TEN YEARS OF PFRI
1986–1996

by

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Faisalabad
PAKISTAN

September, 1996

PREFACE

The Punjab Forestry Research Institute, Faisalabad was established during 1986. It has completed one decade of its existence. These have been eventful years during which the Institute has gradually grown into a good research institution of the province. This graduation has not come about easily. Some one has spent the most precious and experienceful time of his life for it, and the Institute has remained the focus of his mind all the time.

Scientific research is a creative activity and flourishes only in a conducive environment which generally remains absent in our country. Un-willingness, lack of dedication and almost absence of experience on the part of most of the scientists, meager incentives, low priority for research and training, the social milieu have been the main constraints for quality research. The entire environment is not only inconducive to creativity, it can demotivate even the most devoted people. To overcome the handicaps a researcher here needs a much greater perseverance, greater initiative and drive and nothing less than missionary zeal. It is very easy to get disheartended and get attracted to better avenues elsewhere but more difficult to make the hard choice of combating the odds here. Some committed individuals do survive the vagaries of the environment and succeed in creating a mini-environment of their own where seeds can be sown for a better tomorrow. This shows that though the difficulties in carrying out research in the country are enormous it is not impossible to surmount these.

It is a research and training organization and the development of such institutions requires decades of dedicated efforts before tangible results can be expected. It started functioning from a scratch during July, 1986. Basic institutional development was rightly given high priority and it has been successfully completed. Besides institutional development, other basic essential tasks taken up simultaneously were the formulation of research programmes, writing of study plans for individual research projects, layout of experiments, data collection, its analysis and interpretation of results, improvement of forestry education and training through development of syllabii and compilation of training material.

The institute regularly conducted short courses (1-3 weeks)in specific subjects, which were attended by the officers and officials of all levels from the Punjab Forest Department and Farmers and NGOs. Over 72 courses were conducted in varied subjects such as Forestry Extension Education, Social Forestry and Agroforestry, Irrigation Management, Seed and Nursery Technology, Tree establishment and their management, Computer training, Financial discipline and office procedure, etc. Diploma-in-Forestry and Certificate-in-Forestry courses of two years and one year duration respectively were also conducted regularly for pre-service training of the technical forest staff of the department. Nearly 19 subjects of forestry and allied disciplines are taught, with detailed touring and excursions to various types of forests.

The programmes of the institute are reviewed through formal and informal processes. The formal process consists of annual review by the Forestry Research Review Committee chaired by the Inspector General of Forests, Government of Pakistan and consisting of Chief Conservators of Forests of all the provinces, representative of Pakistan Agricultural Research Council, etc. Punjab Agricultural Research Board also reviews the annual research programme of PFRI, especially its technical and scientific aspects The Programme Committee to approve the annual research and training programmes in the Punjab is, of course, there. The informal process is the collective periodic review at the Institute where all scientists present their respective work. The discussion is held and suggestions made are noted by the Heads of Branches.

The institute scientists regularly publish in national journals. An annual report and comprehensive periodic reports are issued and distributed among Senior Forest Officers Reports on completed projects and pamphlets on new technology developed at the Institute are also produced. The new technology is also demonstrated in PFRI research garden when participants of various short courses visit PFRI.

It is gratifying to see that despite all the handicaps of working in trying circumstances, PFRI has been able to develop and play its role reasonably well and has made impressive contributions in the field of training and research. It is a tribute to the Institute scientists that they have succeeded in creating a conducive environment around themselves which has allowed a good start in right direction. The experience in the Institute has shown that before any investment in research is made, human capital needs to be developed.

The salient achievements of PFRI during its short period of one decade have been given in this report for the perusal of field foresters and other interested persons. Any suggestions for future shall be welcome.

In this report we have talked about positive things and not about our failings. It is not because there were no weaknesses; definitely there were. We are, indeed, very conscious about what could be done and what should have been done and has not been done. Some of the failings could be due to lack of effort, some due to inherent incapability and many really due to circumstances. But we are the ones who create the circumstances. We pray that God give us the will and capability to try and change the circumstances.

Sahibzada M. Hafeez
Director

EXECUTIVE SUMMARY

- Preparation of a small team of young scientists through personal guidance as well as by nominating them to participate in 48 courses in various subjects in various organizations in the country to enhance their capabilities, as a first pre-requisite for any research organization.

