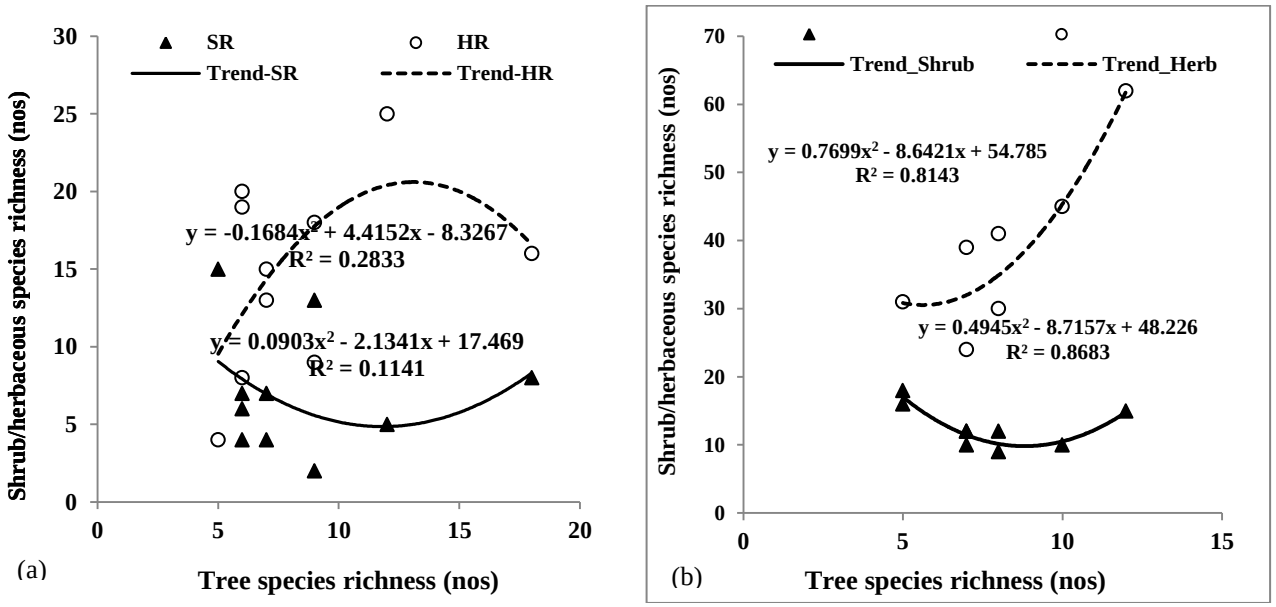


Fig. 5. Relationships tree species richness with shrubs and herbaceous species richness at Jaipur (a) and at Mount Abu (b).

2.1.5 Forest Botany:NIL

2.1.6 Tribals and Traditional Knowledge System:Nil

2.2 Forest Productivity

2.2.1 Overview

Urban afforestation model developed by planting and maintaining *Jacaranda mimosifolia, Plumeria alba, C. lanceolatus, Adansonia digitata, Azadirachta indica, Bauhinia purpurea, Cassia fistula, Dalbergia sissoo, Millingtonia hortensis, Mimusops elengi, Pongamia pinnata* and *Spathodia campanulata*at newly developed High Court Aarea of Jaodhpur.

While working on biomass partitionaing and growth equation, average dry biomass per tree was 749.92 kg for *E. camaldulnsis* and 327.47kg for *V. tortilis.* Partitioning of biomass in stem, branches and leaves were 68.36%, 29.04% and 2.59% in case of *E. camaldulensis* and 28.08%, 67.50% and 4.42% in case of *V. tortilis* respectively. Total dry biomasses of both the species have been observed significantly related with their girth at breast height by a power equation.

2.2.1.2 Project under the theme

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During the Year2019-20
Plan	1	3	-
Externally Aided	1	-	-
Total	2	3	-

2.2.2 Silviculture

1. Studies on Seed Germination and Nursery Technology of *Anogeissus pendula* (2016-20) P.I. Dr.N.K.Bohra, Scientist C

35 seedlots from different agroclimatic zones including Jojaver, Kalighati,Desuri, Pali, Sawai Madhopur , Kota , Bundi for testing various germination parameters and further nursery work. Different Biofertilizers and different potting mixture ratio were established to study the biofertilizer and other parameters effect. Growth data were taken from polybags and root trainer transferred seedlings. Seedlings were raised from best seed trees seeds and were transferred in different potting mixture ratio for further data recording and analysis. Effects of Various container size as well as potting mixture ratio and type of manures were studied. This project was completed September 2019.

Fig. 6: Treatment of different bio-fertiliser application with seedlings of *Anogeissus pendula*

2. Urban Forestry model for RSJA Campus (2015-2020)(**External Aided Project**)

PI : Dr.N.K.Bohra, Scientist-C

472 Neem Trees and 56 Khejri and Rohida plants with some ornamental plants were planted and maintained . Height of Neem tree recorded more than 12 feet and Khejri and Rohida tree height was 4-5 feet . Plants were planted at Periphery of Judicial Academy Building. This project was completed March 2020.

Fig. 7: Plantation at Judicial Academy at Jodhpur

3. Evaluation of existing Sandal wood (*Santalum album*) plantations and development of agro forestry trials and capacity building to promote cultivation in Gujarat and Rajasthan (2017-21)

PI : Dr.N.K.Bohra, Scientist-C

Established Three Agro forestry trials with horticulture plant and Sandal plantation at Anand Agriculture University, Anand, Gujarat, VVK field at Rajkot and at Jaipur National University,Jaipur.

Different crops were sown in between Sandal plantation to find suitability of crop yield.

Growth data and crop yield data in all three trials were taken. Plant height was more than 100 cm in Rajkot and Anand.Similarly at Jaipur national University survival was 50 percent and plant height was 80 cm and above

Fig. 8: Plantation in Anand Agriculture University host Casuarina and Rajkot

Fig. 9: Plantation at Jaipur Natinal university Campus (one year old)

Benefits of the research: Development of scientific model with aim to provide livelihood for Sandal growing farmers is carried out so that farmers can earn some income from agroforestry crops while growing Sandal Plantation in their fields for 15-20 years.

2.2.3 Social Forestry, Agro-forestry/ Farm Forestry

4.Study on crop yield, soil fertility and gum production in *Acacia senegal* based traditional agroforestry system in arid region of Rajasthan (2017-22) PI: Dr. Bilas Singh, CTO

Sample plots of *Acacia senegal* tree densities viz. 10-20, 20-30 and 30-40 tree/ha were laid out at nine sites on farm land in Sheregarh in Jodhpur, Jakhara (Bayatu) and Lilsar (Chouhatan) in Barmer district and three sites on farm boundary in Didwana, Nagaur District.

Tree growth of *A. senegal* trees measured and height of tree was significantly ($p< 0.05$) highest (7.60 m) at 20-30 trees /ha in comparison of the other tree densities. Diameter at best height (DBH) of trees was also significantly higher (22.9 cm) in tree density at 20-30 trees as compared to tree density at 30-40 trees/ha. Light intercept did not differ between tree densities. Crop yield reduction did not differ between tree densities. However, reduction of crop yield was greatest (58.12%) at 30-40 trees/ha and reduction was less (53.71%) at 10-20 trees/ha. Crop yield reduction was higher (61.6%) near tree trunk (1 m distance from tree trunk) than respective sole crop whereas reduction was also higher (57%) near tree trunk as compared to canopy edge of tree density.

Ethophon was injected in *A. senegal* trees to enhance gum arabic production where gum yield produced from 0.10 kg to 2.00 kg per tree. Cost of cultivation recorded through interaction of the farmers and its economic return was calculated. Economic return was highest for Pearl millet crop (Rs. 62933/ha) under irrigated condition followed by un-irrigated Pearl millet (Rs. 15542/ha). Economic return of Mothbean based agroforestry was observed lowest (Rs. 1165/ha) in Kharif season. In rabi season, economic return was higher (Rs. 22663-60316/ha) in cumin based agroforestry system as compared to mustard (Rs. 2770/ha) based agroforestry system in irrigated condition. Seed production of *A. senegal* ranged between 0.180-3.10 kg/trees.

2.2.4 Forest Soils and Land Reclamation

5.Impact of harvesting on soil nutrients and carbon stock in canal side plantations of Indira Gandhi Nahar Pariyojana (IGNP)(2017-22) PI: Dr. G. Singh, Scientist G

This project aims at studying the impact of tree harvesting on soil nutrients and carbon stock in canal side plantations of IGNP, quantify harvested wood biomass and develop allometric equations based on tree growth parameters and monitor temporal changes in soil parameters brought about by the plantations. Soil samples collected were analyzed for soil available NH_4-N, NO_3-N and

PO_4-P. Dry biomasses of harvesting trees of *E. camaldulensis* (5 plots) and *A. tortilis* (3 plots) harvested during 2018-19 depending on the schedule of harvesting defined by Forest Department and execution by the contactor, were recorded and allometric equations developed. Different growth variables like total height, girth at breast height (GBH), clear stem height, collar girth and girth at bifurcation varied significantly for both these species with large variations in all data in *E. camaldulensis* than *A. tortilis*. Total height ranged from 11.0 to 30.0 m and 6.0 to 13.0 m, whereas GBH ranged from 32.0 to 160.0 cm and 33.0 to 132.0 cm for *E. camaldulensis*, and *A. tortilis* respectively with average values of 18.29±4.72 m (mean±1SD) and 8.85±2.36 m (Table 1). Clear stem bole was almost 3-fold greater in former than in the latter species. Average dry biomass per tree was 749.92±599.15 kg for *E. camaldulnsis* and 327.47±242.55 kg for *A. tortilis* (Table 2). Partitioning of biomass in stem, branches and leaves were 68.36%, 29.04% and 2.59% in case of *E. camaldulensis* and 28.08%, 67.50% and 4.42% in case of *A. tortilis* respectively. The increase in total biomass favoured increasingly higher biomass allocation towards stem in *E. camaldulensis*, and in branches in *A. tortilis* (Fig 10). Total dry biomasses of both the species have been observed significantly related with their girth at breast height by a power equation.

Table 1. Growth variables of harvested trees of *E. camaldulensis* and *A. tortilis* in IGNP area of Rajasthan.

Growth variables	Mean	Std. Deviation	Minimum value	Maximum value	Range
E. camaldulensis					
Total height	18.29	4.72	11.00	30.00	19.00
GBH(cm)	100.60	37.05	32.00	160.00	128.00
Stem height (cm)	1065.64	503.90	270.00	2400.00	2130.00
Collar girth (cm)	121.12	37.13	44.00	190.00	146.00
Girth at stem bifurcation (cm)	59.84	23.96	20.00	95.00	75.00
A. tortilis					
Total height	8.85	2.36	6.00	13.00	7.00
GBH(cm)	72.80	28.87	33.00	132.00	99.00
Stem height (cm)	313.87	147.66	200.00	760.00	560.00
Collar girth (cm)	80.13	30.81	40.00	149.00	109.00
Girth at stem bifurcation (cm)	64.53	28.35	26.00	130.00	104.00

Table 2. Dry biomasses of different components ofharvested trees of *E. camaldulensis* and *A.. tortilis* in IGNP area of Rajasthan.

Biomass	Mean	Std. Deviation	Minimum value	Maximum value	Range
E. camaldulensis					
Stem biomass (kg)	512.68	431.98	28.00	1758.00	1730.00
Branch biomass (kg)	217.80	196.94	8.00	616.00	608.00
Leaf biomass (kg)	19.44	27.44	1.00	123.00	122.00
Total biomass (kg)	749.92	599.15	37.00	2381.00	2344.00
A. tortilis					
Stem biomass (kg)	92.00	71.22	19.00	260.00	241.00
Branch biomass (kg)	221.00	202.05	28.00	731.00	703.00
Leaf & twig biomass (kg)	14.53	26.38	1.00	101.00	100.00
Total biomass (kg)	327.47	282.55	48.00	939.00	891.00

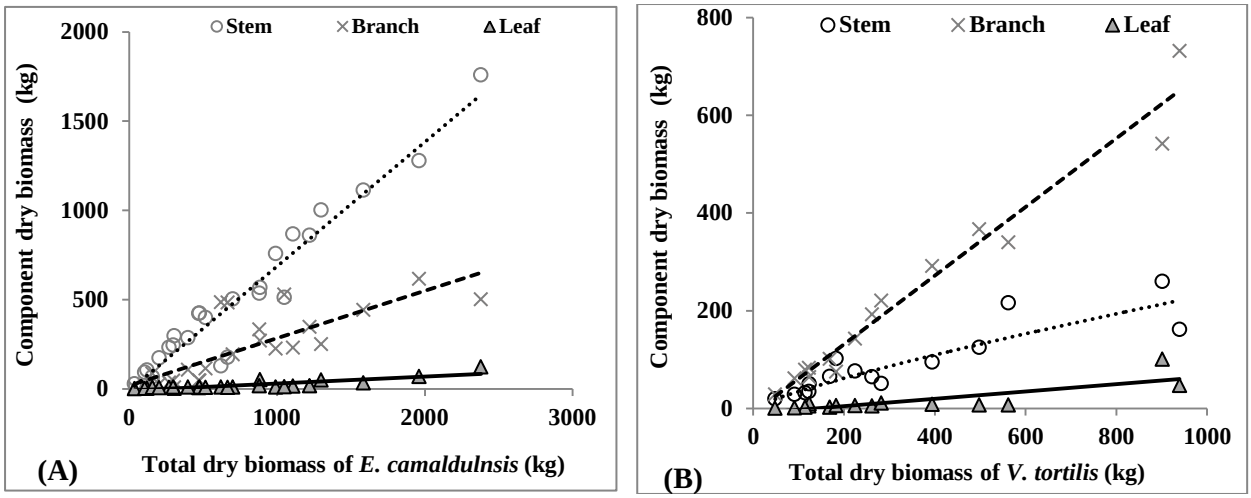


Fig. 10: Biomass allocation in stem, branches and leaf & twigs in relation to total biomass in *E. camaldulensis* (A) and *A. tortilis* (B).

Soil pH and soil bulk density were relatively lower in the plantation area as compared to that in the outside plantation area (control). However, electrical conductivity and availability of PO_4-P, NO_3-N and NH_4-N were greater in plantation area of both *E. camaldulensis* and *A. tortilis* than in the control plots. Soil pH, available PO_4-P and bulk density were lower under *E camaldulensis* plantation than under *A. tortilis* plantation. The other soil variables were higher under former species than the latter ones.

2.2.5 Watershed Management: NIL

2.3 Genetic Improvement

2.3.1 Overview

Under GTI Division 6 ICFRE Plan funded and 3 externally funded projects were underway in the year 2019-20. The project - **Genetic Improvement of *Azadirachtaindica* (Neem) through Transgene Pyramiding for Enhancement of Cold Endurance,** aims at developing a genetic transformation protocol for neem using *Agrobacterium*. Once established, the protocol will be used to insert two genes in to the neem genome to test their effect on development of cold-tolerance character. Confirmation of gene transfer event (for *gusA* gene) has been obtained through the sqRT-PCR analysis.

The project - **Cloning and Characterization of Salt Tolerance Conferring Vacuolar Na+/h+ Antiporter (*nhx*1) Genes From *Prosopisjuliflora* (Sw.) Dc. &*Salvadorapersica*L,** intends to isolate and clone the vacuolar Na^+/H^+antiporter gene – *NHX1* from *Prosopisjuliflora* and *Salvadorapersica* and to carry out functional validation of the cloned genes via transgenic approach. The antiporter in responsible to maintain Na^+ homeostasis (ion balance) in cytosol in the absence of which the plant cannot survive high salt concentration in soil solution. Partial length isolation of Na^+/H^+ antiporter gene and its sequencing was done.

In the project **Development of tissue culture protocol for economically important bamboo-*Schizostachyumdullooa,*** aims for the development of vegetative multiplication technology through tissue culture. This will make possible production of *S. dullooa* bamboo to be used for plantation purpose. *In vitro* shoot multiplication was achieved on MS medium supplemented with cytokinin while rooting recalcitrance persists in it.

Screening of DNA markers to Distinguish Male and Female *Ailanthus excelsa* trees for Higher Biomass Production, aims atidentification of gender at seedling stage can help in quality production planting stock in this species. Morphological marker (leaf trichome) is the best, cost effective as well as highly reliable marker for gender identification in Ailanthus excelsa as yet. **Studies on phenology, molecular analysis and wood properties of *Tecomella undulate* with respect to three flower color morphotypes aims at** correlating three flower color variants of *Tecomella undulate* with respect to its timber quality, phenology and at molecular level present project. The project **Identificationof juvenility markers to improve rooting potential of some important tree species identifies** some indicators such as physiological and biochemical characteristics on coppicing potential of different genotypes in field conditions for predictability of rooting potential. Leaflet numbers per leaf were identified as juvenility marker in Ardu and Neem.

Three Externally aided projects were executed funded by NMPB, New Delhi. The project -**Non-destructive *in vitro* Production of Pharmacologically-active Natural Extract Containing Guggulsterones – A Potent Cardio-protective and Anti-cancer Drug from *Commiphorawightii* (Guggul) Using Bioreactor**envisages *In vitro* production of guggulsterone-rich cell biomass from plant source in a bioreactor format enabling up-scalability of the technology once standardized. Optimization of 5L Bioreactor and ethyl acetate extraction of guggulsterones has been carried out.

The project**Clonal propagation, characterization and biochemical analysis of *Leptadeniareticulata*– a threatened medicinal plant** aimed to develop micropropagation techniques useful to obtain true-to type plant materials from an elite germplasm to meet the high demands.

Under the project **Development of Seed Production Area and Haploid plants in *Commiphorawightii* (Arnott)- A rare and threatened medicinal plant,** seed studies were conducted to identify maximum seed producing genotypes to get better germplasm for viable and quality seeds.

2.3.1.1 Project under the theme

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During **2019-20**
Plan	3	3	1
Externally Aided	1	2	-
Total	4	5	1

2.3.2 Conservation of Forest Genetic Resources: Nil

2.3.3 Tree Improvement

1. **Development of Seed Production Area and Haploid plants in *Commiphora wightii* (Arnott)- A rare and threatened medicinal plant (2016-21).**

PI: Dr. U.K. Tomar, Scientist-F, NMPB Project

Achievments:

Screening of superior family and genotypes by repeated winter collection of seeds in different years: Total mature seeds were collected in four months of winter season in two successive years (November 2017, December 2017, December 2018 and February 2019) were separated on the basis of color (black and white). These seeds were counted and weighted. Total 102 genotypes were selected after analysis of pooled data on the basis of high seed yield (more than 100 seeds) and black seed ratio (above 80%).

Seed germination: Seed collected in November 2017, December 2017, December 2018 and February 2019 were sown in root trainer filled with fine sand, coarse sand and compost in 3:2:1 ratio in March month which were kept in polyhouse condition (35.88 ± 0.12˚C temperature and 53.83 ± 0.24% humidity) of AFRI to record seed germination data. Seed germination data was recorded after one-week interval. Seed germination increases from 1st to 2ndweek (Figure 11) but after 2nd week some casualty was observed.

For further analysis, plants bearing more than 50 black seeds in November 2017, December 2017, December 2018 months were marked. In February 2019 collection, the black seeds number was lower hence for this month plants having more than 30 black seeds were marked. The black seed weight of these marked plants from all the four months were recorded prior to sowing. Correlation analysis between the black seed weight of marked plants and their respective germination was studied and revealed highly significant ($p<0.01$) positive correlation. With increase in black seed weight seed germination also increased in all four collections (Figure 12). Therefore, seed weight is better criteria for superior genotypes selection without waiting for seed germination.