- Conducting of 44 short training courses in various subjects for 923 in-service personnel of Punjab Forest Department to refresh their knowledge.

- Conducting of 28 special short courses for the training of 469 farmers and NGOs, especially in seed and nursery technology, tree establishment and their management.

- Pre-service training of 201 Diploma-in-Forestry and 1207 Certificate-in-Forestry stipendiaries of the Punjab Forest Department.

- Training of 6 Sericulture Supervisors and 10 Seed Examiners through 1-year courses.

- Up-gradation of training level of Foresters and Forest Guards upto Diploma-in-Forestry (2-year) and Certificate-in-Forestry (1-year) courses, respectively.

- Improvement of syllabii for Diploma and Certificate courses in view of today's technical and socio-economic requirements of the forest service.

- Improvement of training facilities by compiling nearly 40 textbooks/training material for various categories of trainees.

- Revision and improvement of training schedule for both the courses to make it practical-oriented.

- Improvement of system of examination for diploma and certificate courses through its centralization.

- Development of physical facilities for training like construction of new hostels and renovation of existing ones. Construction of residences for the Instructors and improvement of water supply through installation of new tubewell and construction of water tank, etc.

- Development of research laboratories, computer laboratory and library for aid in research and teaching assignments

- Development of a few Agroforestry Models for growing poplars with agricultural crops on farmlands and their recommendation to the farmers.
- Improvement of nursery technique through experimentation for raising poly-bag plants.
- Screening and propagation of better clones of *Populus deltoides*.
- Identification of better performing salt-tolerant tree germplasm for afforestation of saline areas.
- Selection of economical method for regeneration of *Eucalyptus camaldulensis* through coppicing.
- Introduction and selection of bamboo species for planting on farmlands.
- More economical use of *Eucalyptus camaldulensis* wood by converting into ballies instead of firewood for earning 36% additional revenue.
- Development of seed sources and collection and supply of quality tree seed to field officers for their afforestation programmes.
- Establishment of seed supply system in the Punjab for supply of quality seed of major forest tree species.
- Development of pure races of silkworm and development of their disease free F1 hybrid.
- Selection and propagation of mulberry varieties for silkworm rearing and improvement of sericultural techniques for the development of sericulture industry in the province.
- Screening of international and national professional journals and supply of 72 selected articles to Senior Forest Officers in the Punjab Forest Department to abreast them with latest developments in the field of Forestry the world over.
- Control of shisham defoliator and powder post beetle in plantations through pest control activities.

Promotion of tree growth on farmlands through training of farmers and demonstration.

- Providing advice to government departments and farmers for the development of the forestry sector.

Mr. Muhammad Akram, Secretary, Government of the Punjab, Forestry, Wildlife, Fisheries and Tourism Department being presented PFRI Shield by Mr. M. Saleem Chaudhry, C.C.F.

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1 INTRODUCTION

1.1 BRIEF HISTORY

For providing appropriate scientific support to accelerate the developmental activities in the Punjab province, Punjab Forestry Research Institute (PFRI) was established under a developmental project, over a period of four years, 1982-86, at a total cost of Rs.18.85 million and started functioning during July, 1986. Later on, five more development projects were implemented at a total cost of Rs 19.69 million for the development of research and training facilities. The Institute is a research and training organization meant to promote sustainability of forests and development of agroforestry systems.

The Institute started with a small nucleus of silvicultural and sericultural research. Afterwards, both the Punjab Forest Schools at Ghoragali and Bahawalpur were put under the control of Director, PFRI during 1987 so that research and training could go together. Similarly, during 1987-88 Pest Control Forest Division was also given under the administrative control of Director, PFRI.

This is the only research and training organization for Forestry in the Punjab, and its development from a scratch upto full-fledged institution required intensive efforts, dedication, experience and continuity. Research institutions take a long time in maturing, before one can expect tangible results, especially in the field of forestry which is a long term discipline. Shortage of manpower, inexperienceness and unwillingness on the part of most of the available personnel has been the main handicap in full functioning of the Institute. However, inspite of numerous constraints and problems, particularly regarding manpower which still continue, the achievements of the Institute have been impressive and appreciable and these are briefly described in this report.

1.2 MAIN OBJECTIVES:

- To promote sustainability of forests and development of agroforestry systems through research in a systematic and planned manner.
- To impart technical forestry education.

- To conduct refresher and special courses for inservice personnel as well as for farmers and NGOs.

- Production and supply of quality seed of major forest tree species.

1.3 BROAD FIELDS OF ACTIVITY:

- Developing suitable technology for seed, nursery and tree establishment.

- Increasing the yield of wood per unit area from all types of forests including farm lands by introducing fast growing multipurpose species. such as eucalypts, poplars, acacias and pines etc.

- Studying tree/crop interface for improvement and designing of agroforestry systems.

- Streamlining tree planting practices in arid and semi arid areas, waterlogged and saline soils and similar lands.

- Developing wild lands for the production of one or more goods and services associated with forest areas such as timber, fuelwood, water, wildlife, forage and minor forest produce.

- Managing existing forest resources on sustained yield basis by keeping proper growing stock densities, estimating growth rate, yield, allowable cut, ensuring natural regeneration, etc. by identifying the requisite silvicultural treatments and management systems.

- Improving rangelands through reseeding, introduction of fodder shrubs and trees and rotational grazing.

- Controlling insects to save the standing trees as well as converted or used wood including control of damage by animals such as porcupines, wild-boars, etc.

- Developing ways and means to improve sericultural practices by improvement of moriculture; control of diseases; segregation of pure races; and development of disease-free hybrid.

- To publish and disseminate research results in the form of technical notes, scientific papers, journals, bulletins, etc.

- To popularize growing of trees by private individuals through advanced extension techniques and transfer of technology.

- To impart pre-service forestry education at technical level to the stipendiaries from the Punjab and sometime other provinces.

- To conduct refresher and special courses for inservice personnel for updating their knowledge in the field of forestry and related subjects.

- To arrange special short courses for farmers and members of NGOs/COs for transfer of technology.

- Production and supply of quality seed of major forest tree species.

2 INSTITUTIONAL DEVELOPMENT

2 1 ORGANIZATIONAL SET-UP

The Institute is headed by a Director and supported by two Additional Directors. One Additional Director is incharge of research whereas the other Additional Director controls Seed Supply System. There are twelve (12) branches in it including two forest schools. Each branch is headed by a Senior Research Officer/Principal. The organization chart of the Institute is given on the following page.

Director
Additional Director (Seed)
Additional Director (Research)
Senior Research Officer (Silviculture)
Senior Research Officer (Forest Management)
Senior Research Officer (Agroforestry)
Senior Research Officer (Sericulture)
Senior Research Officer (Range Management)
Senior Research officer (Pest Control)
Senior Research Officer (Extension and Training)
Senior Research Officer (S S S. Gujrat)
Senior Research Officer (S S S. Faisalabad)
Senior Research Officer (S S S. Bahawalpur)
Principal PFS Ghoragali
Principal PFS Bahawalpur

2 2 SANCTIONED STRENGTH OF PFRI STAFF

In the regular sanctioned posts of 275, new development posts under Punjab Forest Sector Development Project were added during 1995-96. Number of sanctioned posts in various basic scales are given below

ORGANIZATIONAL CHART
OF
PUNJAB FORESTRY RESEARCH INSTITUTE FAISALABAD

BS.No.	Number of sanctioned posts		
	Regular	Development	Total
19	1	-	1
18/19	-	2	2
18	8	4	12
17	20	6	26
16	25	-	25
12	8	5	13
11	14	16	30
10	3	-	3
9	2	-	2
8	14	-	14
7	18	-	18
6	14	5	19
5	29	14	43
4	16	-	16
3	6	-	6
2	2	-	2
1	95	25	120
Total	275	77	352

1. Scientific Staff = 40
2. Technical Staff = 48
3. Supporting Staff = 264

Total: 352

2 3 SANCTIONED STRENGTH OF TECHNICAL STAFF

There has always been a shortage of scientific and technical staff in PFRI because post in PFRI is not generally liked This has been a main constraint in its working. Number sanctioned, effective and vacant posts is given below