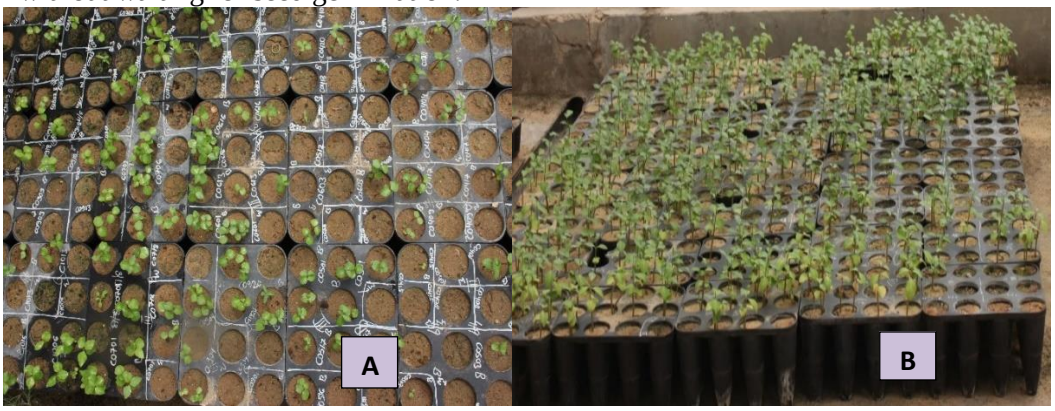


Figure 11: (A) seed germination after one week; (**B)** Seed germination after two weeks

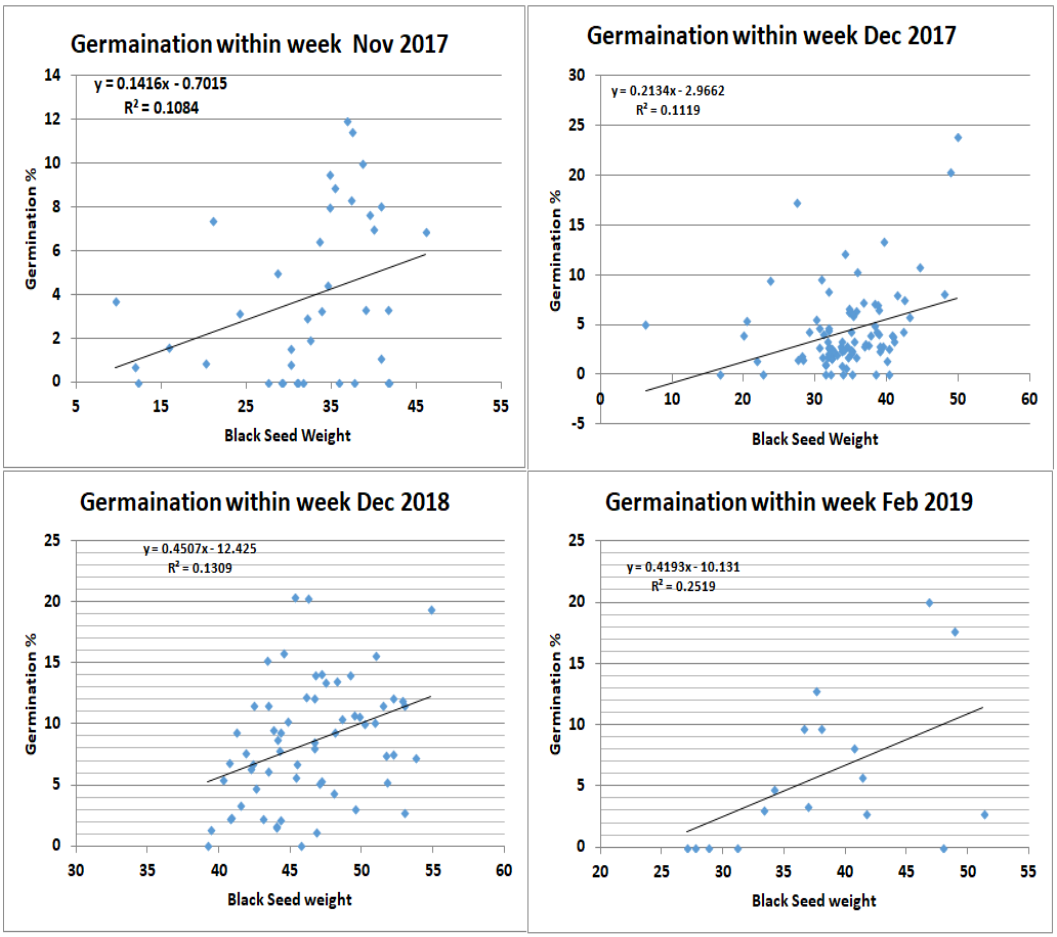


Fig. 12: Correlation of black seed weight with seed germination for four collections (November 2017, December 2017, December 2018 and February 2019)

Selection of superior genotypes: Seeds collected in four winter months from 647 genotypes were pooled and zero seed producing genotypes were removed in first filter**.** Genotypes were short listed by selecting the minimum 100 seed yielding genotype (142 genotypes). Top 100 genotypes were selected out of 142 genotypes in each of three parameters i.e. black seed ratio, black seed weight and black seed germination percentage. Total 61 genotypes which were common in all three parameters were selected. Based on black seed ratio and black seed germination from the seeds collected in November 2017 and December 2017, top 25 genotypes were selected for estimation of growth performance. Out of these 25 genotypes previously selected on two time collected, 19 genotypes were listed in selected 61 genotypes screened on above mentioned all three parameters.

Table 1: List of selected superior 25 genotypes

Field A	Field B	Field C
A0501 A0903 A0303 A0104	B0211	C0207, C0517, C0518, C0201, C0616, C0501, C0505, C0212, C0414, C0305, C0516, C0303, C0601, C0419, C0218, C0114, C0511, C0503, C0609, C0312

Growth performance of 25 superior genotypes: Seedlings were transferred from root trainer to polybags after four months of germination. Growth performance (height and collar diameter) of progenies (500 progenies) of 25 superior genotypes were recorded after three months of sowing. Regression curve of deviation from mean height (after three months of seed germination) of these genotypes revealed that four genotypes namely C501, C516, C503 and C609 were superior in terms of height among 25 selected superior genotypes. The positive outliers of these four genotypes in regression curve indicated the individual superior progenies (Figure 13A).

The regression curve of deviation from mean collar diameter (after three months of seed germination) of 25 superior genotypes revealed that C501, C516, B211 and C609 genotypes are superior genotypes. The positive outliers of these four genotypes in regression curve indicated the individual superior progenies in terms of collar diameter growth (Figure 13B).

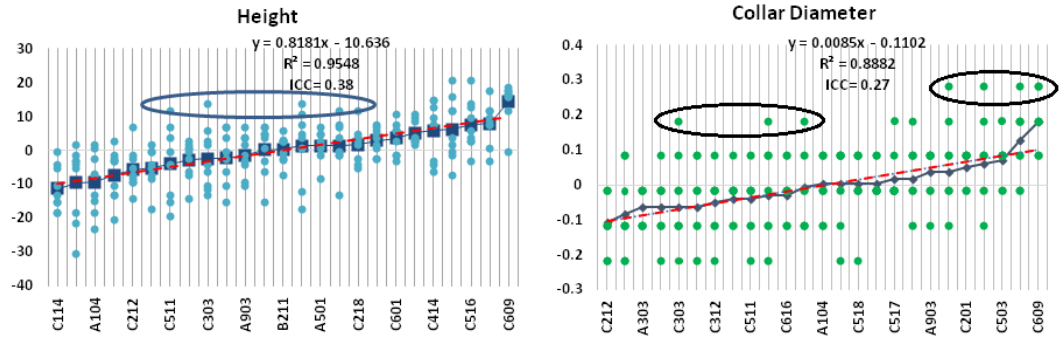


Fig. 13: A; Regression curve of height of 25 superior genotypes and B; Regression curve of collar diameter of 25 superior genotypes

Field Establishment: Total 7697 guggal germplasm are available in AFRI (Figure 14 B). Out of these 714 are superior female progenies (Figure 14). Area for plantation has been identified and plantation of superior genotypes will be done in last year of project.

Fig. 14: A) Progeny of superior genotypes; B) Total Guggal germplasm in AFRI polyhouse

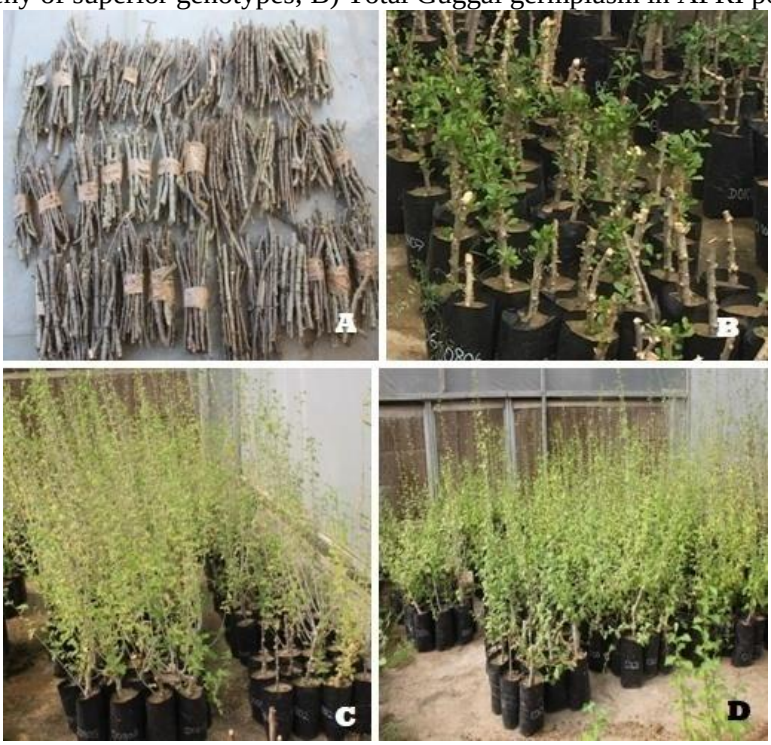


Fig. 15: A) Male and selected superior female guggal cuttings collected from Deesa, Gujarat; B) Sprouting in male cuttings; C) Response in cuttings of 13 male genotypes; and D) Response in cuttings of 25 superior female genotypes - Total 7697 plants

Macro propagation was also done for multiplication of selected superior female genotypes (higher black seed yielder). Total 435 cuttings of 25 superior female genotypes from Deesa, Gujarat were raised in AFRI mist chamber in Feb, 2019 (Figure 15 A&B). Total 55.40% cuttings responded after two months (Figure 15 C&D).

Benefits of the project: Out-come of project will provide quality seed sources, high quality seedlings for establishment of seed production Area and SSOs for production of quality seeds. It can also be treated as Genetic Resource of Guggul (particularly extremely rare male plants) for future improvement and Breeding Programme. Genetic contribution of seed viability through laboratory and field experiments will be useful to stakeholders who are interested in raising large scale plants of Guggul through seeds.

2. Genetic Improvement of *Azadirachta indica* (Neem) through Transgene Pyramiding for Enhancement of Cold Endurance(2017-20 Subsumed in AICRP).

PI: Dr Tarun Kant, Scientist-F, ICFRE Project

Achievements: Besides two *Agrobacterium*-strains (GV-3101 and LBA-4404) that were being maintained at AFRI as stocks and through culturing, LBA4404 strain was also procured and being maintained. LBA4404 strain of *Agrobacterium* was also successfully transformed with the pCAMBIA1304 plasmid vector which contains genes for selectable marker - *gusA* and *gfp*. Neemcalli after 3 days of *Agrobacterium* co-cultivation on modified co-cultivation (MCCM) medium were incubated in X-Gluc solution at 37°C from a few minutes to overnight and scored for evidence and extent of GUS activity. Stable expression of □-glucourinidase gene was observed as blue patches on callus surface and inside upon sectioning after over 12 weeks of co-cultivation, indicating positive transformation events and successful integration of the introduced (*gus*A) gene in Neem genome. The effeciency of transformation has to be further optimized. Semi Quantitative Reverse Transcriptase-PCR (sqRT-PCR) was done using *gus*A gene primers and *npt*II gene primers and a distinct bands were obtained corresponding to each oof the two genes, giving molecular confirmation of the transformation success.

Benefits of the research project: Neem is medicinally and economically important tree with an established market of medicinal products and bio-pesticides world over. By extending the range of its growing region to even the colder regions, new industries dependent on neem products will come up in such areas, generating job opportunities, boosting the regional economy and creation new markets. Moreover, since there is a cross talk between the abiotic-stress tolerating genes, the transgenic cold-enduring neem is also expected to show better tolerance towards other abiotic stresses like drought and salinity. Such plants may also have better growth performance, which will be evaluated in future.

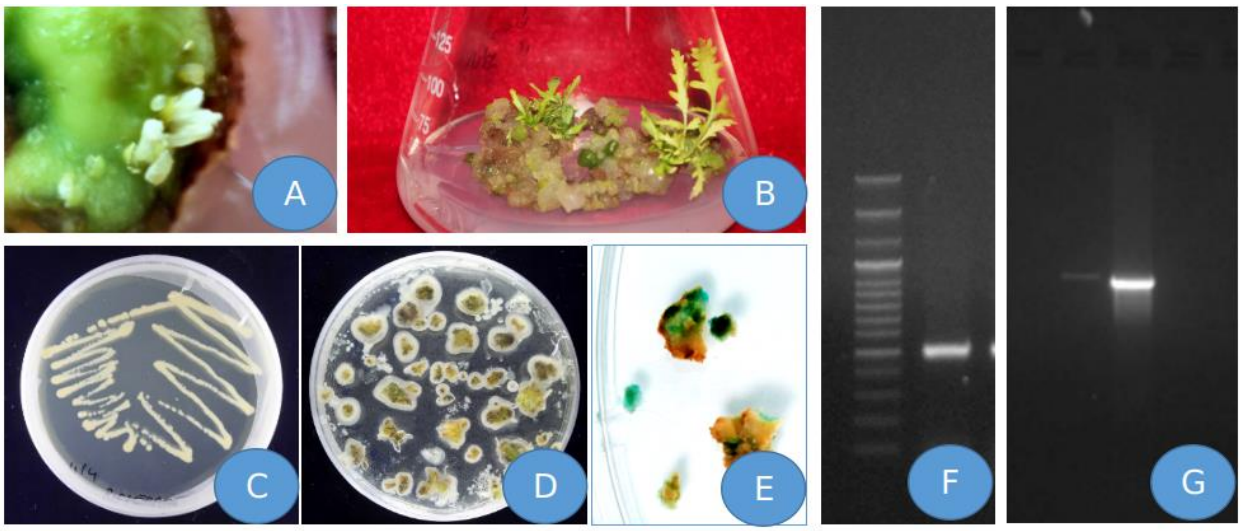


Fig. 16 *:*Neem Genetic Transformation. **A**. Somatic embryos in Neem; **B.** Shoot formation in vitro from neem callus; **C.** *Agrobacterium* culture maintenance; **D**. Agro-Neemcocultivation plate; **E**. GUS Positive callus of Neem; **F**. Expression of hpt-II gene introduced in Neem; G Expression of GUS gene introduced in Neem callus.

3. **Cloning and Characterization of Salt Tolerance Conferring Vacuolar Na+/h+ Antiporter (*nhx*1) Genes From *Prosopisjuliflora* (Sw.) Dc. &*Salvadorapersica*L (2017-22). (PI: Dr Tarun Kant; ICFRE Funded)**

Achievement: *Prosopisjuliflora*and *Salvadorapersica* seed collection Seeds have been collected, procured and stored.Raising of seedlings aseptically: Seedlings have been grown on hydroponics system containing hoagland medium supplemented with different NaCl concentrations for different duration as required. Plants were treated with various concentrations of NaCl (40mM, 100mM, 200mM, 300mM and 400mM) for different time period 1h, 3h, 6h, 12h, 24h, 36h, 72h and 7 days. *RNA extraction from P. juliflora and S. persica tissue:* RNA extraction from leaves and roots from both species have been achieved. Quantification of extracted RNA have been done. cDNA have been prepared from the RNA and stored for future objectives. Total RNA was isolated from young shoots and roots. **The yield of RNA ranged between 0.5-0.75 mg per gram of fresh tissue and the absorption ratio (A260/A280) was 1.98** (close to ratio for pure RNA. Partial length isolation of Na^+/H^+ antiporter gene and its sequencing was done and Designing of primers based on closely related species is in progress. Few primers which are already reported have been checked.

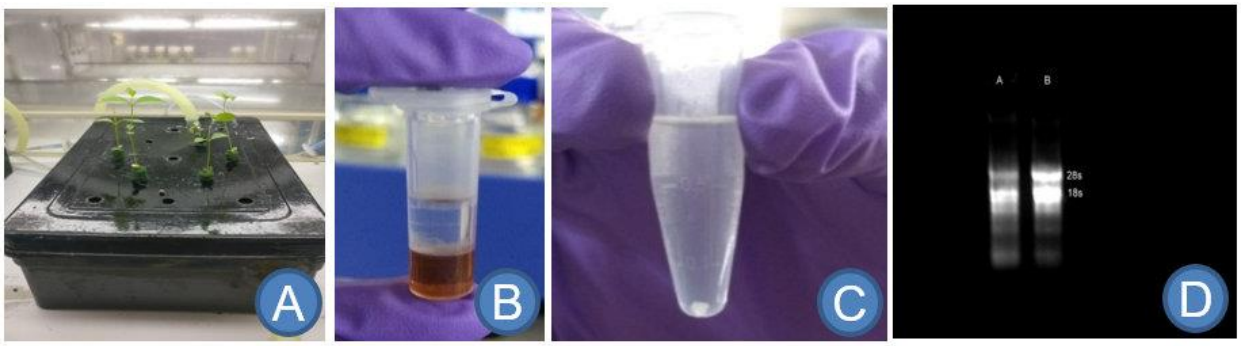


Fig. 17 : Gene Cloning of *nhx1* gene from trees: **A**. *Salvadorapersica* seedlings growing hydroponically; **B.** RNA extraction protocol optimization step; **C.**RNA pallet at the bottom; **D**. Denatuting Gel electrophoresis showing good RNA yield from *S. persica.*

Benefits of the research project: This work will lead to deciphering of complete gene sequence of vacuolar *NHX1*antiporter of*Prosopisjuliflora*(*PjNHX1*) and *Salvadorapersica*(Sp*NHX1*). It will lead to development of the binary vector for plant transformation with *PjNHX1 as well as SpNHX1* gene constructs, which can be used for genetic improvement of crop plants through transformation approach in the future and will aid the ongoing genetic improvement effort to grow plants with higher productivity even under abiotic stresses conditions like salinity.