Level of staff	Sanctioned strength	Effective strength	Vacant on 26 9 ...
Director (BS-19)	1	1	-
Addl Director (BS-18/19)	2	1	1
S R O (BS-18)	10	9	1
Principal (BS-18)	2	2	2
Research Officer (BS-17)	25	7	18
Asstt Research Officer (BS-16)	15	5	10
Instructor (BS-16)	7	3	4
Research Assistant (BS-11)	25	10	15
Libranan BS-16)	1	-	1
Total	88	38	50

2.4 INFRASTRUCTURE DEVELOPED

Infrastructure developed during early years of the establishment of PFRI is given below

Year of commencement of main PC.I. Project = 1992-83
Year of completion of Project = 1985-86
Total cost of the Project = 18.85 (Million Rs.)
Additional Development Projects completed from 1986-96 (5 No.) = 19.69 (Million Rs.)

OFFICE AND RESIDENTIAL ACCOMMODATION

Main Academic Building (45 rooms)	= 20171	sft
Research Sub-Centre Ghoragali	= 1700	"
Research Sub-Centre Bahawalpur	= 1700	"
Forest Guest House, PFRI	= 2550	"
Residential Buildings (58 No)	= 46416	"
Officers Training Hostel, PFRI	= 4500	"
Total:	= 74037	"

2.5 FINANCIAL RESOURCES

Annual non-developmental and developmental expenditure of PFRI is given below:

Year	Development	Non-Development	Total
1983-84	6.037	-	6.037
1984-85	5.491	-	5.491
1985-86	5.975	-	5.975
1986-87	1.417	2.244	3.661
1987-88	2.907	6.465	9.372
1988-89	2.577	8.473	11.050
1989-90	3.458	8.607	12.065
1990-91	3.109	9.639	12.748
1991-92	2.728	10.236	12.964
1992-93	0.424	10.961	11.385
1993-94	-	13.654	13.654
1994-95	1.297	14.143	15.440
1995-96	3.481	13.802	17.283

2.6 PHYSICAL FACILITIES AVAILABLE

The physical facilities developed and available at PFRI are:

- PFRI Main Academic Complex at Faisalabad
- Field Research Sub-Centres:
  - Ghoragali
  - Lahore
  - Bahawalpur
- Field Research Stations:
  - Kharian
  - Daphar
  - Changa Manga
  - Chichawatni
  - Khanewal (Pirawala)
  - Shorkot
  - Dagarkotli (Thal)
- Research Laboratories at PFRI
  - Plant Propagation and Tissue Culture
  - Chemical Analysis
  - Seed Testing
  - Sericulture Research
  - Computer Laboratory
- Research Nursery and Green House at PFRI
- Seed Storage:
  - Tree Seed Godown PFRI
  - Silk Grainage Centre, Murree
- Seed Supply Centres:
  - Seed Supply Centre Gujrat
  - Seed Supply Centre Faisalabad
  - Seed Supply Centre Bahawalpur

a) Mr. Khalid Latif Chaaudhry, Secretary, Government of the Punjab, Forestry, Wildlife, Fisheries and Tourism Department visits PFRI Computer Laboratory.

b) Computer - A Necessity in Today's Life

. Forestry Schools:

. Punjab Forest School, Ghoragali

. Punjab Forest School, Bahawalpur

. Hostels:

. Officers' Hostel PFRI

. Forest Technicians Hostel, Murree

. Forest Technicians Hostel, Bahawalpur

. Libraries:

. PFRI Library

. PFS Bahawalpur Library

. PFS Ghoragali Library

. PFRI Guest House

. Residential Buildings at PFRI Campus and others

2.7 BASIC ESSENTIAL TASKS AT PFRI

The basic essential tasks carried out and successfully completed for the development of this newly established institution are:

1. Procurement of Manpower and its Training
2. Arrangement of Additional Scientific and Research Equipment
3. Setting up of Research Laboratories and Library
4. Formulation of Research programme
5. Writing of Study Plans for Individual Projects and their Layout
6. Improvement of Forestry Education and Training:
   . Periodic Review and Improvement of Syllabi
   . Periodic Review of Training Schedule
   . Conducting of Refresher and Special Courses
   . Writing of Text Books/Training Material
   . Improvement of Physical Facilities.
7. Collection of Quality Seed and its Supply
8. Landscaping and Beautification of PFRI

2.8 DEVELOPMENT IN BASIC ASPECTS OF PFRI

In the establishment and development of a new institution, certain basic aspects required attention on priority which was duly given and fundamental developments made as under:

1. A team of young scientists was procured and trained which is the first requisite for undertaking research on scientific lines.

2. Research laboratories for seed testing, tissue culture, soil testing and sericulture have been established.

3. Additional scientific and research equipment has been arranged under PC.I. Projects and GOP/USAID Forestry Planning and Development Project.

4. Computer Laboratory has been set-up.

5. A good library has been developed.,

6. Research Programme has been formulated and is under continuous review.

7. Study Plans have been prepared for all the individual projects.

8. Development of campus and landscaping is under continuous improvement.

9. Collaboration with National and International Organizations has been established.

10. Conference Room has been provided with latest Audio Visual Aids.

11. A Green House has been constructed for aid in research work.

12. Syllabi for Forest Schools have been much improved and are reviewed periodically.

2.9 ESTABLISHMENT OF LIBRARY AND RESEARCH LABORATORIES

1. Establishment of Library

i SDI Service is being operated regularly, and 72 important professional articles concerning forestry and allied disciplines which appeared in renowned international and national journals were selected and sent to all senior forest officers in the Punjab.

ii. More than 40 international and national organizations have been contacted for mutual cooperation in the development of library.

iii. PFRI Library has become member of the Board of Science and Technology for international Development (BOSTID).

iv. Quite a few International and National Scientific Journals are being procured in the library for the scientists.

2. Research and Scientific Equipment

Handsome equipment has been procured under PC.I. Projects and Forestry Planning and Development Project (USAID)

3. Setting up of Research Laboratories

i. Seed Testing Laboratory
ii. Tissue Culture and Plant Propagation Laboratory
iii. Chemical Analysis Laboratory
iv. Sericulture Laboratory
v. Computer Laboratory with 6 Computers and a Laser Jet Printer

4. Collaboration with other Research Organizations

i Collaboration with other research organizations within the country like PARC/NARC, P.F.I., Ayub Agricultural Research Institute, NIAB, IWASRI, University of Agriculture, Faisalabad, etc. has been developed.

ii. Collaboration of some foreign research/donor organizations like F/FRED, USAID Mississippi State University, USA is being obtained whereas efforts are going on to develop such collaboration with other foreign agencies also.

2.10 DEVELOPMENT AND IMPROVEMENT OF TRAINING FACILITIES

This important subject was given its due importance and following developments have been made to improve the quality of education and training:

1. Up-gradation of training level of Foresters and Forest Guards upto Diploma-in- Forestry (2 years) and Certificate-in-Forestry (one year) courses respectively.

2. Enhancement of basic qualifications for the Diploma and Certificate courses upto matriculation (2nd Division) with science.

3. Framing of rules and regulations for the Diploma and Certificate trainees.

4. Improvement of syllabi for the Diploma and Certificate courses in view of today's technical and socio-economic requirement of the service.

5. Schedule of training for both the courses has been drastically revised and made practical-oriented.

6. System of examination has been improved and centralized for both the schools.

7. Another significant achievement has been the writing of text books/training material for the forest schools.

8. Improvement of teaching faculty through regular teaching by research officers and special lectures by the Director and other officers.

9. Practical field training documents have been prepared and got printed for the judicious use of field training time in different aspects of forestry by the stipendiaries.

2.11 DEVELOPMENT OF PHYSICAL FACILITIES FOR TRAINING

1. Renovation of Hostel at Bahawalpur.
2. Improvement of water supply through installation of a tubewell at Bahawalpur.
3. Improvement of water supply through construction of a water tank at Ghoragali
4. Laying out a new sewerage system in Forest School, Bahawalpur.
5. Installation of Sui-gas in Forest School, Bahawalpur.
6. Construction of three residences for the Instructors at Ghoragali.
7. Construction of metalled road in Forest School, Ghoragali.
8. Provision of heating arrangement in Forest School, Ghoragali.
9. Procurement of Audio-Visual AIDS for Forest Schools.
10. Construction of officers hostel for inservice training at PFRI.
11. Construction of hostel at Ghoragali under FPDP/USAID/GOP

3 DEVELOPMENT OF HUMAN RESOURCES

Human resources of PFRI have been built up gradually over a short period of time. Training of PFRI personnel as well as officers and officials of Punjab Forest Department through regular long courses and short inservice courses was given due priority with good results.