4. **Studies on phenology, molecular analysis and wood properties of *Tecomella undulata* with respect to three flower color morphotypes (2017-21).**

PI: Mrs. Desha Meena, Scientist-C, ICFRE Project

Achievements: Based on the survey conducted in eight districts of Rajasthan (Nagaur, Sikar, Churu, Bikaner, Jalore, Jaisalmer, Barmer and Jodhpur), it was observed that the percentage ratio of orange color morphotypes was more in comparison to yellow and red color morphotypes. For phenological studies of *Tecomellaundulata*, ninty trees (30 trees of each color) were marked at Bhadrajune, Jalore and phenological data like leaf size, pod size, flowering pattern and percentage were recorded among the three different flower color morphotypes. For testing mechanical and physical properties of wood among three different color morphotypes,nine wood logs from Mohangarh, Jaisalmer were collected and supplied to FRI, Dehradun. One log from each set was converted, seasoned and mechanical properties like specific gravity, modules of elasticity, modulus of rupture, fibre stress at elastic limit was investigated. For molecular analysis, out of the shortlisted 32 primers, 25 primers were used for PCR analysis for differentiating three flower colourmorphotypesagainst 45 samples of *Tecomellaundulata.*

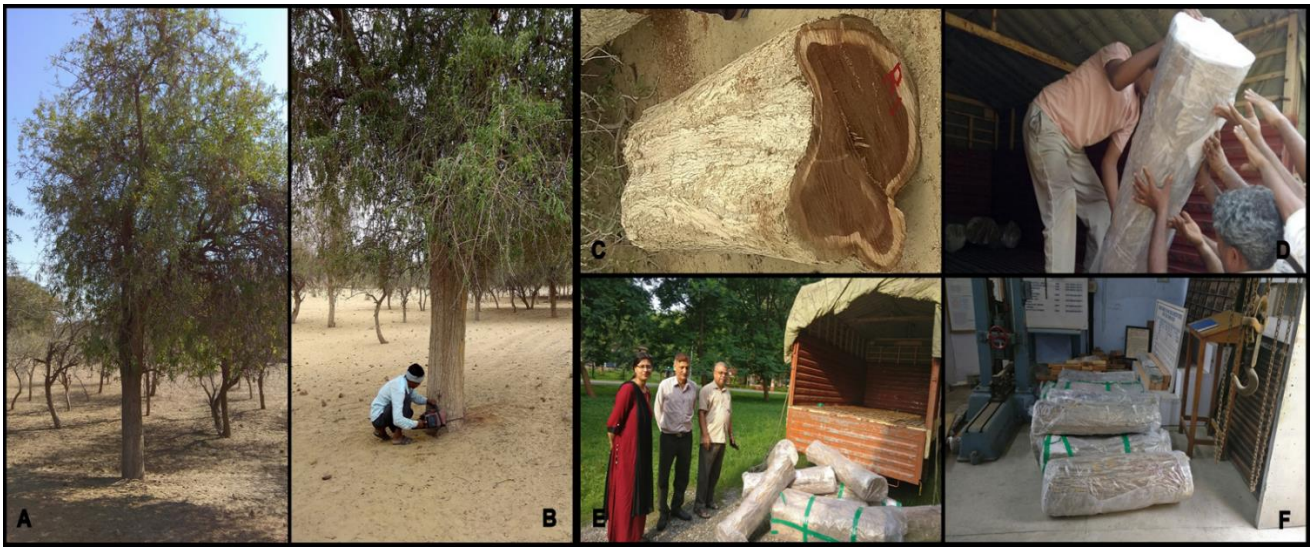


Fig. 18 : Marking, felling and transportation of nine logs of *Tecomellaundulata*from Mohangarh, Jaisalmer to FRI, Dehradun

Benefits of the Research project:

Proposed study will be the first attempt to assess the wood properties and molecular analysis of *Tecomella undulate* with respect to different flower colour variants. Studies on phenology of the species will provide useful information about the level of synchrony within and between these three morphotypes. These studies are essential to *Tecomella undulate* long term breeding programme and establishment of SPAs and seed orchards. Similarly, identification of suitable DNA markers will be useful to differentiate flower colour variants at an early stage. The outcomes of the study will take lead in *Tecomellaundulata* improvement programme.

5. Identification of Juvenility Markers to Improve Rooting Potential of some Important Tree Species(2016-20).

PI: Dr. S.K. Rajput, CTO, ICFRE Project

Achievements: Leaflet numbers per leaf were identified as juvenility marker in Ardu and Neem. Seedlings begin with three leaflet number in both Ardu and Neem. The number increases with age of seedling. The appearance of three leaflet number in coppice shoots indicates their juvenile nature in both the species. The treatment of irrigation, compost (5 kg/plant) and 2% NPK 19:19:19 was best for the coppiced shoot number as well as shoot length. The results revealed that the irrigation increases the coppice shoot length significantly as compared with the control. However, use of compost with irrigation does not improve the shoot length. Highest photosynthetic rate was observed in coppice plants of Ardu as compared to Neem. Highest stomatal conductance and substomatal CO_2 were obtained in coppice plants of Ardu followed by Neem and Rohida. Protein contents were found higher side in mature leaf of both Neem and Ardu.The rooting in coppiced shoot cuttings were obtained in Ardu and Neem. In both the species middle portion of the shoot with CD 1.52 ± 0.19 cm in Ardu (Figure 19) and 0.7 ± 0.21 cm in Neem (Figure 20), showed maximum rooting of 10.42% and 21% respectively.

Fig. 19: Rooting in middle portion of stem cuttings from coppice shoots in Ardu

Fig. 20*:* Rooting in middle portion of stem cuttings from coppice shoots in Neem

Benefits of the research project: These studies will be beneficial for both macro and micropropagation. The knowledge will help these techniques and make their results more predictable, which is very much needed in a commercial protocol. Preparation of guide lines to field forester will be helpful tool to develop vegetative propagation techniques of these species.

6. Multilocational clonal trials of Casuarina species for multiple end uses in Gujarat state(2017-20 Subsumed in AICRP 1)

PI. A.Durai, CTO, ICFRE Project

Survival rate and growth were measured in three trials established one in Rajkot and two in Bhavnagar with thirty outstanding clones of *Casuarina equisetifolia*, *Casuarina junghuhniana* and its hybrids. One year growth assessment revealed that CH 18, CH 22 and CH 25 clones are performing better in three places. These clones are belongs to inter specific hybrids between *Casuarina equisetifolia* and *C. Junghuniana.* Ninety eight percentage survival rate was observed in Rajkot (Inland area) compard to 25% in Hatab (sea coast) and Hebatpur (saline area).

Fig.21(a): Clonal plantation at Rajkot(Inland area) Fig.21(b): Clonal plantion at Hepatpurn (Salt affected area)One year old

Benefits of the research: Three clonal trials of Casuarina will be assessed with thirty clones in different environment condition (Inland, Saline and Coastal areas) and will be selected for best performing clones and short listed. These short listed clones are multiplied and propagate and supply quality planting stock to the farmers, wood-based industries and State Forest Department.

2.3.4 Vegetative Propagation:

7. Screening of DNA markers to Distinguish Male and Female *Ailanthus excelsa* trees for Higher Biomass Production (2016-20)

PI: Dr. U.K. Tomar, Scientist-F, ICFRE Project

Achievements:

- As per annual review remarks, two new plantations at Deesa (Guj.) and one local area trees of Jodhpur (Raj.) were selected for the genetic marker study. Genomic DNA was extracted from leaf samples of total 80 trees (20 Male and 20 female trees from each block) from plantation at Deesa Block 2 and Block 3, Gujarat. Total 30 (15 male and 15 female) Ardu trees leaves samples from Jodhpur local area were also collected for genomic DNA extraction. Total 42 RAPD, 20 ISSR and 23 Scot primers were screened for DNA amplification of the male and female trees. Out of which only 13 RAPD, 6 ISSR and 6 SCoT primers were found to be polymorphic for all three sites. Binary matrixes were prepared for data analysis of all the three sites (two from Deesa, Gujarat and one from Jodhpur local area, Rajasthan). None of the RAPD, ISSR and SCoT primers showed private band which can clearly differentiate between two genders.
- Morphological parameters such as clear bole height, DBH and tree height were studied for the Deesa block 1, block 2 and CAZRI, plantation. Analysis of these studies revealed that CBH were higher in male (1.09 ± 0.47 m) trees as compare with female trees (0.793 ± 0.367 m). While DBH and tree height was higher in female trees. Likewise, leaflet surface area was found higher in male (33.73 ± 1.32 cm^2) as compare with female trees (39.23 ± 1.82 cm^2). Microscopic studies were also done for leaflet trichome number in Both Deesa plantation 40 male and 40 female trees. Result of the studies showed that leaflet trichome no. higher in male trees (19.00 ± 0.79/mm^2) as compare with female (14.66 ±1.19/mm^2).
- Photosynthetic pigments (Chl-a, Chl-b, and Carotenoids) were estimated from Deesa and CAZRI leaf samples. Result of the study showed that Chl-a (6.10 ± 0.25, µg/ml) and Carotenoids (2.57 ± 0.12, µg/ml) content was higher in male trees sample as compare to female trees (Chl-a= 5.43 ± 0.45, Car. = 2.33 ± 0.16, µg/ml). While Chl-b content was higher in female trees (3.89 ± 1.09, µg/ml) sample than to male trees (1.91 ± 0.30, µg/ml).
- Cost analysis completed for morphological markers and DNA markers for 10,000 samples in two months in a defined laboratory facilities and manpower. It was found that morphological markers are 10 times cheaper than DNA marker. Morphological markers cost is about Rs 50 per sample. Detailed will be submitted in the final project completion report..

Highlight: Morphological marker (leaf trichome) is the best, cost effective as well as highly reliable marker for gender identification in Ailanthus excelsa as yet.

Benefit of the project: Screening of female plants at nursery stage will help in increasing the fodder productivity in particular and overall productivity in general by the plantations raised through the seedlings screened at nursery stage.

2.3.5 Biotechnology

8. Development of tissue culture protocol for economically important bamboo- *Schizostachyum dullooa* (kite bamboo)(2016-20)

PI- Dr. Sarita Arya, Scientist-G, ICFRE Project

Achievements:

Tissue culture studies were carried out in*Schizostachyumdullooa*commonly known as Dolu bamboo used in kite making in Gujarat due to its long internodes. Nodal segments were used for micropropagation. Nodal segments were washed with detergent and surface sterilized with 0.1% bavistin, streptomycin and

tetracycline and rinsed with distilled water after this explants were sterilized with 0.1% $HgCl_2$ for 6-8 min and were washed 3-4 times with autoclaved distilled water. Sterilized explants were inoculated on Murashige&Skoog Medium supplemented with different concentrations of BAP with 0.7% agar (solidifying agent) and 3% sucrose (as carbon source) and pH of medium was kept 5.8. Best axillary bud break was achieved on MS medium supplemented with 5.0 mg/l BAP. After 2 weeks proliferated shoots were subcultured on fresh MS medium supplemented with cytokinin. Proliferated shoots were excised and transferred on fresh MS medium for multiplication.*In vitro* shoot multiplication was achieved on MS medium supplemented with 2.5mg/l BAP. Experiments were conducted for large scale *in vitro* shoot multiplication. Later these in vitro raised shoots were transferred on different types of rooting medium. It was observed that this bamboo is very recalcitrant for in vitro rooting as all the experiments conducted fail to produce in vitro rooting. More studies with separate project is needed for the development of in vitro rooting in this bamboo as presently physical and chemical requirement is not known. The present tissue culture studies will be helpful in future development of its protocol.

Benefits of the research project: Large-scale plantlets of dolu bamboo can be produced through tissue culture technique once the protocol is developed. Later, Field trials may be established at Gujarat.

9. Clonal propagation, characterization and biochemical analysis of *Leptadenia reticulata*– a threatened medicinal plant (2016-20)

PI- Dr. Sarita Arya, Scientist-G, NMPB Project

Achievements: Developed tissue culture protocol for multiplication of *Leptadenia reticulate (Jivanti/Dodi)*. Surveyed and selected plants of *Leptadeniareticulata* from Jodhpur, Barmer and Manaii village, Pali District, Udaipur, Mehsana and Anand Agriculture University, Gujarat. The plants were established in the shade house and field. Nodal segments were used as an explant for micropropagation work. Seasons play anf important role in successful establishment of nodal explants collected from mature plants . The percentage of aseptic culture with maximum bud break response and axillary shoot proliferation was significantly high during February to April. 80-90% bud break response and 2-3 shoots proliferated from nodal segments on modified MS medium (Ammonium Nitrate and Potassium Nitrate were reduced to half, KH_2O_4 and $MgSO_4$ were doubled, 150 mg/l Ascorbic Acid, 90 mg/l Citric Acid and 80 mg/l Adenine) supplemented with 5.0 mg/l BAP. Best *in vitro* shoots multiplication was obtained on modified MS medium supplemented with 2.0 mg/l BAP + 0.5 mg/l Kinetin + 0.1 mg/l IAA. Best in vitro rooting was obtained on $1/4^{th}$ MS medium supplemented with 2.0 mg/l IBA and 100 mg/l activated charcoal. Best *ex vitro* rooting was obtained by pulse treating *in vitro* raised shoots with 200 mg/l IBA for 3min. *In vitro* and *ex vitro* rooted plantlets were transferred to bottles containing soilrite and moistened with 1/2 strength MS medium. These bottles were initially kept in growth chamber and then shifted to green house for further hardening. These plants were transferred to polybags containing sand : soil: FYM in 1:1:1 ratio hardened and acclimatized before field transferred. Different explants were used for callus induction. Callus initiation was obtained on modified MS medium supplemented with different concentrations of 2,4-D. Maximum callus induction was obtained on modified MS medium supplemented with 2.0 mg/l 2,4-D. Optimum callus proliferation was achieved on modified MS medium supplemented with 0.5 mg/l 2,4-D + 0.5 mg/l BAP. Callus obtained from leaves and internodal segments resulted in organogenesis. Organogenesis in callus raised by leaves was found to be best. Callus obtained from flowers and immature seeds resulted in somatic embryogenesis.

Benefits of the research project: There is high scope of identifying superior genotypes having high contents of bioactive compounds which can be clonally multiplied and field tested.

10. Non-destructive *in vitro* Production of Pharmacologically-active Natural Extract Containing Guggulsterones – A Potent Cardio-protective and Anti-cancer Drug from *Commiphora wightii* (Guggul) Using Bioreactor (2017-21)

PI: Dr Tarun Kant, Scientist-F, ICFRE Funded

Achievements: The callus cultures were successfully established from guggul immature fruits. The cultures were then used to establish the suspension cultures in 250 ml flasks. The cells started to multiply under suspension state. The growth parameters were studied in suspension cultures in both hormone supplemented and hormone free media. The inoculum so produced was then used as seeding material to initiate the 5L bioreactor cultures. Different parameters (like speed of impeller, frequency of aeration, and composition of

medium) were studied during the establishment phase of bioreactor. Biomass accumulation rate of guggul cells and cell-aggregates was recorded. Ethyl acetate extraction of guggulsterones was carried out and HPLC standard curves were established. The work is progressing well on optimization of bioreactor parameters for achieving high growth rate of guggul cell biomass.

Benefits of the research project: The project envisages development of a technology that can give natural guggulsterone from the plant, for possible commercial exploitation yet without destroying its dwindling natural populations. And at the same time it will be helpful in conservation of the endangered species.

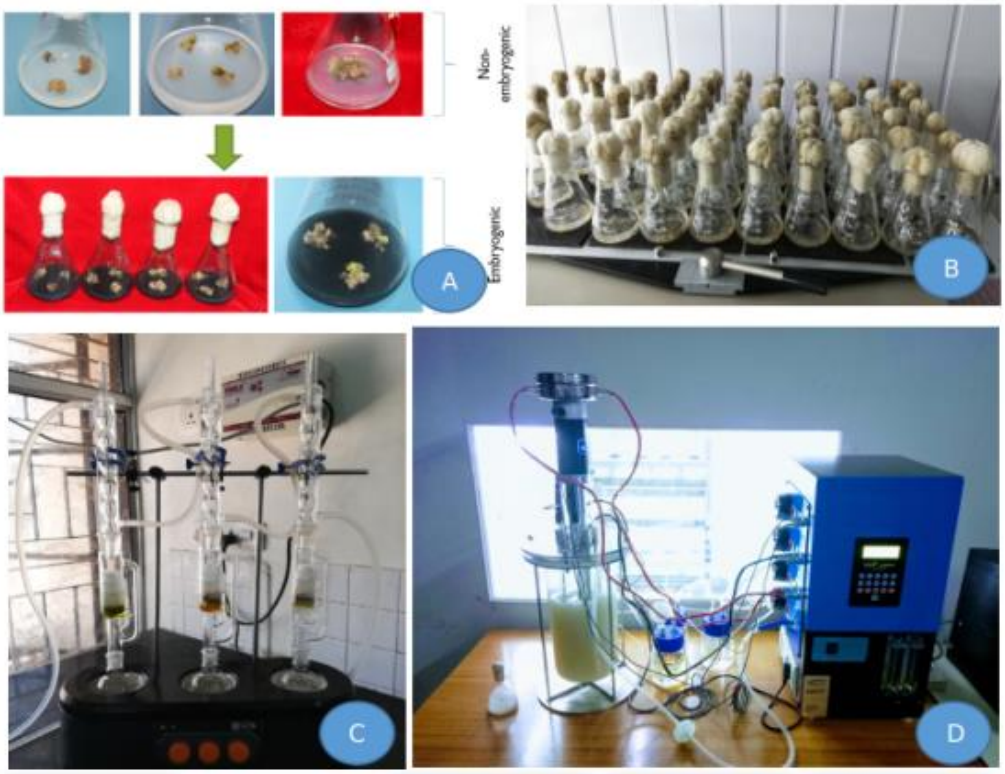


Fig 22: Guggul culture and bioreactor: **A**. *Commiphorawightii* (guggul) callus cultures (conversion of non-embryogenic to embryogenic); **B**. suspension cultures; **C**. extraction of guggulsterone from cell biomass over soxhlet**D**. Bioreactor with actively growing cell biomass

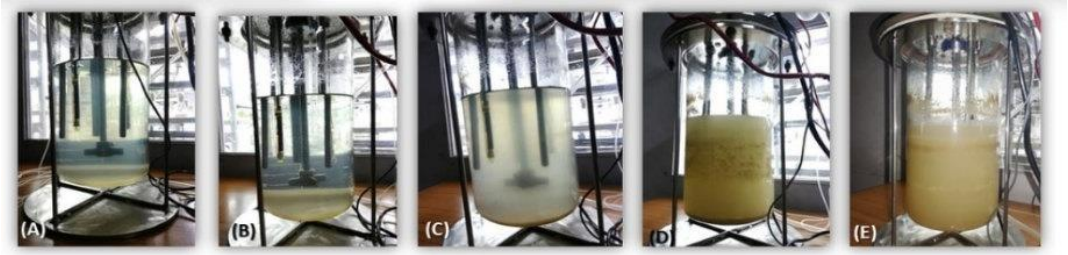


Fig 23(A to E): Stages of biomass accumulation of guggul cell lines in the bioreactor over time at 1 week interval

2.4 Forest Management

2.4.1 Overview

2.4.1.1 Project under the theme

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During 2019-20
Plan	-	-	-
Externally Aided	-	-	-
Total	-	-	-

2.4.2 Sustainable Forest Management (SFM): NIL

2.4.3 Forest Economics: NIL

2.4.4 Forest Biometrics: NIL

2.4.5 Participatory Forest Management: NIL

2.4.6 Policy and Legal Issues: NIL

2.4.7 Information and Communication Technology (ICT) : NIL

2.5 Wood Products

2.5.1 Overview

2.5.1.1 Project under the theme

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During 2019-20
Plan	-	-	-
Externally Aided	-	-	-
Total	-	-	-

2.5.2 Wood and other Lignocellulosic Composites: NIL

2.5.3 Wood Processing: NIL

2.5.4 Value Addition and Utilization : NIL

2.5.5 Wood Chemistry: NIL

2.5.6 Pulp and paper: NIL

2.6 Non-wood and Forest Products (NWFPs)

2.6.1 Overview

Value addition studies of ***Cordia gharaf*** **(fruits)** ***and Leptadenia reticulata*** **(pods)** were carried out and value added products such pickle and murrabba were prepared from the fruits of ***Cordia gharaf*** and pods of ***Leptadenia reticulata***. Training cum demonstration programmes for Bhurki Devi Mahila SHG in Jamboori and Mahadev SHG in Surpagla village were organized on value addition of *Feronia limonia* fruits for capacity building of SHG members.