3.1 PFRI MANPOWER DEVELOPMENT

The Institute staff was provided maximum possible number of opportunities for training to improve their working capabilities in various subjects as under:

Sl.No.	Field of Training	Duration	No. of persons trained
1.	Agricultural Research Methodology	6 weeks	1
2.	Extension Education	2 weeks	6
3.	General Computer Training	4 days	4
4.	Watershed Management and Conservation Extension	2 weeks	1
5.	Operational Research and Quantitative Techniques	7 weeks	1
6.	Training of Trainers	8 weeks	1
7.	Training in Tissue Culture	15 weeks	2
8.	Computer Course (SAS) Statistical Analysis System	12 days	1
9.	Research Methodology	4 days	4
10.	Tractor Training Course (PC-SAS)	5 days	1
11.	General Computer Training	5 days	2
12.	Computer Training - Introduction to different packages	2 weeks	1
13.	M.Sc. Forestry Course	2 years	2
14.	Special Course in Forestry Research Methods	1 week	20
15.	Range Management and Forage Production	8 weeks	1
16.	Improving your personal effectiveness	1 week	1
17.	Training of Trainers	8 weeks	1
18.	Short course on scientific skills, problems identification and research proposal preparation	5 days	1
19.	Agricultural Research Management	2 weeks	2
20.	Computer Training	2 weeks	2
21.	Silkworm Breeding	10 days	5

22.	Computer Training	3 days	7
23.	English Language Course	9 weeks	2
24.	Computer Training	1 week	2
25.	Seed Technology	2 weeks	3
26.	Plant Material Analysis	5 weeks	1
27.	Land Use Planning	12 days	2
28.	Forest and Farm Woodlot Management Planning and Harvest Scheduling	11 days	1
29.	Computer Course on Office Automation	2 weeks	1
30.	Computer Application in the field of Forestry	9 days	2
31.	Research Planning and Study Plan Preparation	5 days	16
32.	Office Accounts and Procedure	10 days	21
33.	Planning, Execution and Documentation of Research Studies	2 days	22
34.	Basic Training in Sericulture	8 weeks	2
35.	Departmental Training in Sericulture	12 months	5
36.	DATA Base for Micro Computer	2 weeks	1
37.	Library Automation Course	6 weeks	1
38.	Cataloguing and Computerization	8 days	1
39.	Diagnostic Survey and Training Course	4 weeks	1
40.	Forestry Extension Training	5 days	17
41.	Rural Development Administration	8 weeks	1
42.	Ph.D. Forestry	3 years	1
43.	TREECD Computer Training	5 days	1
44.	Office Procedure and Financial Management	2 days	32
45.	Formulation of Research Design at Rural Academy Peshawar	3 days	3
		Total:	206

3.2 PARTICIPATION OF PFRI SCIENTISTS IN NATIONAL AND INTERNATIONAL CONFERENCES

SEMINARS/CONFERENCES/WORKSHOPS ATTENDED BY PFRI OFFICERS

Sl.No.	Name of Seminar/Workshop	Period	Country
1.	IUFRO Symposium "Role of Research in Soling Socio-Economic Problems of the Himalayan Region" at PFI, Peshawar	16.10.87-21.10.87	Pakistan
2.	International F/FRED Workshop "Multipurpose Tree Species Research for Use on Farms in Arid and Semi-arid Tropics" at Karachi.	16.11.87-19.11.87	Pakistan
3.	International F/FRED Meeting "To Make Detailed Designs of and Preparation for Implementing the 'Network Trials" at Kathmandu.	21.03.88-25.03.88	Nepal
4.	FAO Regional Workshop "Development of Wastelands for Fuelwood Energy and Rural Needs" at Vadodara, India.	01.11.88-09.11.88	India
5.	"Range - Livestock Seminar at Quetta"	21.12.88-23.12.88	Pakistan
6.	National Seminar "The Role of Plant Health and Care in Agriculture Production" at UAF.	28.12.88	Pakistan
7.	Forestry Workshop "Network Experiments" at NARC, Islamabad	22.01.89-25.01.89	Pakistan
8.	FAO Regional Seminar "Himalayan Fodder and Grass Land Problems" at PFI, Peshawar.	20.11.89-26.11.89	Pakistan