2.6.1.1 Project under the theme

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During 2019-20
Plan	-	1	-
Externally Aided	1	-	-
Total	1	1	-

2.6.2 Resource Development of NWFPs

1. Studies on estimation of Agro-economics, market price spread and gap analysis in cultivation and processing of Senna and Isabgoal in Jodhpur Division of Rajasthan (NMPB, New Delhi) (2017-20)

PI : Sangeeta Tripathi, CTO

Achievements: To study market dynamics of Senna in Jodhpur Division of Rajasthan a reconnaissance survey was conducted and findings reveals that small farmers are compelled to sell their products to middleman at lower prices as transportation cost from their fields to APMC is high.

Fourteen Sonamuki processing industries in Jodhpur and Pali districts were surveyed for identifying constraints in processing and marketing of sonamukhi (*Cassia aungustifolia*) in Jodhpur division of Rajasthan. Constraints identified includes- unavailability of labour on time and at fair prices, entire crop gets damaged if there is moisture condition during harvesting, farmers are compelled to sell their product to village/local traders as transportation cost is high, MSP is not fixed, market exploitation of farmers by middlemen, lack of knowledge about post-harvest technology and problems associated with long term storage of leaves, monopoly of traders, mandi system regarding intake of senna leaves and pods is not organized at some places etc.

Senna in farmers field in Lohawat (Jodhpur District)	Collection & Storage in Farmers Field in Pali District
	
Collection & Storage in Farmers Field in Jaiselmer District	**Discussion with middle man at Jambha (Jodhpur District)**
	
Discussion with APMC Authorities (Sojat) in Pali District	**Storage of Senna in APMC Sojat**
	
Processing of Senna in Industry	**Bailing of Senna**

Fig. 24

Research Benefit: This study will be helpful for senna cultivators, processor and traders.

2. Capacity building of VFPCs/SHGsthrough *v*alue addition of selected underutilized NTFPs for enhanced livelihood opportunities in arid and semiarid Rajasthan (2017-21)

PI: Sangeeta Triapathi

Achievements:

Value Addition of *Cordia gharaf* (fruits)and *Leptadenia reticulata* (pods): Fresh *C. gharaf* fruits and *L. reticulata* pods were collected and their nutritional analysis for carbohydrate, protein, ash and moisture was carried out. . Prepared pickle and murabba from *C. gharaf* fruits and pickle from *L. reticulata* pods. Shelf life of value added products was studied for change in colour, taste and microbial growth. No microbial growth was observed after six months in *C. gharaf* products. However, after three months, the taste of pickle prepared from L. reticulate pods was changed and it tasted bitter.

Study of shelf life of Value added products of *Tamarindus indica* (pods), *Diospyros melanoxylon* (fruits) and *Feronia limonia* (fruits): Pickle and murrabba from *F. liomonia* fruits, squash, chutni and Jam from *T. indica* (pods) and Jam and squash from *D. melanoxylon* products were studied for change in colour, taste and microbial growth. Studies on shelf life of value added products reveals that no change in colour, consistency and taste was observed in all the products except *D. melanoxylon* after six months. In *D. melanoxylon* products microbial growth was observed after one month.

Capacity Building ofVFPCs/SHGsthrough *v*alue addition of *Feronia limonia* (fruits):Organized interactive meeting with VFPC/ SHG members in Sirohi district, briefing them with project objectives. SHG members agreed for taking up Value Addition activities.Two training cum demonstration programmes for Bhurki Devi Mahila SHG in Jamboori and Mahadev SHG in Surpagla villages (three days each) were organized w. e. f. 03.11.2019 to 08.11.2019 on value addition of *Feronia limonia* fruits for VFPC/SHG members in Surpagla and Jamboori. Total 40 members including SHG/VFPC members, 5 representatives of Hand in Hand NGO and Rajasthan State Forest Department officials participated in the programme. Pickle and Murabba were prepared and distributed among VFPC/ SHG members. Acceptability of pickle and Murabba was tested on 9-point Hedonic scale. A good response of SFD officials, District Administration Officials, serpanch and other authorities was obtained.

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>Scooping out Shell</td><td>Cutting and weighing of fruits</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Mixing of Juggary</td><td>Mixing of Spices</td></tr>
</table>

	
Mixing of Oil	Distribution of Murabba among SHG Members

Fig. 25

Research Benefit: The project will be helpful in providing employment opportunities to SHG members for livelihood support.

2.6.3 Sustainable Harvesting and Management:NIL

2.6.4 Chemistry and NWFPs, Value Additional and Utilization: NIL

2.6.5 Biofuels and Bioenergy: NIL

2.7 Forest Protection

2.7.1 Overview

Eighty four isolates of *Rhizobium* have been isolated from Khejri nodules using trapping technique. The isolates showed characteristics pink pigmentations on YEMA medium. Based on phenotypic, biochemical and molecular characterizations, these isolates were grouped in 23 groups based on similarity. One isolate from each group was selected and nursery experiment with one isolate of Azotobacter and one of bacillus was layed out in combination as well as singly. *Glomus, Acaulospora, Gigaspora, Sclerocystis* and *Scutellospora* spp. have been observed in the rhizospher soils of *Dendrocalamus strictus* and *Bambusa bambos*.

Prosopis cineraria, Capparis decidua and *Acacia senegal* are the most important ingredients of the famous panchkuta and Trikuta Marwari vegetable prepared from five and three types of dried fruits or seeds respectively. These trees/shrub are cross pollinated in nature and require pollination by insect.Present investigation is being carried to record diversity, foraging behaviour and abundance of insect pollinators visiting the blossoms of *Prosopis cineraria, Capparis decidua* and *Acacia senegal.*The pollinating insect plays an important role in fruit/pod production and are helpful in cross pollination in the trees/shrubs under study.

*Prosopis cineraria*pods are used in the immature or ripe form to prepare vegetables (panchkuta), pickles and various other dishes. Dried pods called khoka are used by rural people on a daily basis. Damage by the flower galls is not only the aesthetic problem but it also lowers down the yield of pods, thereby levitating the price per kg pods. In the present investigation average no. of flower gall per inflorscence was higher at Phalodi followed by Lohawat in comparison to osian, baori and pipar sites, reducing the pod formation and affecting the yield of sangri.In heavily infested trees 9-12 galls per inflorescence was recorded. Galls varied in size from few mm to 34 mm in diameter. Heavily infested inflorescence spikes were either completely devoid of pods or only 2-3 pods per inflorescence was recorded.

2.7.1.2 Project under the theme

Projects	Completed Projects	Ongoing Projects	New Projects Initiated During **2019-20**
Plan	1	3	-
Externally Aided	--	-	-
Total	1	3	-

2.7.2 Insects pests, diseases and control

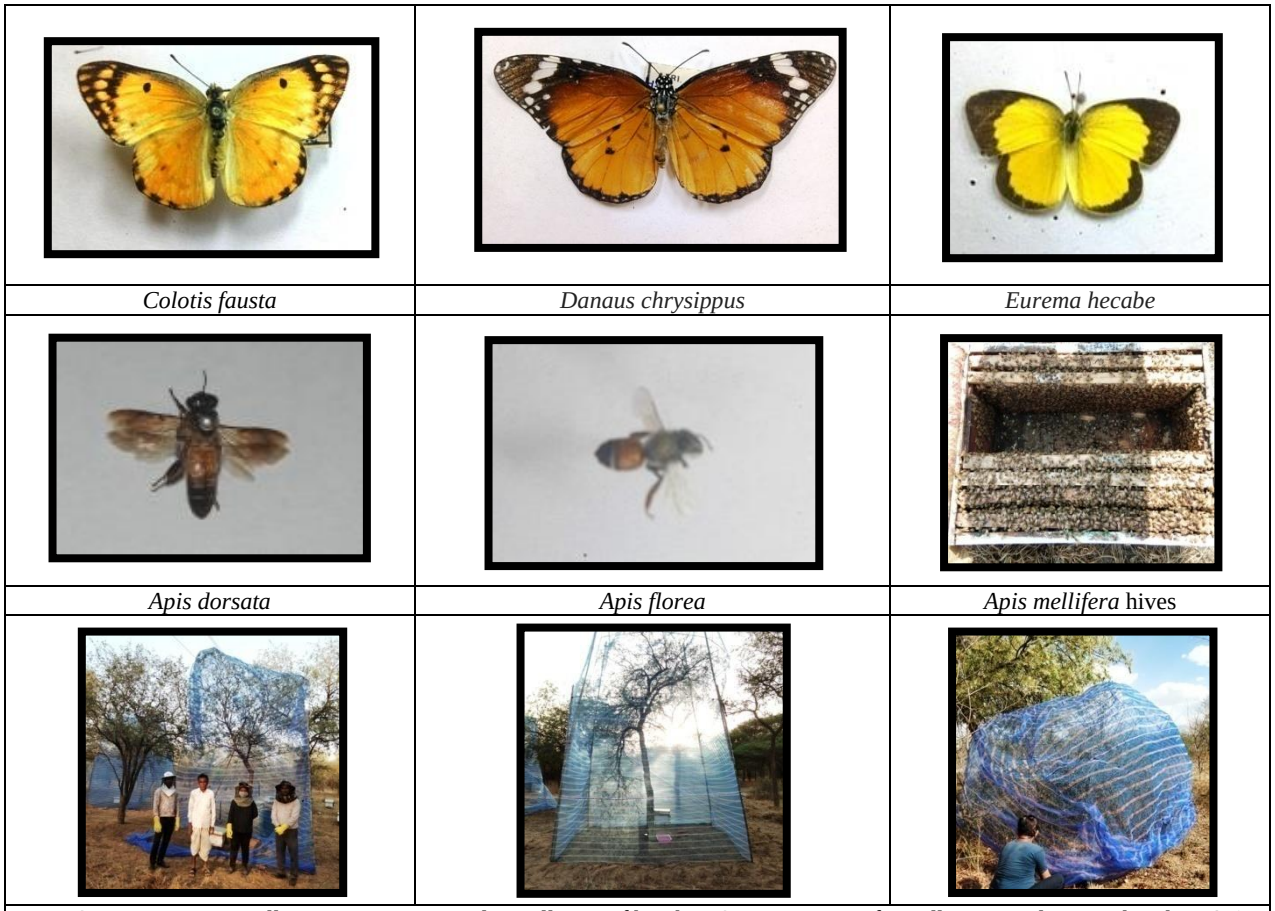
1. Diversity of insect pollinators and their role in fruit/ pod production of *Acacia senegal, Capparis decidua* and *Prosopis cineraria* (Tricuta) in Rajasthan(2016-20)

PI: Dr. Shiwani Bhatnagar, Scientist-D

Achievements: Documentation work on diversity and abundance of insect pollinators visiting the blossoms of *Prosopis cineraria, Capparis decidua* and *Acacia senegal* was completed. Insect pollinators were recorded during morning to evening hours of a day. On *Prosopis cineraria* 37 species of insect pollinators were observed belonging to 8 families: 16 genus of order Hymenopterans; 2 families: 2 genus of order Diptera and 3 families: 7 genus of order Lepidopteran were recorded. On *Acacia senegal* 50 species of insect pollinators belonging 5 families:15 genus of order Hymenopteran;4 families:7 genus of order Coleopterans ;7 families:17 genus of order Lepidopteran;4 families:4 genus of order Diptera and 1 family:1 genus of order Hemiptera were observed. On *C.decidua* 44 species of insect pollinators belonging to 5 families: 16 genus of order Hymenopteran; 3 families: 7 genus of order Lepidopteran; 1 families: 1 genus of order Diptera; 2 family: 2 genus of order Coleopteran and 1 family: 2 genus of order of Hemiptera were recorded.

Study of foraging behaviour and pollination efficiency index of insect pollinators visiting the blossoms of *Prosopis cineraria*, *Capparis decidua* and *Acacia senegal* was completed. The bees were found to be abundant floral visitors followed by Dipetrans syrphids and butterflies.

Total number of pollen grains on pollinators body varied from species to species. Among bees maximum pollen grains were recorded from *A. florea* and *A.dorsata* followed by *Amegila* sp. and *Xylocopa* sp. Pollinator exclusion experiment by keeping *Apis mellifera* honey bee boxes was laid in *Prosopis cineraria* and *Capparis decidua* field. Data on fruit yield was collected and recorded on *Prosopis cineraria*.



Colotis fausta	*Danaus chrysippus*	*Eurema hecabe*
Apis dorsata	*Apis florea*	*Apis mellifera* hives

Fig 26. Various insect pollinators, Bee Hive and Installation of bamboo & Net structure for pollinator exclusion other than *Apis mellifera* on *Prosopis cineraria* and *Capparis deidua*

Benefits of the research projects: Project will be beneficial in finding out role of insect pollinators in fruit/pod production of Khejri, Kair and Kumat.

2. Development of Integrated management strategy against flower gall inducers of *Prosopis cineraria* (L.) Druce *(2017-21)*

PI: Dr. Shiwani Bhatnagar , Scientist-D

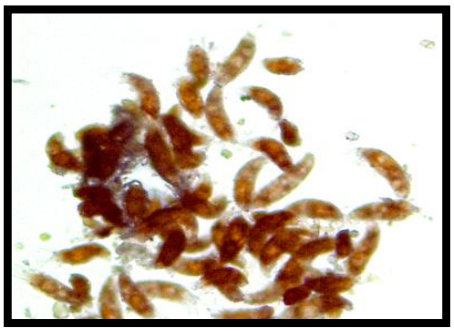
Achievements: For integrated management of flower gall of khejri two rounds of treatments with entomopathogens, botanicals and miticides at five sites selected (Phalodi, Lohawat, Osian, Pipar Baori) under study were givenin Feb-March 2019.Data collected in month of April-May 2019 revealed thattwo botanicals-hingota and putanjeeva, two entomopathogenic fungi *Metarhizum* and *Lecanicillum* and chemicals Germantec and abamectin were found effective. Incidence of flower galls of Khejri at baori, pipar, Phaludi and lohawat sites was recorded. Flower galls incidence at Phaludi, Lowhawat and Osian was more severe in comparison to Baori and Pipar. Khejri trees were selected based on girth of the tree at study sites. Average no. of galls per inflorescence in

trees of girth class 70-100cm, was higher in comparison to trees of girth class 130-160 cm at all the sites under study. Average no. of flower gall per inflorscence was higher at Phalodi followed by Lohawat in comparison to osian, baori and pipar sites. The gall infested trees had large number of unorganized, round, oblong and spindle-shaped galls. These were initially green and soft but on maturation became firm to hard at outer shell and brown in colour when dried.These galls remained on the trees up to June and when they fall from the trees they are covered with rusty mass of eriophyid mites which can be seen under the microscope.

To study the influence of lopping on khejri flower gall formation lopping experiment was laid with four treatments: lopping trees at interval of one year (T_1), two year (T_2) three (T_3) yearsand control (no lopping).

In Feb-March 2020, two rounds of management trial was given at five different sites Phaludi, lohawat, baori, piparand Osian at bud initialtion stage in last fortnight of Feb. and First fortnight of March with ten botanicals, three chemicals and three entomopathogenic fungi at an interval of 15 days to selected khejri trees.

Fig 27. Fresh and dried khejri galls



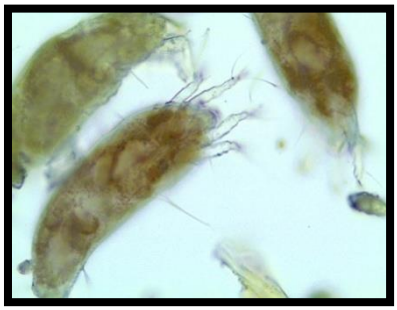


Fig 28 Khejri flower gall eriophyid mite

Fig 29. Culture &Mass multiplication of entomopathogenic fungi



Fig 30: Lopping experiment


Fig 31: Laying out management Trial

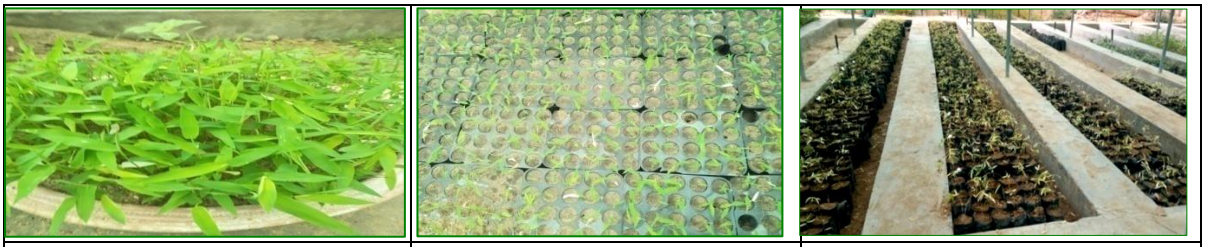
Benefits of the research projects: Project will be beneficial in managing the problem of flower galls of Khejri through integrated management approach.

2.7.3 Mycorrhizae, rhizobia and other useful microbes

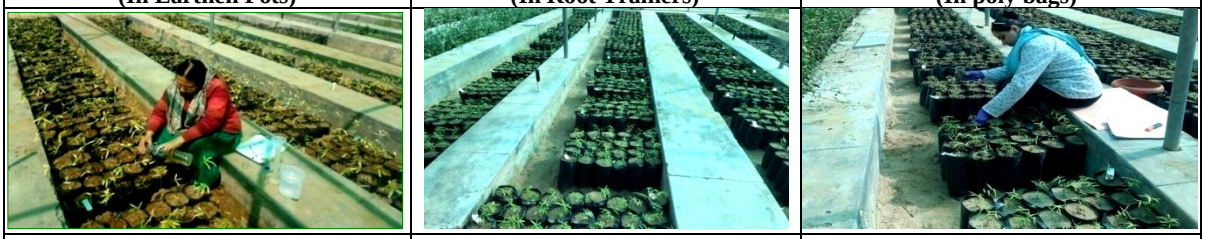
3. Selection of efficient AM fungi, PSBs and *Azospirillum* for productivity enhancement of *Dendrocalamus strictus*&*Bambusa bambos* (2016-21**)**

Principal Investigator : Dr. Neelam Verma, CTO

Nursery experiments on selection of efficient AM fungi, PSBs &*Azospirillum* for productivity enhancement of *D. strictus* (in 2018-19) and *Bambusa bambos* (in 2019-20) were laid out in AFRI Model nursery. Sixteen (16) treatments with or without combination of different biofertilizers and control was used for both the species. No. of replications were three (03) & no. of seedlings per replications were 24. All Growth parameters *viz.,* Shoot height; Root length; Shoot & Root Fresh weight; Shoot & Root dry weight; Plant Biomass; Root/Shoot ratio were recorded/completed for ***D. strictus*** experiment. Work onplant nutrient status *i.e,* uptake of P, Cu & Zn for ***D. strictus*** experiment is in progress.



Raising of seedlings *(D. strictus)* in AFRI Model nursery (In Earthen Pots)	Raising of seedlings *(D. strictus)* in AFRI Model nursery (In Root Trainers)	Raising of seedlings *(D. strictus)* in AFRI Model nursery (In poly bags)



Different Treatments were given to seedlings (D. strictus) in AFRI Model nursery	*Raising of seedlings (Bambusa bambos) in AFRI Model nursery*	*Different Treatments were given to seedlings (B. bambos) in AFRI Model nursery*

Fig. 32: Raising of seedlings and treatments for *D. strictus* and *B. bambos* at AFRI Model Nursery

Benefit of The Project: The study under this project will provide first hand information of AM technology to end users to apply eco-friendly use of biofertilizer to enhance the productivity of (*Dendrocalamus strictus* and *Bambusa bambos*).

4. Evaluation of plant growth promoting (PGP) activity of *Rhizobium* from native legumes and development of consortia with other PGP rhizobacteria (2017-21)

PI: Dr. Sangeeta Singh

Eighty four isolates of *Rhizobium* have been isolated from Khejri nodules using trapping technique. The isolates showed characteristics pink pigmentations on YEMA medium. Characterization of these isolates was done on the basis of phenotypic characters (growth characters in media, ACC utilization), Biochemical reactions (IAA production, starch hydrolysis test, catalase and oxidase activity test, activity of cellulase, chitinase, pectinase, urease and nitrate reductase, hydrolysis of gelatin and casein, hydrogen sulphide production and litmus milk test) and molecular methods (RAPD). Based on these characterization 23 groups of the isolates were made. From each group one isolate was selected and nursery experiment with these 23 isolates of Rhizobium was laid out singly as well as in combination with Azotobacter and PSB to study the effect of these biofertilizers consortia on growth characters of khejri plant.

Nursery experiment with for growth studies	Ammonia production	Catalase activity

Fig. 33 Activities under the project on evaluation of PGPs

2.7.4 Weeds and Invasive species: NIL

2.7.5 Forest Fire and Grazing: NIL

3. Education Vistas/Activities

3.1 FRI University (Applicable for FRI Only)

3.2 Training organized:

Sl. No.	No. of Trainings	Duration (in days)	No. of participants
1	MoEF&CC sponsored **One Week Refresher Course for Indian Forest Service Officers** on "Integrated approach for sustainable development of fragile desert ecosystem" from 16 – 20 December 2019	5	39
2	**Mrs Sangeeta Tripathi conducted** training programme on "NTFP (Plant origin): Value Addition & Marketing" under **Green Skill Development Training Programme (GSDP)** held at Arid Forest Research Institute, Jodhpur on 6th to 26th Feburary 2020	21	20
3.	**Dr Sangeeta Singh** conducted GSDP training on "Waste Management, Solid Waste, Bio-Chemical Waste, Plastic waste, E-Waste, construction and Demolition waste" on 20 February, 2020 to 20 March, 2020 as Course Co-Ordinator.	30	15

3.3 Visit Abroad: Nil

3.4 Participation in Seminar/Symposia/Workshop/Trainings

Sl. No.	No. of Seminar / Symposia / Workshops/ Trainings	Duration (in days)	No. of participants
1	G. Singh (2020). Attended review meeting of Draft DPR and its progress on "Preparation of the DPR for Rejuvenation of the Luni River through Forestry Interventions" the ICFRE Dehradun on 6,7 and 8th January 2020.	3	
2	Desha Meena attended training on "Forest Genetic Resources Management and Conservation" at NBPGR, New Delhi from 27.01.2020-31.01.2020.	5	
3	**Neelam Verma** delivered lecture on, **"Diseases and their management in NTFP yielding plants"** in Green Skill Development Training Programme (GSDP) from (06/02/2020 to 26/02/2020) organized at AFRI, Jodhpur.	3	20
4	S.R. Baloch (2020). Participated in Five days training cum workshop on" Study of climate driven effects on Indian forests through long term monitoring" from 18th to 22nd February 2020, at Madumali , T.N.	5	
5	Shri A. Durai, CTO , Shri Mahipal Bishnoi, STO and Shri Sohanlal Garg, Senior Technician Participated on ICFRE-HRD Training programme on Tissue culture of trees and Bamboos at IFGTB, Coimbatore from 24.02.2020 to 28.02.2020.	5	
6	Dr Tarun Kant, Dr. N.K. Bohra and Sh. S.R. Baloch attended the **Inception Training Workshopof the CAMPA funded National Programme on Gorest Genetic Resources Development and Management** from 2 - 4		

	March 2020		
7	B. Sharma (2020). Attended five days training Programme on 'Environmental Impact Assessment' organized by CSE from March 2nd to 6th 2020 at Anil Agarwal Environment Training Institute (AAETI), Alwar, Rajasthan.		
8	G. Singh (2020). Presentation and review meeting of Draft DPR on "Preparation of the DPR for Rejuvenation of the Luni River through Forestry Interventions" the ICFRE Dehradun on 12th March 2020.		
9	**Dr. Shiwani Bhatanagar** presented paper on "Impact of global warming and climate change on insect pollinators: A review", in National seminar on Agriculture, climate resilience and nutrition: Adoption of integrated Approach for sustainable Development organised on 15-16 march 2020 by J.V. Jain College, Saharanpur (U.P) & Karpa Foundation, Ghaziabad.	2	
10	G. Singh (2019). Participated in inception workshop on 'River rejuvenation' organized at ICFRE, Dehradun during 24-25, April, 2019.	2	
11	S. R. Baloch (2019). Presentation of two new research projects in RAG meeting organized on 14th June, 2019 by Rajasthan Forest Department at Jaipur.	1	
12	S. R. Baloch (2019). Presentation of a new project "Restoration of Degraded Aravalli hills through rainwater harvesting, afforestation and soil amendments for increased biodiversity and people livelihood inwestern Rajasthan" for funding by district Collector Pali, Rajasthan at Pali on 16th July 2019.	1	
13	S. R. Baloch, (2019). Monthly seminar presentation on "Forest resource dependence and ecological assessment of forest fringes in rainfed districts of India" at AFRI, Jodhpur on 26th July 2019.	1	
14	Shri. Sohanlal Garg, Senior Technician participated on NTFP Value and Assessment training from 19.08.2019 to 23.08.2019 at Central Institute of Medicinal Plants and Aromatic Plants (CIMAP), Lucknow, UP.	5	
15	G. Singh (2019). Participation in Regional workshop organized at TFRI Jabalpur 23-24 August 2019.	2	
16	G. Singh (2019). Participated as a member of the committee in exhibition show organized by ICFRE for Cop-14 New Delhi during 30-08-19 to 05-09-19.	7	
17	Dr Tarun Kantmade a **Presentation as a Panalist**during the **14th Session of Conference of Parties (COP-14) of the United Nation's Convention to Combat Desertification (UNCCD)** held at India Expo Center and Mart, Greater Noida, Delhi NCR from 2-13 September 2019	12	
18	S. R. Baloch (2019). Participated in one day metting with Chairman-SLNA Shri Rajeshwar Singh (IAS) Additional Chief Secretary-Rural Development & Panchayati Raj held at Jaipur on 13th September 2019.	1	
19	S.R. Baloch (2019). Panel Expert in the Ad-hoc basis Selection Committee of PGT and TGT held on 22th September, 2019, at KV Air force no.1, Jodhpur	1	

	(Rajasthan).		
20	B. Sharma (2019). Attended five days training programme on "Use of Remote Sensing and GIS in forestry" at 23-27 September 2019 at IIRS, Dehradun	5	
21	Dr Tarun Kant **attended the National Symposium on Arid Environment & Sustainable Development**, held at Jai Narain Vyas University on 22 September 2019	1	
22	Dr. N.K.Bohra attended Training at Indian Institute of Remote Sensinsing ,Dehraun on Uses of Remote Sensing and GIS in Forestry from 23-25 September ,2019	3	
23	**Seema Kumar. 2019.**Delivered monthly lecture entitled **"Role of faunal elements in forestry with special reference to insects"** under monthly seminar held at AFRI Jodhpur on 30 September, 2019.	1	
24	एस. आर. बालोच (2019) कलेक्टर जोधपुर की अध्यक्षता में राजीव गांधी जल संचयन योजना के क्रियान्वयन हेतु आयोजित कार्यशाला, मे दिनांक 30 सितम्बर, 2019 को भाग लिया।	1	
25	Dr Tarun Kant gave an invited lecture, as a keynote speaker at the **National Conference on Biodiversity Conservation for Sustainable Future,** held from 11-12 October 2020 at IIS University, Jaipur	2	
26	Dr. N.K.Bohra attended and deliver presentation on "Bio Diesel Plants-Biofuel" in Hindi at Rajbhasha Sangoshti held at Desert Medicine Research Center, Jodhpur from 20-21 October ,2019	2	
27	Dr. N.K.Bohra attended as expert on behalf of AFRI ,jodhpur at International Centre for Environment Audit and Sustainable Development (ICED),Jaipur on 24 October ,2019	1	
28	Dr. N.K.Bohra attended and deliver lecture on "Sandal wood plantation in Rajasthan and Gujarat- A new Initiative" in National Conference on Global Research for Sustainable Development-Recent trends challenges and approach-at Aishwarya College of education, Jodhpur from 8-9 November ,2019	2	
29	S.R. Baloch (2019). Attended Vidhlya Management Committee meetings as a member at Kendriya Vidhalaya No. 1, Air force Jodhpur on dated 20th November 2019.		
30	**Seema Kumar 2019.**Attended and participated in DST Sponsored Training Programme on Environmental Leadership & Life skills for women scientists" held at IIFM Bhopal, from 25-29 November 2019.	5	
31	G. Singh (2019). Attended at meeting at the office of PCCF (HoFF), SFD, Rajasthan at Aranya Bhawan and Add. PCCF (Silva) Jaipur on 2-3 December 2019.	2	
32	**Neelam Verma. 2019.** Delivered a monthly seminar on **"Role of Mycorrhiza in Forestry"** under Thrust area: *Managing Forest & Forest Products for Livelihood Support & Economic growth* and Theme: Mycorrhiza, rhizobia & other useful microbes as per the directives of ICFRE	2	AFRI Members
33	Dr. N.K.Bohra attended meeting at ICICI Rural Self Employment Training Institute, Jodhpur on Technical knowhow on farm forestry for awareness among farmers on	1	

	11.12.2019		
34	Shri. A . Durai ,CTO and Shri Sadul Ram Deora, TO participated on Sandal Wood seed handling, Nursery and plantation technology at IWST, Bangalore from 09.12.2019 to 13.12.2019.	5	
35	Dr. N.K.Bohra attended KVK,CAZRI 35 th Scientific Advisory committee meeting at CAZRI on 18.12.2019	1	
36	Dr. N.K.Bohra attended two days workshop on "Preparing of Rajasthan State Biodiversity strategy and Action plan "at Rajasthan Forestry and Wildlife training Institute, JLN Marg, Jaipur from 30-31 December,2019	2	
37	B. Sharma (2019). Attended two days workshop on 'Biodiversity' organized by State Biodiversity Board Rajasthan from 30-31 December 2019 at Jaipur, Rajasthan	2	
38	M.R. Baloch IFS, Director AFRI attended compulsory training for IFS officers organized by WII at Port Blair, A&N from 10 to 14 Feburary 2020.	5	

4. Extension Panorama/Activities:

4.1 Report on Van Vigyan Kendras (VVKs), Demo Village (DV), Tree Growers Mela (TGM), Prakriti and Green Skill Development Programme (GSDP)

(a) Bichhwal (Bikaner), Rajasthan, **established**

(b) Chhipardi Beedi (Rajkot) Gujarat, **established**

(c) Rudana Nursery, Khanwel (Silvasa) Dadra & Nagar Haveli and Daman, **established**

Proposed Environmental Awareness Centre under KVK, Bikaner

On 08/10/2019 a meeting was organized between Director AFRI and Officers of Extension division with the members of All India Bishnoi Mahasabha at Muktidham Mukam, Tehsil Nokha, district Bikaner (Raj), to discussion on setting up the Environmental Awareness Centre at Mukam, Nokha, Bikaner under jurisdiction of the Indian Council of Forestry Research and Education, Ministry of Forest, Environment and Climate Change. It was proposed to establish a nursery, tubewells and plantation activities. It was also discussed to make tanks, making a short film showing AFRI's developed forestry techniques and the Bishanoi society's contribution in conservation of trees and wildlife etc.

Above mentioned topic of VVK were also discussed in a meeting on 9.10.2019 with Sh. M.K. Agrawal, CCF, Bikaner, Sh. Jai Prakash, CF, Bikaner, Mr. B.S. Solanki, D CF, IGNP_ II, Bikaner, Shri Madan Singh, ACF, Bikaner, Shri Ram Narayan Bishnoi, RFO, Nokha Bikaner.

VVK/KVK Networking:

An e-copy of three pamphlets on (1) Plant management in nursery (2) Miscellaneous benefits of agroforestry and (3) Kejri mortality: Causes severity and remedies have been sent to different centre of KVKs under Networking of ICAR Krishi Vigyan Kendras (KVKs) and ICFRE, Van Viigyan Kendras on 27/08/2019.

Dr. Bilas Singh, Chief Technical Officer and Sh. Dhanaram, Senior Technical Officer were attended the Scientific Advisory Committee Meeting at KVK Gudamalani (Barmer) on 13.9.2019. In this meeting Progress Report of the last year was presented and Action Plan of year 2019-2020 and linkage with line departments was discussed.

An e-copy of hindi magazine AFRI Darpan (January-September 2019) published by Extension Division to disseminate research and extension activities of AFRI was sent to different centre of KVKs under Networking of ICAR Krishi Vigyan Kendras (KVKs) and ICFRE, Van Viigyan Kendras on 23 January 2020.

Tree Growers Mela

On 16.9.2019 AFRI participated in Kisan Mela evm Krushi Navachar Divas 2019 organized by CAZRI, Jodhpur. In this fair AFRI exhibited different posters of developed techniques on sand dune stabilization, rehabilitation of saline lands, agroforestry and silvipastoral models, rehabilitation of water logged areas, carbon sequestration, khejri mortality management and seedling of forestry plants/medicinal plant species. Brochure of AFRI and Pamphlets/leaflets of different techniques and medicinal plants are also distributed among farmers.

Prakrati

Prakriti programme is to provide platform for school children to learn practical skills towards sustainable use of resources. It also aims to promote awareness about forests and environment and stimulate interest among students of Kendriya Vidyalay and Jawahar Navodya Vidyala in maintaining the balanced. Under this programme AFRI's conducted various activities. Brief details of activities are:

S. No.	Name of KV/JNV	Date	Participants	Activity
1	KV No. 1 Airforce, Jodhpur	3.5.2019	Principal of School	Visited AFRI labs and Interpretation Centre and discussed about MoU between ICFRE and Kendriya Vidhyalaya Sanghthan with Director, AFRI and Head, Extension Division and acquired information about research activities of the institute.
2	KV, IIT Karward, Jodhpur	20.7.2019	Principal, Teachers and students of class 6 to 12	Delivered a lecture on planting techniques and soil and water conservation. A Plating program was also organized in school.
3	KV, BSF, Pokhran	27.9.2019	Principal, Teachers and 318 students of class 6^{th} to 12^{th}	Delivered lecture about "Forest and Environment" and demonstrated planting techniques by plant the sapling.
4	KV no. 1, Bikaner Rajasthan	10.10.2019	Principal and Teachers of School	Discussed about MoU between ICFRE and Kendriya Vidhyalaya Sanghthan
5	KV No. 2 Ajmer	28.11.2019	Teachers and 500 students from class 4^{th} to 9^{th}	Delivered a lecture Forest and Environment Conservation and demonstrated planting techniques
6	KV No.1 Ajmer	29.11.2019	390 Students of class 3^{rd} to 9^{th} and all PGT TGT teachers of the school	Delivered lecture about Climate change, global warming, Afforestation and role of plants in Environment
7	Jawahar Navodaya Vidyalaya, Jaswantpura (Jalore)	27.12.2019	Students and Teachers of the school	A talk on the topic "Forest and Environment" to the students of class 9 and 10, about the global warming and greenhouse effect.
8	KV, Rajkot, Gujarat		Teachers and Students of Class XI^{th}	Delivered a lecture on Environmental awareness

Participation of KVs on Biodiversity Day

On 22/05/2019, Shri Vivek Yadav Principal K.V. AFS, Jodhpur,Shrimati Durga Chauhan Principal KV AFS-2 Jodhpur, Shri Vishnu Datt Tailor Principal K.V.Banar Jodhpur Shri B.L. Saran Vice Principal K.V. No. 1 Army Jodhpur, Shri S.S. Meena Principal, K.V. Pali, Shri Mahendra Singh Principal, K.V. Tiwari Shri Suresh Jangid, K.V.AarmyNo. 2 and Shri Syam Sundar K. V. B.S.F. Jodhpur were present and addressed in celeberation of Biodiversity day at AFRI Jodhpur.

Neem leaves composting on mass scaling at AFRI

As per Director's instructions and guidelines,neemleaves and its nimboli's (around 12000 cu.ft) were collected and put into 15 nos. of composting pits (24x8x5 fts) at main campus and pure organic neem compost of approx 4000 Cu. Ft was prepared and put at nursery (after having physical/chemical analysis) for sale @ 30/-Kg. Farmers response is verygood and they are using in their fields. AFRI is also utilizing this mannures for its various plantations, gardening thus lot of funds being saved. In the plant this neem litter being just thrown away or burnt by labourer staff causing pollution. Now, with this little extra expenditure and efforts these litter are being utilized in better way and revenue is genarated.

Fig.34 Heap Method(Composting)

Fig. 35 Pit Method (Composting)

4.2 Technologies transferred

1290 visitors in 28 groups visited Extension and Interpretation Centre, AFRI.

Sr.	Name of Visitors/Group	Date	No. of Visitors
1	Trainee Civil Judges from Rajasthan State Judiciary Academy, Jodhpur	4.4.19	35+2
2	Students of Lachoo Memorial College of Science and Technology, Jodhpur	10.4.19	41
3	ShrimatiShakuntala Pandey and other Scout and guide of summer camp Rajasthan Rajya Bharat Scout and Guide division Jodhpur.	04.06.19	50
4	Range Forest Officer Trainees from State Forest As academy, Telangana	29.6.19	35
5	A group of 35 trainee civil judges of Rajasthan State Judicial Academy Jodhpur.	4.7.19	35
6	Indian Audit and Account Service Officer Trainees of International centre for Environment Audit and Sustainable Development.	12.7.19	25+3
7	Range Forest Officer Trainees from Kundal Academy of Development Administration and Management, Kundal, Maharashtra	27.7.19	41+1
8	Students of Shri Hari Adarsh Higher Secondary School, Borunda, Jodhpur	22.8.19	72
9	Trainees of one year Diploma course in Agriculture Extension Service for Input Dealer (DAESI) from KVK, CAZRI, Jodhpur	26.8.19	40+1
10	Range Forest Officer Trainees from State Forest Academy, Dharwad, Karnataka	26.8.19	45+2
11	Forest Guard Trainees from Forest Training Center, Chhail, Himachal Pradesh	12.9.19	60+1
12	A Group of Press Reporters from Nagaland	25.9.19	7
13	Students from College of Agriculture, Anand, Agriculture University, Anand	10.10.19	51+1
14	B.Sc. Students from Madhav University, Pindwada, Sirohi	15.10.19	34+3
15	Trainees of Basic Training of Rajasthan State Allied Services from Harish Chandra Mathur Rajasthan State Institute of Public Administration (RIPA), Jodhpur	16.10.19	18+1
16	Students of College of Agriculture, Junagarh, Agriculture University, Khapat, Porbandar	18.10.19	68
17	Forest Guard Trainees of Forest Training Institute and Rangers College, Sundernagar)	22.10.19	54+2

18	M.Sc. Students of Wood Science, Forest Research Institute, Dehradun	22.10.19	40+1
19	Students of Class 11th and 12th from Army Public School, Jodhpur	23.10.19	40+1
20	Students of B.Sc. Forestry from Forest College and Research Institute, Hyderabad, Telangana	25.10.19	49+1
21	B.Sc. Final Year Students from Forestry College and Research Institute, Tamilnadu Agriculture University, Metupallayam	6.11.19	46+2
22	Students from Swami Vivekanand Govt Model School, Tasvariya Block Hurda, Bhilwara	13.11.19	60+1
23	Students of Class 3rd to 8th from Shamphered Futuristic School, Jodhpur	15.11.19	148+10
24	Nursery Students from Kinder Cocoon Play School, Jodhpur	29.11.19	24+5
25	Forest Range Officer Trainees from State Forest Academy, Dharwad, Karnataka	5.12.19	45+1
26	State Forest Officer Trainees from Central Academy of State Forest Services, Coimbatore	9.12.19	30+1
27	A group of Journalist of Press information bureau, kolkata	18.12.19	9
28	State Forest Service Officers Trainees of Central Academy for state forest services, Dehradun	27.12.19	47+1
		Total	**1290**

Lecture Deliverd

1. **10.05.2019,** Shri Uma Ram chaudhary, IFS, head extension division delivered lecture in Scouting camp at Jodhpur on " Forest and Disaster management".
2. **24/05/2019**, Shri Uma Ram chaudhary, IFS, head extension division delivered lecture in Scouting camp at Jodhpur on " Forest and Environment conservation".

Participation in CMS COP-13

AFRI was participated in The Thirteenth Session of the Conference of the Parties (COP-13) to the Convention on the Conservation of Migratory Species of Wild Animals held at Gandhi Nagar, Gujarat during 15-22 February 2020. The theme of the COP-13 was “Migratory species connect the planet and together we welcome them home”. CMS-COP-13 was largest conference of the world in history in which 2550 persons United National Agencies, Government organizations and NGOs from different countries were participated. Conference was inaugurated by Hon’ble Prime Minister of the India Sh. Narendra Modiji.

Fig. 36. Honourable Shri Babil Supriyo, MoS, MoEF&CC, Govt. of India visiting AFRI Stall at CMS COP-13 at Gandhinagar, Gujarat.

In this conference a staff of AFRI was exhibited by Extension Division of AFRI by electronic posters, a sample of Khjeri diseases, different pamphlets/leaflets, and seedling of important forestry tree species in root trainers. Visitors from different countries were visited the stall and acquired the knowledge about plants of desert ecosystem, sand dune stabilization, reasons for khejri mortality and remedies for it. Visitors from India as well as foreign countries were very impressed by work and display of AFRI, Jodhpur.

Participation in UNCCD COP-14

India was host country to the 14th Conference of Parties (COP) to the United Nations Convention to Combat Desertification (UNCCD). AFRI officials participated in the exhibition and side event organized by ICFRE ***"Restoration of Degraded Forest Lands and Combating Desertification"*** held at India Expo Centre and Mart Greater Noida, New Delhi NCR, from 2-13thSeptember, 2019. Sh. M.R. Baloch IFS, Director AFRI along with Dr. I.D. Arya (GCR), Dr. G. Singh, Scientist-G and Dr. Tarun Kant had participated in said COP-14.

Fig. 37: AFRI Director and Officials at ICFRE Stall showcasing Tree saplings raised by AFRI

Dr. Tarun Kant, Scientist AFRI, Jodhpur made a presentation on 'Biotechnological interventions for securing land productivity and combating land degradation'. He presented his work of abiotic stress tolerance (salinity, drought and frost) mechanism in plants using functional genomics approach.

Fig.38 Participation and presentation during the Side event organized by ICFRE at UNCCD COP-14

4.3 Research Publications: Please provide information in the table given below:

Books	Booklets/Brochure /Bulletins/ Pamphlets	Article in Seminar/ Conference/ Workshops Etc		Popular Article	Research Papers in Journal		Chapters in Books / Proceedings
		Article	Abstracts		Foreign	Indian	
2	-	6	3	4	-	13	5

Books

- Dr. D.K. Mishra, Dr. N.K.Bohra andDr. U.K. TomarPublished Book Title- "ADARSH PODHSHALA –STAPANA AVAM PRABHANDHAN," Published by Scientific Publishers, Jodhpur
- Ashwani Kumar, G. Singh and U.K. Tomar (2019). A Monograph on Marwar Teak (*Tecomella Undulata* (Sm.) Seem). Bishen Singh Mahendra Pal Singh, Dehradun. 237p.

Article in Seminar/ Conference/ Workshops

Dr. N.K.Bohra, Scientist-C Published following articles

1. "RAJASTHAN ME VAN SAMPADA AUR PARYAVARAN " in Manak Patrika in Rajasthani ,June 2019 issue ,page no 22-26.
2. "DHRMIK MAITAV RA UPYOGI RUKH-" in Manak Patrika in Rajasthani ,June 2019 issue ,page no 26
3. "Shataver –Khubio Ka khajana " in Farm and Foody Magzine,Published form New Delhi ,Issue 1 st January 2020,page no 23-24
4. "Ghair Paramparaghat Nakdi Faslo Ki kheti "in Farm and Foody Magzine,Published form New Delhi ,Issue 1 st January 2020,page no 28-29
5. "Jungle ki Aag-Palalsh " in Rajasthani Kheti Magzine ,February 2020,page no 11-12
6. "Kitnashak Davavo ka prayog karte samay dhyan dene yogaya baate " in Sucess Mirror Magzine ,February 2020,issue 12 ,page no 50-51

Abstracts

1. Bhawana Sharma, **Neelam Verma** and Meeta Singh (2019). "**Antifungal potential of leaf extract of *Balanites aegyptiaca* L, against some important plant pathogenic fungi"** In Three Days International Conference On "INNOVATIONS IN PLANT AND ANIMAL SCIENCES for SUSTAINABLE AGRICULTURE AND RURAL DEVELOPMENT (IPASSARD 2019)" held on 07-09 December, 2019. Venue: Rajasthan Agricultural Research Institute, (SKNAU), Jaipur (India). Organized by Shri Karan Narendra Agriculture University, Jobner (Jaipur) Rajasthan and National Agriculture Development Co-operative Ltd. (Under Ministry of Cooperatives) HMT, Zainakotte, Srinagar, (J & K).
2. Bhawana Sharma and **Neelam Verma** (2020). **"Arbuscular mycorrhizal diversity in *Salvadora persica* in Western Rajasthan"** In Abstract book on "3rd National Conference on Innovation in Bioscience and Technology (NCIBT-2020) held on 7th March, 2020 organized by Faculty of Life Sciences, Multani Mal Modi College, Patiala (Punjab), India, Reaccredited by NAAC with Grade A, CGPA-3.26, College with Potential for Excellence-CPE (II0 by UGC). Pp.69.
3. Bhawana Sharma, **Neelam Verma** and Meeta Singh (2020). **"Antifungal potential of *Citrullus colocynthis* (L) Schrad against some important plant pathogenic fungi**" In Abstract book on "3rd National Conference on Innovation in Bioscience and Technology (NCIBT-2020) held on 7th March, 2020 organized by Faculty of Life Sciences, Multani Mal Modi College, Patiala (Punjab), India, Reaccredited by NAAC with Grade A, CGPA-3.26, College with Potential for Excellence-CPE (II0 by UGC). Pp.79

Popular articles:

1. एस. आर. बालोच एवं एन. के. लिम्बा (2019). "वर्षा पोषित क्षत्रों में सामाजिक आर्थिक एवं पारिस्थितिकीय अंतर्सम्बंध" आफरी दर्पण 15 (3) :
2. एन. के. लिम्बा एवं एस. आर. बालोच (2019). "गुजरात एवं राजस्थान में ओषधिय खेती व् विपणन : एक अध्ययन" आफरी दर्पण 17 (१-३)
3. जी. सिंह, बिलास सिंह, एस आर बालोच एवं के. आर. चोधरी. पी. आर. नागोरा एवं एन. के. लिम्बा (२०१९) जोधपुर जिले में सामुदायिक संरक्षण क्षेत्रों हेतु जागरूकता बढ़ाने और विकास योजना बनाने के लिए जन मानस विचार और जैवविविधता का आंकलन" आफरी दर्पण १६ (४).
4. th- flag vksj ih- vkj- ukxksjk ¼2019½- vkss|kSfxd vif'k"V ty ds Hkwfe eas foltZu ds QyLo:i e`nk vodze.k dk fofHkUu izdkj ds ikniksa }kjk mipkj आफरी दर्पण १६ (1-2)

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1. Bari Bhavna, Singh Shruti and Singh Sangeeta. (2019). Isolation and Characterization of Halotolerant *Azotobacter* Species from Different Coastal Soils of South Gujarat Region. *International Journal of Pharmacy and Biological Sciences*. 9 (2): 774-779.
2. Bhatnagar Shiwani, Meena Desha and Singh Sangeeta (2019). Effect of climate change on plants and their pollinators-A review. *International journal of biotech trends and technology (IJBTT)*, 9(3):33-38.
3. Bhatnagar Shiwani, Singh Sangeeta, Khan Ameen Ullah, Kumar Bundesh, Goran Parveen, Ahmed S. I., And Rathore T.S. (2020). Antifeedant effects of some botanical extracts against cerambicid *Acanthophorous serraticornis*. *Journal of entomology and zoology studies*; 8(1):1656-1658.
4. Ranjana Arya , Sohan Garg and Shruti Sharma (2019): Effect of fertilizer application on Kair (*Capparis decidua*) fruit yield enhancement on arid sandy forest soil of Nagaur; Current Agriculture;38(1);29-33.
5. Ranjana Arya (2019) "Sustainable oleo gum resin harvesting from *Commiphora wightii* through non destructive tapping technique" *Indian forester*, 145 (4):368-374.
6. Sharma, B., **Verma, N.** and Singh, M. (2019). Antifungal potential of leaf extract of *Balanites aegyptiaca* L, against some important plant pathogenic fungi. Presented in International Conference On "Innovations in plant and animal sciences for sustainable agriculture and rural development (IPASSARD 2019), held on 07-09 December, 2019. At Rajasthan Agricultural Research Institute, (SKNAU), Jaipur (India).
7. Sharma, B. and **Verma, N.** (2020). Arbuscular mycorrhizal diversity in *Salvadora persica* in Western Rajasthan. Published in abstract book on "3rd National Conference on Innovation in Bioscience and Technology (NCIBT-2020) held on 7th March, 2020 organized by Faculty of Life Sciences, Multani Mal Modi College, Patiala (Punjab), India. Pp.69.
8. Sharma, B., **Verma, N.** and Singh, M. (2020). Antifungal potential of *Citrullus colocynthis* (L) Schrad against some important plant pathogenic fungi. Published in Abstract book on "3rd National Conference on Innovation in Bioscience and Technology (NCIBT-2020) held on 7th March, 2020 organized by Faculty of Life Sciences, Multani Mal Modi College, Patiala (Punjab), India. P.79
9. DeshaMeena, Tarun Kan**t**. Optimization of DNA Extraction Protocol For RAPD And ISSR analysis In *Tecomellaundulata*. *J. Phytol. Res.* **31(1 & 2**) : 23-28
10. DeshaMeena, Tarun Kan**t**, Aastha Sharma. Genetic Improvement, Propagation And Conservation Efforts For TecomellaUndulata, A Flagship Timber Species Of The Drylands- A Review. *Int J. Biotech Trends & Tech* (2019) **9(3):** 23-37
11. देशामीणा,अनिलसिंहचौहान ,आस्थाशर्माएवंतरुणकां.2019 .**राजस्थानमेंरोहिड़ाकेआनुवंशिकविविधताकामूल्यांकन .** आफरीदर्पण**01 ,-03**: 2-4.
12. Bano S, Ansari S, Choudhary M and Tomar UK (2019). Significant leaf morphological differences in male and female trees of Alianthusexcelsa and their role in differential

growth. (Abstract publishes in National conference on Biodiversity conservation (2019), Jaipur).

13. Bano S, Ansari S, Choudhary M and Tomar UK (2019). Gender-based genetic variability of Ailanthus excelsa populations using, RAPD, ISSR and SCOT markers. (Approved Institutional Committee and submitted in International journal for publication).
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Chapter in Book

- Seema Kumar. (2020). Biological control of invasive alien species in forests of India" after incorporating corrections for inclusion in publication on "A handbook on Invasive Species" Chapter 6. Pp. - In: Operational manual on Forest Invasive Species, published by ICFRE.
- Kumar, S. and Kumar Seema. (2020). Lepidoptera: Heterocera diversity of Rajasthan for State Fauna Series, ZSI publication (Submitted).

Publications: Sent in AFRI Darpan:

- **डॉ. के. के. श्रीवास्तव, डॉ. संगीता सिंह एवं डॉ. नीलम वर्मा "गर्म / उच्च तापमान वाले शुष्क क्षेत्रों में कम्पोस्ट और जैव-उर्वरकों का उत्पादन बढ़ाने हेतु नवीन विधियाँ/रुझान/तकनीकें"Hindi Article published in AFRI Darpan October-December, 2019 YR15, no.04**
- A Quarterly Hindi Magazine - **AFRI Darapn,** January to September 2019 (Year 17th Joint Editions 1-3., 500 Copies Published) (Extension Division)
- **AFRI Darpan,** October to December 2019 (Year 17th Edition 4th, 500 copies) (Extension Division)

4.4 Seminars/Symposia/Workshops Organized

Sl. No.	No. of Seminar / Symposia / Workshops/ Trainings/ Meetings	Duration (in days)	No. of participants
1	Meeting for review of Draft DPR and its progress on 6,7 and 8th January 2020, at the ICFRE Dehradun	3	50
2	Meeting with State Forest Department, CCF Jodhpur Circle on 9th January 2020, at CCF Office Jodhpur Circle	1	16
3	Meeting with Agriculture and Horticulture Department of Luni basin divisions on 10th January 2020, at the AFRI Jodhpur	1	20
4	Meeting with official of Agriculture and Horticulture Department, Jalore, Pali and Sirohi divisions on 15th January 2020, at Agriculture Department, Jalore	1	13
5	State level Workshop for finalization of Draft DPR 4th February 2020, at the AFRI, Jodhpur	1	72
6	Dr. Sangeeta Singh organized **workshop** on "Waste Management, Solid Waste, Bio-Chemical Waste, Plastic waste, E-Waste, construction and Demolition waste" on 20 February, 2020 to 20 March, 2020 as Course Co-Ordinator.	1	30
7	A meeting held with PCCF & HOFF, Rajasthan Forest Department , Jaipur on 17th April 2019, Aranya Bhawan, Jaipur, Rajasthan	1	8
8	A meeting for the Luni-DPR by the Director, AFRI, Jodhpur on 2nd May 2019, at the AFRI, Jodhpur	1	40
9	A meeting for the Luni DPR by the Project Coordinator on 9th May 2019, FE&CC, Division AFRI, Jodhpur	1	10

10	A meeting for the Luni DPR by the Project Coordinator on 16th May 2019, FE&CC, Division at the AFRI, Jodhpur	1	10
11	A meeting for the Luni-DPR by the Director, AFRI on 23rd May 2019	1	40
12	One day Interactive Workshop on "Preparation of the DPR for Rejuvenation of the Luni River through Forestry Interventions" on 27th May 2019, at the AFRI, Jodhpur	1	80
13	An MoU between the AFRI and the CAZRI, Jodhpur on 25th July 2019, at the AFRI, Jodhpur	1	12
14	Discussions on formats for different landscape on 16th September 2019 at the AFRI, Jodhpur	1	26
15	First regional one day interactive workshop involving forest field functionaries and line departments on 17th September 2019, at the AFRI, Jodhpur	1	65
16	Second one day Interactive Workshop with forest field functionaries on 26th September 2019, at Department of Environmental Sciences, MDS University, Ajmer	1	35
17	A progress review meeting for the Luni-DPR preparation by the Director, AFRI, Jodhpur on 22nd October 2019, AFRI Jodhpur	1	20
18	A progress review meeting of GIS work for the Luni-DPR preparation by the Director, AFRI, Jodhpur on 11 November, 2019, AFRI Jodhpur	1	20
19	Meeting related to proposals from different divisions by Coordinator, the Luni DPR preparation on 19th December 2019, at CCF office, Jodhpur	1	13
20	Meeting with State Agriculture Department, Jodhpur on 20th December, 2019, at office of the Joint Director Agriculture and horticulture, Jodhpur	1	4
21	Workshop for finalization of models and Draft DPR on 26th December 2019, at the AFRI, Jodhpur	1	70

4.5 Consultancies

1. Designing, development and performance of urban forestry model for new campus of Rajasthan High court, Jodhpur

Principal Investigator: Sh. K.R. Choudhary CTO

The project 'Designing, Development and Performance of Urban Forestry Model for New Campus of Rajasthan High court, Jodhpur' was implemented by Arid Forest Research Institute, Jodhpur during 2016-19. In this 605 plants of 19 tree species with varying morphological and phenological characters were planted along the boundary wall as well as the roads sides of the newly constructed High Court Campus for intended ecosystem services. The plants were regularly watered after the rainy season and weeding, soil working was done to conserve moisture. Mortality was replaced subsequently. Plant protection measures were taken up as and when required to save the plants from the diseases and insect/pest attack or other damages. Weeding and soil working (hoeing) was done regularly to conserve moisture in the soil and to avoid competitive effects of weed on the planted saplings for soil water and nutrients. Weed control was done by manual weeding at the time of planting and on a regular basis afterwards, i.e. every month and general weed removal after rainy season. The plants were regularly watered after the rainy season as it is essential for the establishment of urban trees. Apart from taking the obvious precaution of timing

planting to coincide with the beginning of the rains and ensuring that the pit is at least well watered at the time of planting, plants were irrigated thrice a month @ 40 lit per plant.Neem compost was applied in each plant twice in maintenance period. Due to construction activities and other factors few plants died and replaced during the maintenance period of 2019-20. Total numbers of plants surviving as on 17th March 2020 are presented in Table 1.

Table 1. List of species with their local names and number of saplings planted.

Sl. No.	Name of the tree species	Local name	Number of plants
1.	*Adansonia digitata*	Kalpbriksh	6
2.	*Aegle marmelos*	Bel	22
3.	*Azadirachta indica*	Neem	150
4.	*Bauhinia purpurea*	Kachnar	50
5.	*Bombax cieba*	Semal	19
6.	*Callistemon lanceolatus*	Bottle brush	7
7.	*Cassia fistula*	Amaltas	40
8.	*Ceiba pentandra*	Kapok	15
9.	*Dalbergia sissoo*	Shisham	47
10.	*Delonix regia*	Gulmohar	8
11.	*Jacaranda mimosifolia*	Jakaranda, Nili Gulmohar	9
12.	*Millingtonia hortensis*	Akashneem	69
13.	*Mimusops elengi*	Bakul	55
14.	*Mitragyna parvifolia*	Kadamb or Kalam	20
15.	*Peltophorum pterocarpum*	Peltophorum	14
16.	*Plumeria alba*	Nagchampa	2
17.	*Pongamia pinnata*	Karanj	55
18.	*Spathodea campanulata*	Spathodea	17
		Total	**605**

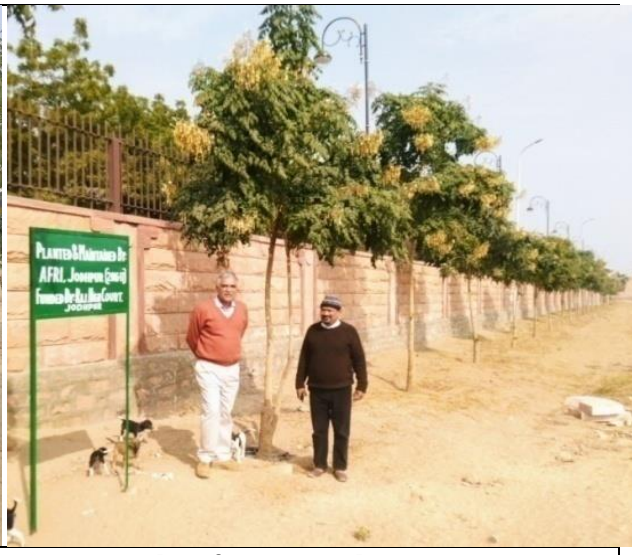
Though varying in nature, the species found least successful at the site are *Jacaranda mimosifolia, Plumeria alba* and *C. lanceolatus*, whereas *S. album* did not survive. Best performing species are *Adansonia digitata, Azadirachta indica, Bauhinia purpurea, Cassia fistula, Dalbergia sissoo, Millingtonia hortensis, Mimusops elengi, Pongamia pinnata* and *Spathodia campanulata* (Fig. 1).Conclusively, plantation activities should be done accordingly to the operational ecological and societal benefits both. For further maintenance of the plantation suggestive measures were provided to High Court Authority for further maintenance.

Callistemon lanceolatus (Bottle brush)

Azadirachta indica (Neem)

Fig. 39 Trees established by AFRI at New building of Rajasthan High Court, Jodhpur

Plantation site visit by Director AFRI and team



Site visit by former and present Director AFRI

Fig. 40: Visit to the plantation site at Rajasthan High Court by Sh. M.R. Baloch, Director AFRI with past Director, Sh. N.K. Vasu

2. Preparation of Detailed Project Report (DPR) on Rejuvenation of Luni River through forestry intervention.

Coordinator: *Dr. G. Singh, Scientist G*

The Luni River is a monsoon fed west flowing river that is 511 km in total length, 2.4 m in average depth and 1140.1 m average width. Water quality of this river changes from freshwater to saline during its travel of about hundred km because of run-off water received from the salt rich saline surfaces and industrial pollutants in the way. After origin from western slopes of Nag Pahar of Aravalli Range in Pushkar valley, it **flows through Nagaur, Pali, Jodhpur, Barmer and Jalore districts and ultimately drains into Greater Rann of Kuchch**. Sagarmati, Saraswati, Bandi, Lilri, Raipur Luni, Khari (Hemawas), Sagi, Sukri and Jojari I and Jojari II are different tributaries of Luni River. Total basin area is 40978.62. Changing climatic conditions, siltation of riverbeds due to winds and water erosion, extreme climatic conditions with frequent drought and occasional floods, encroachments and illegal mining, over grazing due to high livestock pressure, illicit cutting and over exploitation of minor forest produce and NTFPs in forest areas, invasion of different landscape by *P. juliflora* and *L. camara*, increased levels of soil and water pollution, and deterioration of ground water quality in adjoining to industrial zones are the major threats in the basin.

Developing strategies and managing river bank erosion for maintaining ecosystem services and supporting geomorphological functions of the rivers are very much essential in present scenario of degradation in ecological functions of the Luni River. Forests play an important role in proper functioning of the hydrological regime in a watershed or river basin and human well-being as well. Forestry interventions will ameliorate environmental conditions, maintain hydrological cycle and help rejuvenate Luni Rivers and its tributaries, while maintaining river ecology and improving the livelihood of forest dependent communities and desert dwellers in the basin area. To overcome the weaknesses and threats in the region and achieve the desired goal, a set of objectives devised are: (i) To identify and assess the ongoing forestry activities and potential and possibilities of forestry interventions for rejuvenation of the Luni river through multi-stakeholder participation; (ii) To integrate and implement innovative approaches and modern technology for rejuvenation of the Luni riverscape, while improving and maintaining forest/tree cover and protecting, conserving and enhancing biodiversity in the region; (iii) To encourage and support sustainable land management and improve livelihood opportunities for local communities along with conserving and enhancing green cover in agricultural lands; and (iv) To promote awareness, enhance capacity, and devise

research needs and monitoring and evaluation mechanism for protection of the ecological environment of the Luni River.

Multidisciplinary participatory approach adopted in preparation of Luni River DPR, wherein a various departments and government and non government organizations were involved and a series of consultative workshops and meeting organized. Field level data was recorded through devised performas for forest, agriculture, community and urban landscape, and conservation interventions and present and past work on the related aspects reviewed including existing legal and policy issues and institutional context. After prioritization, 2042 sites were selected for forestry and conservation interventions in riverscape area (1831.7 sq km) of Luni River and its tributaries. Among the landscapes, 258 are forests, 1665 are agriculture, 101 are community and 14 are urban, and 4 are common macro-watersheds. These altogether covers an area of about 70224.6 ha (i.e. 702.25 sq km). To treat these sites numbers of forestry intervention models proposed are 7 for forest lands, 8 for agriculture and other lands, 1 for community lands, 3 for urban lands and 2 for conservation interventions. About 6766493 seedlings will be planted in the prioritized area of the riverscape covering 38982.6 ha area by adopting different forestry models in 4 different landscapes. In addition 31242.0 ha area will be treated under habitats improvement and soil and water conservation. Various supporting activities have also been proposed that include nursery renovation (7) and creation (3), research needs,capacity building, awareness generation, and monitoring and evaluation implemented through SFD, Rajasthan under facilitation by the state facilitation organization.

4.6 Technical Services

1. Furnished scientific information on "Impact of the pollens from *Caesalpinia pulcherrima* and *Peltophorum pterocarpum* flowers for onward transmission to ICFRE, HQ on 16 May, 2016.
2. Description of 32 species of aves identified under the externally funded project entitled Study of Flora and Fauna of Raj Bhawan, Rajasthan was prepared and submitted.
3. Participated in the photo contest held on the occasion of World Environment Day 05 June, 2019 at ICFRE by submitting 3 photographs on 31 May 2019.
4. Submitted information required on research achievements for MoU 2019.
5. Submitted refined formats for scientific evaluation.
6. Dr. Sangeeta Singh delivered Lecture to Ph.D students on forest pathology
7. Supervised and judged the posters drawn by the children of AFRI Employees during the poster competition held on the occasion of Sambhidhan Diwas on 20 November, 2019.
8. Prepared and submitted reply to audit para 7 related to the project concluded on *P. juliflora* on 17 January, 2020.
9. Prepared and submitted reply to matter raised under rule 377 regarding need to formulate an action plan to weed out Vilayati Babul in the country, particularly in Rajasthan on 21 January, 2020.
10. As subject expert attended interview related to AICRP 7A & 7B held at AFRI, Jodhpur on 21 January, 2020 for selection of JPF and PA.
11. G. Singh (2019). Attended BOG meeting of ICFRE Society at Dehradun on 16th December 2019
12. G. Singh (2020). Attended field visit of Mount Abu Eco-sensitive zone area related to master plan of Mt. Abu as committee member during 15-18th January 2020.
13. Dr. Maheshwar Hegde Scientist F delivered lecture onProspects of Improving the income of farmers in arid and semi arid regions of Rajasthan and Gujarat through cultivation of high value trees like Sandalwood and Red sanders. During one week refresher course for IFS Officers 16-20th December 2019 at AFRI Jodhpur.
14. Dr. Maheshwar Hegde Scientist F delivered lecture on Status of Sandalwood (*Santalum album* L.) in India on 28-5-2020 during monthly seminar held at AFRI Jodhpur
15. Mrs. Seema Kumar delivered two lectures to four PhD scholars on topics entitled:

Lecture 1: Introduction to Forest Protection-Its Need & Scope to four PhD scholars on 14/10/2019.

Lecture 2: Agencies Causing Forest Damage *viz*. Man, Fire, Cattle, Wildlife, Insects and Pathogens, Nature of Their Damage, Cause, Prevention, Remedial Measures and Benefits to four PhD scholars on 14/10/2019.

16. Dr.N.K.Bohra, Scientist- C Delivered Lecture:

Lecture 1:Water Conservation – Need in Western Rajasthan- Lecture deliver to State Rural Development Service officer at Harish Chandra Mathur Rajasthan state Institute of Public Administration Regional Training Centre, Jodhpur on 5 Dec 2020.

Lecture 2:Agroforestry in Western Rajasthan- Lecture deliver to State Rural Development Service officer at Harish Chandra Mathur Rajasthan state Institute of Public Administration Regional Training Centre, Jodhpur on 5 Dec 2020.

4.7 Activities of Rajbhasha:

राजभाषायी गतिविधियाँ

शुष्क वन अनुसंधान संस्थान,जोधपुर में दिनांक 13 से 19 सितंबर,2019 के दौरान हिन्दी सप्ताहका आयोजन किया गया जिसमें हिंदी राजभाषा पर विचार अभिव्यक्ति के साथ हिन्दी टिप्पण -आलेखन,हिन्दी प्रश्नोत्तरी, हिन्दी टंकण(सामान्य व सारांश),हिंदी राजभाषा बोध,हिंदी वर्ग पहेली एवं स्वरचित कविता पाठ प्रतियोगिताएं आयोजित हुईं। हिंदी सप्ताह के समापन समारोह के मुख्य अतिथि डॉ.गोपाल कृष्ण लोहरा,चिकित्सा अधिकारी,आफरी डिस्पेन्सरी,जोधपुर थे। इस अवसर पर मुख्य अतिथि ने हिन्दी प्रतियोगिताओं के विजेता कर्मियों को पुरस्कार व प्रमाण - पत्र प्रदान किए।

Fig. 41 *हिंदी सप्ताह-2019 के समारंभ का दृश्य*

Fig. 42 हिन्दी प्रश्नोत्तरी प्रतियोगिता का दृश्य

Fig. 43 मुख्य अतिथि का पुष्प गुच्छ से स्वागत करते हुए संस्थान निदेशक श्री माना राम बालोच

Fig. 44 *हिंदी सप्ताह के समापन समारोह में मुख्य अतिथिका सम्बोधन*

Fig. 45 *हिंदी सप्ताह के समापन समारोह में सभागार का दृश्य*

इसके अतिरिक्त संस्थान में वर्ष में 04 विभागीय राजभाषा कार्यान्वयन समिति की तिमाही बैठकों का आयोजन किया गया तथा 03 हिन्दी कार्यशालाएं आयोजित हुई। भारतीय वानिकी अनुसंधान एवं शिक्षा परिषद, मुख्यालय द्वारा 01 अप्रैल,2018 से 31 मार्च,*2019* की अवधि का दिनांक 09/01/2020 को संस्थान का राजभाषा निरीक्षण किया गया। हिन्दी पत्राचार में वृद्धि हेतु जांच बिन्दु बनाया जाना तथा समुचित मोनिटरण द्वारा 'क', 'ख' व 'ग' क्षेत्रों के हिन्दी पत्राचार में बढ़ोत्तरी हासिल हुई। अंग्रेजी के प्राप्त पत्रों का उत्तर हिंदी में दिये जाने की पहल की गई।

Fig. 46 हिंदी कार्यशाला (26/06/2019) का दृश्य

Fig. 47 राजभाषा बैठक (27/06/2019) का दृश्य

4.7 Popular articles:

- एस. आर. बालोच एवं एन. के. लिम्बा (2019). "वर्षा पोषित क्षत्रों में सामाजिक आर्थिक एवं पारिस्थितिकीय अंतर्सम्बंध" आफरी दर्पण 15 (3) :
- एन. के. लिम्बा एवं एस. आर. बालोच (2019). "गुजरात एवं राजस्थान में ओषधिय खेती व् विपणन : एक अध्ययन" आफरी दर्पण 17 (१-३)
- जी. सिंह, बिलास सिंह, एस आर बालोच एवं के. आर. चोधरी. पी. आर. नागोरा एवं एन. के. लिम्बा (२०१९) जोधपुर जिले में सामुदायिक संरक्षण क्षेत्रों हेतु जागरूकता बढ़ाने और विकास योजना बनाने के लिए जन मानस विचार और जैविविधता का आंकलन" आफरी दर्पण १६ (४).
- जी. सिंह ओर पी. आर. नागोरा (२०१९). ओद्योगिक अपशिष्ठ जल के भूमि में विसर्जन के फलस्वरूप मृदा अवक्रमण का विभिन्न प्रकार के पादपों द्वारा उपचार आफरी दर्पण १६ (१.१)

4.8 Awards and Honours:

Dr. G. Singh, Scientist G awarded S.K. Seth prize of the year 2017 for the best paper on Environment and Ecology', published in 'The Indian Forester'.

4.9 Special Activties (such as Van Mahotsava, Forestry Day and Other occasion)

Days Celebrated

- International Day of Forests on 19.3.2019
- Earth Day on 22.4.2019
- International Biodiversity Day on 22.5.2019
- World day to combat desertificationon on 17.6.2019
- Environment Day on 5.6.2019
- Van Mahotsava Celebration on 31.7.2019

सतर्कता जागरूकता सप्ताहरूसत्यनिष्ठा व पारदर्शिता की जवाबदेही को बढ़ावा देने के लिए प्रतिबद्ध शीर्ष संस्थाएं केन्द्रीय सतर्कता आयोग के निर्देशानुसार हर वर्ष की भांति इस वर्ष भी सभी अधिकारियों एवं कर्मचारियों को भ्रटाचार को रोकने और उस पर नियंत्रण के लिए सहभागी बनाने के लिए 28 अक्टूबर, 2019 से 2 नवम्बर, 2019 तक सतर्कता जागरूकता सप्ताह का आयोजन शुष्क वन अनुसंधान संस्थान (आफरी), जोधपुर में किया गया । सप्ताह की शुरूआत में दिनांक 28.10.2019 को आफरी के सतर्कता अधिकारी डॉ. जी. सिंह ने संस्थान के समस्त अधिकारियों एवं कर्मचारियों को सतर्कता सबंधी शपथ दिलायी । इस वर्ष शपथग्रहण ई–प्रतिज्ञा के रूप में संपन्न हुआ । जिसमें संस्थान के समस्त अधिकारियों एवं कर्मचारियों ने भाग लिया । जो अधिकारी अथवा कर्मचारी किसी कारणवश उक्त ई–प्रतिज्ञा में शामिल नही हो पाये तो उन्होनें अपना निजी ई–प्रतिज्ञा लिया । उपरोक्त क्रम में दिंनाक 29.10.2019 को दो पोस्टर प्रतियोगिताएँ **''भ्रष्टाचार निवारण'** विषय पर आफरी अधिकारियों/कर्मचारियों एवं विद्यालयों के छात्र/छात्राओं हेतु आयोजित की गयी। दिंनाक 30.10.2019 को निबंध प्रतियोगिता **''भ्रष्टाचार निवारण में जीवन शैली का महत्व''** विषय पर आयोजित की गयी। जिसमें संस्थान के कर्मचारियों एवं शोधार्थीयों ने भाग लिया। इसी क्रम में दिंनाक 31.10.2019 को **''जीवन शैली एवं ईमानदारी''** विषय पर वाद विवाद प्रतियोगिता का आयोजन किया गया, जिसमें संस्थान के कर्मचारियों एवं शोधार्थीयों ने भाग लिया।

दिंनाक 01.11.201 को ''**भ्रष्टाचार बनाम जीवन शैली**'' विषय पर एक व्याख्यान रखा गया। विभिन्न प्रतियोगिताओं के विजेताओं को पारितोषिक वितरण का कार्यकम भी रखा गया । डॉ.साधना मेघवाल सहायक आचार्य सरदार पटेल पुलिस विश्वविधालय जोधपुर इस कार्यक्रम के मुख्य अतिथि एवं वक्ता थे। इस कार्यक्रम के दौरान सतर्कता अधिकारी डा.जी.सिंह ने सतर्कता संबंधी नियमो, 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 ।

मुख्य अतिथि महोदय द्वारा विभिन्न प्रतियोगिताओं के सभी विजेताओं को पारितोषिक वितरण किया गया। इस अवसर पर संस्थान के निदेशक श्री एम.आर. बालोच ने भी संस्थान के अधिकारियों एवं कर्मचारियों को संबोधित किया एवं अपील की कि सभी अपना कार्य पूर्ण, मेहनत, लग्न व निष्ठा से करे एवं सभी कार्यों में सतर्क एवं जागरूक रहे साथ ही जनसहभागिता को बढ़ाने में मदद करें।

मुख्य अतिथि द्वारा भ्रष्टाचार बनाम जीवन शैली पर संस्थान के अधिकारियों एवं कर्मचारियों को संबोधित किया गया । मुख्य अतिथि महोदय ने यह बताया कि सरकारी कार्यप्रणाली में जीवन शैली एवं रहन सहन महत्वपूर्ण है । हम खुद अपनी जीवन शैली मे सुधार लाकर भ्रष्टाचार को कम करने या उसे समाप्त करने मे अपना सहयोग दे सकते हे।अपने में भी सुधार लाकर भ्रष्टाचार उन्मूलन अपना सहयोग दे सकते हैं। व्याख्यान

के शीर्षक को उन्होने कई उदाहरणों द्वारा भी समझाने का प्रयत्न किया जिसमें इसके उन्मूलन में हमारी भागीदारी बढ सकें और हमारा देश भ्रष्टाचार मुक्त हो सके ।

70वें 'संविधान दिवस' का आयोजन

दिनांक 26 नवंबर,2019 को शुष्क वन अनुसंधान संस्थान,जोधपुर में भारतीय संविधान के अधिनियमन की 70 वीं वर्षगांठ मनायी गयी जिसका मुख्य प्रयोजन मौलिक कर्तव्यों के प्रति जागरूकता पैदा करना रहा। कार्यक्रम में कलकत्ता उच्च न्यायालय के माननीय पूर्व मुख्य न्यायाधीश,सर्वोच्च न्यायालय के पूर्व न्यायाधीश तथा सातवें वेतन आयोग के अध्यक्ष श्री अशोक कुमार माथुर मुख्य अतिथि रहे तथा विशिष्ट अतिथि डॉ. नीति माथुर, सहा॰आचार्य, जोधपुर विधि विश्वविद्यालय थीं। श्री माथुर ने संस्थान के निर्वचन केंद्र का अवलोकन कर वर्तमान शोध गतिविधियों की जानकारी ली | इस अवसर पर श्री अशोक कुमार माथुर तथा डॉ. नीति माथुर ने लाल काष्ठीय चन्दन का पौधा रोपित किया।

संस्थान निदेशक श्री माना राम बालोच,भा.व.से. ने साफा पहना कर मुख्य अतिथि का पारंपरिक स्वागत किया तथा डॉ.सरिता आर्य,वैज्ञानिक-जी ने डॉ. नीति माथुर को शॉल ओढ़ाकर स्वागत किया। इस अवसर पर मुख्य अतिथि तथा गणमान्य जन के सम्मान में केंद्रीय विद्यालय नं. 02 (वायुसेना स्टेशन) के विद्यार्थियों ने स्वागत गीत प्रस्तुत किया।

कार्यक्रम की शोभा तब और बढ़ गयी जब मुख्य अतिथि ने नीम की लकड़ी के सुंदर फ्रेम से सज्जित भारत के संविधान की प्रस्तावना का अनावरण किया तथा उसके समक्ष दीप प्रज्वलित किया।

Fig. 48

Fig.49

Fig.50

Fig.51

श्री माना राम बालोच,निदेशक,आफरी ने स्वागत भाषण दिया। उन्होंने माननीय मुख्य अतिथि श्री अशोक कुमार माथुर के उत्कृष्ट जीवन-वृत्त पर प्रकाश डाला तथा विशिष्ट अतिथि डॉ. नीति माथुर का परिचय दिया। श्री बालोच ने देश के संविधान तथा दैनिक जीवन में इसके महत्व पर प्रकाश डालते हुए बताया कि मसौदा समिति डॉ.बी.आर.

अंबेडकर की अध्यक्षता में बनाई गयी थी व संविधान सभा को संविधान का ड्राफ्ट बनाने में 2 वर्ष,11 माह तथा 17 दिन का समय लगा। श्री बालोच ने कहा कि प्रस्तावना अपने आप में एक परिपूर्ण दृष्टि है जो हमारे देश को आगे बढ़ाने हेतु हमारे लिए मार्गदर्शिका है।

श्री कैलाश चन्द गुप्ता, सहा.निदेशक (राजभाषा) ने कार्यक्रम का संचालन करते हुए 11 मौलिक कर्तव्यों को पढ़कर सुनाया एवं उनके महत्व पर प्रकाश डालते हुए कहा कि संविधान देश की आत्मा है तथा हमारा संविधान हमारी पहचान है, इसका सम्मान करना हमारी नैतिक ज़िम्मेदारी है।विश्व का सबसे बड़ा संविधान जिसमें देश के हर धर्म,जाति और वर्ग के लोगों को अपने-अपने विश्वासों के अनुसार रहने और विकास करने का अधिकार प्रदान किया गया है।

इसके बाद माननीय मुख्य अतिथि ने संविधान की प्रस्तावना का वाचन किया तथा सभागार में उपस्थित सभी ने अनुसरण किया।

विशिष्ट अतिथि डॉ. नीति माथुर ने भारतीय संविधान पर अपनी विचार अभिव्यक्ति देते हुए सोशल मीडिया का प्रयोग ज़िम्मेदारी से करने की बात कही कि हमें संदेशों को सोशल मीडिया पर बिना पहले उनकी उपादेयता व सत्यता को जाने फैलाने से बचना चाहिए। उन्होंने भारतीय संविधान के विभिन्न प्रावधानों पर बात की कि कैसे सरकार बालिकाओं की शिक्षा व विवाह हेतु विभिन्न योजनाएं चलाकर समाज को सशक्त कर रही है। डॉ.नीति ने विभिन्न मुद्दों जैसे सामाजिक न्याय तथा सशक्तिकरण, कॉर्पोरेट सामाजिक दायित्व तथा अभिव्यक्ति की स्वतन्त्रता आदि पर अपने विचार रखे। डॉ. माथुर ने कहा कि उन्हें संस्थान परिसर की हरियाली से प्रभावित होकर पेड़ लगाने हेतु प्रेरणा मिली है।

डॉ. इन्द्र देव आर्य, समूह समन्वयक(शोध) ने इस अवसर पर अपने विचार रखे तथा राष्ट्र निर्माण में वानिकी अनुसंधान तथा विस्तार गतिविधियों में आफ़री की भूमिका से सदन को अवगत कराया। डॉ. आर्य ने रेत टिब्बा स्थिरीकरण,बंजर भूमि का पुनरुद्धार, कार्बन स्टॉक पर जैवतकनीक प्रयोग से आफरी के किए गए प्रयासों पर प्रकाश डाला।

कार्यक्रम में पर्यावरणए वन तथा वन्य प्राणी संरक्षण के क्षेत्र में सराहनीय कार्य करने वाले कुछ सरकारी तथा गैर-सरकारी व्यक्तियों नामतः श्रीमती विमला सियागए श्री ओमप्रकाश राजोरियाएश्री पूरण सिंहएश्री अशोक राम पंवारए डॉ. श्रवण सिंह राठौड़ समेत संस्थान के श्री सादुल राम देवड़ा व श्री कान सिंह राठौड़ तथा केंद्रीय विद्यालय क्रमांक 02(वायुसेना) के प्रतिनिधि श्री के.सी. रैगर को माननीय मुख्य अतिथि ने स्मृति चिह्न व प्रशंसा पत्र प्रदान कर सम्मानित किया। दिनांक 21 से 23 नवंबरए 2019 के दौरान "भारतीय संविधान" पर आयोजित विचार अभिव्यक्ति तथा पोस्टर प्रतियोगिताओं जिनमें तीन आफरी में तथा दो केंद्रीय विद्यालय क्र.02 में आयोजित हुई थी के विजेताओं को मिमेंटो तथा प्रमाण-पत्र प्रदान किए गए। सभागार के प्रवेश द्वार पर पोस्टर प्रतियोगिताओं के विजेताओं के पोस्टरों का प्रदर्शन भी किया गया।

Fig. 52

कार्यक्रम के माननीय मुख्य अतिथि श्री माथुर ने अपने वक्तव्य में संविधान की महत्ता बताते हुए देश में लोकतन्त्र को सुचारु रूप से चलने में क्या-क्या बाते हैं जो संविधान को एक आदर्श संविधान बनाती हैं के बारे

में बताया। श्री माथुर ने कलकत्ता उच्च न्यायालय के मुख्य न्यायाधीश व उच्चतम न्यायालय के न्यायाधीश के रूप में सेवा के दौरान के अपने अनुभवों को भी सांझा किया उन्होंने इस बात पर बल दिया कि देश का प्रत्येक नागरिक अपने माता- पिता से पहले मातृभूमि की संतान है। खून के रिश्ते से बढ़कर भारतीय होने के भाव को ज्यादा पवित्र व महत्वपूर्ण बताया गया। अपने उद्बोधन में श्री माथुर ने अनुच्छेद 48ए तथा हमारे संविधान में वर्णित पर्यावरण संबंधी कल्याणकारी प्रावधानों का जिक्र किया। वहीं अनुच्छेद 51ए के अंतर्गत मौलिक कर्तव्यों के संदर्भ में कहा कि हमें अधिकारों से पूर्व कर्तव्यों का भान होना चाहिए। विधायिका,कार्यपालिका व न्यायपालिका का जिक्र करते हुए कहा कि ये संविधान के आधार स्तम्भ हैं। देश का संविधान सर्वोपरि है व हमें इसका सम्मान करना चाहिए।

Fig.53

कार्यक्रम के अंतिम चरण में संस्थान निदेशक ने माननीय मुख्य अतिथि तथा विशिष्ट अतिथि को चन्दन का पौधा व स्मृति चिन्ह भेंट किए। श्री रमेश कुमार मालपानी, उपवन संरक्षक ने सभी का आभार व्यक्त किया एवं राष्ट्रगान के साथ कार्यक्रम सम्पन्न हुआ।

128th Birth anniversary celebrated of Baba SahebDr.B. R. Ambedkar in AFRI, Jodhpur

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 2019 to commemorate the birthday of Baba Saheb Ambedkar. Sh. M.R. Baloch, Director, A.F.R.I presided over the program to pay homage to Baba Saheb Ambedkar on his 128th Birth anniversary. Dr. I.D. Arya, GCR and Scientist-G, Dr. G. Singh, Scientist-G & Head, Dr. Sarita Arya, Scientist-G, Dr. U.K. Tomar, Scientist-F, Dr. Tarun Kant Scientist-F, Sh. K.C. Gupta Hindi Officer, Sh. R.K. Gupta, CTO Sh. K.R. Choudhary, ACTO, Sh. Sawai Singh MTS, Miss. Prartibha Lohra addressed the gathering on the ideals of Dr. Bhim Rao Ambedkar and his teacher Jyotiba Fuleand 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.

128th Birth anniversary celebrated of Baba SahebDr.BR Ambedkar in AFRI, Jodhpur

Fig. 54

5. Administration and Information Technology

Introduction

5.1. Information Technology

The existing IT infrastructure was maintained properly. The leased line provided by the National Knowledge Network (NKN) was maintained and 24x7 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 updated regularly throughout the year. The reports of the important events held at the institute were uploaded on the institute as well as on the ICFRE website. The PIMS and payroll modules of the IFRIS were run successfully throughout the year. Four new computers with UPS and printers were procured. Aadhar based Biometric attendance system with CCTV was maintained at the institute. An online portal for new recruitments for various posts at AFRI was developed with the help of RISL, a Government of Rajasthan owned company. Other routine tasks related to the Information Technology were performed during the year.

5.2 Administration: **A brief note on general administration activities along with information on the following:**

5.2.1 Sevottam: Activities relating to the Citizens/Clients Charter:

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

The charter has been prepared based on the seven steps mentioned in Sevottam. Considering the ICFRE's mandated 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", 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 stakeholders. The institute is implementing its research endeavors after duly recognizing the user's needs.

Main research focus of the instituteincludes:

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.

Different procedures have been formulated for identifying the research problems of dry areas; formulating the projects based on the problems; and dissemination of the research results and technologies to the end users. In order to identify the research problems, institute level interaction workshops were organized involving various stakeholders like officials of state forests departments of Rajasthan and Gujarat , scientist of other sister organization like CAZRI and University, progressive farmers and NGO's. Based on the research problems highlited during discussions are taken under projects formulations the scientists after the thorough review of scientific literature.

The projects are then 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 are presented in the Research Policy Committee (RPC) meeting for approval. After the approval of projects, the funds are allotted 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 trials, extension trainings, Van Vigyan Kendras, Demo villege, printed material, radio talk, workshops, conferences and the publications uploaded to the website of the institute.

5.2.1.2 Action taken to implement the Charter

To fulfill the charter, research projects were prepared addressing the research mandate of the institute and submitted for funding to various donor agencies for implementing the Charter. Three new projects were approved for initiation in the next financial year by RPC held in Februray, 2018. Several extension trainings were held during the year for dissemination of the research results of the various projects executed in 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 and World Day for Combating Desertification and Van Mohotsava. The details of these have been mentioned above in this report.

5.2.1.3 Details of Training Programmes, Workshops, etc. held for proper implementation of Charter: Mentioned above under point No. 3.2 & 4.9.

5.2.1.4 Details of publicity efforts made and awareness campaigns organized on Charter for the Citizen/Clients: Various events were organized, manuscript published and talks delivered by AFRI officials during different events, conferences, workshops helped in publicity efforts made and awareness campaigns organized on Charter for the Citizen/Clients. The details are given under point No. 4.9.

5.2.1.5 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 made in the ongoing research projects were presented to the internal and external experts of the RPC, who gave their comments on the quality of the new projects and the progress made in the ongoing projects. The experts prioritized the new projects and expressed their satisfaction on the progress of the ongoing projects.

5.3 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. As per the DOPT's guidelines for various social groups, Liaison Officers had been nominated as below:

Sl.No.	Name of officer & Post	Liasion Officer
1.	Sh. S.R. Baloch, Scientist-C	Liasson Officer for SC
2.	Ms. Desha Meena, Scientist-C	Liasson Officer for ST
3.	Sh. Karna Ram Choudhary, CTO	Liasson Officer for OBC
4.	Under Secretary	Member

6. Annexures

1. RTI

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

Headquarters/ Institutes	Appellate Authorities	Public Information Officer	Subject Matter Allocated
Arid Forest Research Institute	Sh. M.R. Baloch, IFS Director, AFRI Email: dir_afri@icfre.org Phone: 0291-2742549	Sh. K.C. Gupta Email: guptakc@icfre.org Phone: 0291-2729122	All matters related to AFRI Jodhpur

During 2019-20 total 35 applications were received offline u/s 6(3) and directly to PIO as well as online under RTI Act 2005. Opening balance of application as on 01-04-2019 was 02. Out of total 37 application no any information was refused and information of calculation of the amount arrived at for photocopy was provided to applicants. PIO, AFRI, Jodhpur has furnished information to all applicants except 02 as they have not turned up about photocopy charges. During the year the appellate authority received 02 appeal regarding RTI and same were replied as per norms of RTI Act 2005. Quarterly returns of RTI have been furnished regularly to the Secretary, ICFRE, Dehradun.

2. Information on Vigilance cases: NIL

3. Information on Audit objections:NIL

4. E-mail and Postal Address):

Sh. Shivlal Chauhan, ACTO,

P.O. Krishi Upaz Mandi, New Pali Road, Jodhpur, 342005,
Arid Forest Research Institute,
Email: groupco_afri@icfre.org, dir_afri@icfre.org
Phone: 0291-2742549,2729104, Mob.:9414110722, FAX: 0291-2722764

5. Intellectual Property

5.1 Patent Property - NIL

5.2 Others-NIL

6. List of Abbreviations

AF&ED	Agroforestry and Extension Division
AFRI	Arid Forest Research Institute
AM	Arbascular Mycorrhiza
ARS	Agriculture Research Station
AICP	All India Co-ordinated Project
CAZRI	Central Arid Zone Research Institute
CETP	Common Effluent Treatment Plant
CIT	Chartered Institute of Technology
CSOs	Clonal Seed Orchards
CTAB	Cetyl Tri-methyl Ammonium Bromide
DEMO	Demonstration
DFO(WL)	Divisional Forest Officer (Wild Life)
DRDO	Defence Research Development Organization
DST	Department of Science & Technology
DNH	Dadra & Nagar Haveli
DNA	Deoxy Ribo Nucliec acid
DVs	Demo Village
EC	Electrical Conductivity
ENVIS	Environmental Information System
ET	Evapo- Transpiration
FED	Forest Ecology Division
FGTB	Forest Genetics and Tree Breeding
FPD	Forest Protection Division
FSI	Forest Survey of India
FRI	Forest Research Institute
FYM	Farmyard Manure
GM	Genetically Modified
GEF	Global Environmental Facilities
GIS	Geographic Information System
GoI	Govt. of India
GPS	Global positioning system
HoD	Head of Division
HFRI	Himalayan Forest Research Institute
ICFRE	Indian Council of Forestry Research & Education
ICBN	International Conference on Bio-technology & Nano-technology
IBA	Indole butyric Acid
ICAR	Indian Council of Agriculture Research
ICRAF	International Council for Resrach on Agroforestry
IES	Indian Engineers Service
IFFCO	Indian Farmers Fertiliser Cooperative Limited
IFRIS	Indian Forestry Research Information System
IFS	Indian Forest Service
IT	Information Technology
ISSR-PCR	Inter Simple Sequence Repeat-Polymerase Chain Reaction
KVK	Krishi Vigyan Kendra
LCM	Leaf Compost Manure
Mg	Mega Gram (10^6 g)
mM	Milli mole
MoU	Memorandum of Understanding
MoEF&CC	Ministry of Environment, Forest & Climate Change
NAA	Naphthalene Acetic Acid

NFRP	National Forestry Research Plan
NKN	National Knowledge Network
NSFDDE	National Scheduled Castes Finance and Development Corporation
NTFP	Non-Timber Forest Product
NWFP	Non-Wood Forest Product
OBC	Other Backward Class
PIMS	Personnel Information Management System
PSB	Phophorus Solubilizing Bacteria
PAR	Photosynthetic Active Radiation
RAG	Research Advisory Group
RFD	Rajasthan Forest Department
RIMS	Research Management Information System
RPC	Research Priority Committee
RSFD	Rajasthan State Forest Department
RSR	Root to Shoot Ratio
RTI	Right To Information
SAAER	The Society for Agriculture and Arid Ecology Research
SC	Scheduled Caste
SFD	State Forest Department
SFS	State Forest Service
SLEM	Sustainable Land And Ecosystem Management
SPAs	Seed Production Areas
SPSS	Statistical Package for Social Science
SSP	Single Super Phosphate
SSOs	Seedling Seed Orchards
ST	Scheduled Tribe
SWC	Soil Water Content
TREE	Training, Research, Extension & Education
TDS	Total Dissolved Solids
TERI	The Energy and Resources Institute
UT	Union Territory
UNCCD	United Nations Convention to Combat Desertification
UV	Ultra Violet
VAM	Vesicular Arbuscular Mycorrhiza
VMG	Vegetative Multiplication Garden
VVK	Van Vigyan Kendra
VFPMC	Village Forest Protection & Management Committee
ZSI	Zoological Survey of India

Quarterly Return Form

Public Authority : Ministry of Environment, Forests & Climate Change
Quarter – II (April, 2019 to June, 2019)
Year: 2019

Mode Insert : Status : New Return

		Progress during the month				
	Opening Balance as on beginning of qtr.-II	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	02	04	02	Nil	Nil	08
First Appeals	Nil	Nil	02	Nil	Nil	02

No. of CAPIO's 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)
10/-	104/-	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	Sh. Rajesh Meena	Technical Assistant C/o IT-Celi of the Institute

05/07/2019

(Kailash Chand Gupta)
Public Information Officer,
AFRI, Jodhpur

Quarterly Return Form

Public Authority : Ministry of Environment, Forests & Climate Change
Quarter – III (01st july to 30th Sept. 2019)
Year: 2019

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	01	04	08	Nil	Nil	13
First Appeals	Nil	Nil	NIL	Nil	Nil	Nil

No. of CAPIO's 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/-	204/-	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	Sh. Rajesh Meena	Technician C/o IT-Cell of the Institute

(Kailash Chand Gupta)
Public Information Officer
AFRI, Jodhpur

Quarterly Return Form

ublic Authority : Ministry of Environment, Forests & Climate Change
Quarter – IV (01st Oct. to 31 Dec. 2019)
Year: 2019

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	06	01	07	Nil	Nil	14
First Appeals	Nil	Nil	NIL	Nil	Nil	Nil

No. of CAPIO's 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)
30/-	78/-	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	Sh. Rajesh Meena	Sr. Technician C/o IT-Cell of the Institute

(Kailash Chand Gupta)
Public Information Officer,
AFRI Jodhp...

Quarterly Return Form

ublic Authority : Ministry of Environment, Forests & Climate Change
Quarter – I (01st Jan. to 31 March. 2020)
Year: 2020

Mode Insert : Status : New Return

	Progress during the month					
	Opening Balance as on beginning of qtr.-IV	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	03	00	09	Nil	Nil	12
First Appeals	Nil	Nil	NIL	Nil	Nil	Nil

No. of CAPIO's 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)
80/-	04/-	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	Sh. Rajesh Meena	Sr. Technician C/o IT-Cell of the Institute

(Kailash Chand Gupta
Public Information Officer