9.	"National Workshop on Agroforestry Research" PFRI, Faisalabad.	03.04.89-05.04.89	Pakistan
10.	A Seminar "Wood Producers-Users" arranged by GOP/USAID at Lahore.	12.05.90-15.05.90	Pakistan
11.	A Workshop "International and Communication Skills for Professionals in Natural Resources" held at Lahore.	12.05.91-16.05.91	Pakistan
12.	A Seminar "International MPTS Arid/Semi-Arid Zone Network Trials" at Kandi, Sri Lanka.	23.09.91-27.09.91	Sri Lanka
13.	A Workshop "Tree Production on Waterlogged and Saline/Sodic Lands" at Faisalabad.	08.03.92-09.03.92	Pakistan
14.	International Conference on "Innovative Approaches to Utilization of Salt Affected Lands in Agriculture and Forestry", Tandojam, Sindh.	19.03.94-20.03.94	Pakistan
15.	Second National Workshop on "Women in Forestry in Pakistan", PFI, Peshawar.	28.03.94-31.03.94	Pakistan
16.	"Research Monitoring Workshop", PARB, Lahore	07.06.94	Pakistan
17.	"Research Evaluation Workshop", PARB, Lahore.	08.06.94-09.06.94	Pakistan
18.	"In-Country Consultation on Sustainable Use of Natural Resources in Pakistan" PARC/ACIAR. 3-4 April, 1995	03.04.95-04.04.95	Pakistan
19.	Workshop on "Catalytic Effect of Tree Planting on the Rehabilitation of Native Forest Biodiversity on Degraded Tropical Lands" held at PFRI.	06.03.96	Pakistan

20.	Workshop on "Accounting System under PFSDP" held at PFRI.	07.05.96-	Pakistan
21.	International Seminar on "Farming Systems Research in the Context of Food Security in the Region" held at D.G.Khan.	04.08.96- 05.08.96	Pakistan
22.	International Workshop on "Sustainable Utilization of Wasteland and Saline Ground Water for Plant Production" held at Faisalabad.	06.10.96- 07.10.96	Pakistan
23.	International Workshop on "Forestry Research Strategy Formulation, Planning and Management" UPM, Malaysia	12.11.96- 23.11.96	Malaysia

3.3 EDUCATION AND TRAINING

Punjab Forestry Research Institute, Faisalabad has developed adequate facilities to impart pre-service education and training in forestry and allied disciplines at sub-professional level. It has also been equipped to organize and conduct inservice training through refresher courses to acquaint the field staff with modern techniques of forestry. The other provinces like Sind and Baluchistan have the opportunity to train lower staff at these schools whenever they need it.

. Pre-service training

Two regular courses, one for Foresters (Diploma-in-Forestry) of two years duration and the other for the Forest Guards (Certificate-in-Forestry) of one year duration are offered in the Forest Schools at Ghoragali and Bahawalpur

Soon after amalgamation of two forestry schools with PFRI, the curricula were expanded and upgraded upto Diploma-in-Forestry (2 years) and Certificate-in-Forestry (1 year) for Foresters and Forest Guards respectively in order to cope with the increased responsibilities of the forest department and in view of today's socio-economic and technical requirements of the service. Later on schedule of training for both the courses was further revised to improve practical aspect of training.

a) Ladies NGO Batch visits PFRI Research Garden during short training course

b) Trainees of Certificate-in-Forestry course being explained Nursery Techniques by the Principal (PFS Ghoragali)

In addition to classroom lectures in nearly 19 subjects of Forestry, Forest Utilization and allied disciplines, the trainees are imparted practical knowledge by study tours to various types of forests in the province. Moreover, under the revised schedule, the trainees spend 50 percent time of their total course duration in their respective circles or divisions for getting practical training in various aspects of Forestry. Field training during this period of one year for Foresters and six months for Forest Guards is guided by Practical Field Training Documents which prescribe definite credit hours of training for different disciplines of forestry. This is followed by final evaluation when they report back in schools.

Inservice Training

A number of refresher and special courses have been and are being conducted at PFRI and at Forest Schools to refresh the knowledge of field officials and acquaint them with latest forestry techniques. The subjects for such training are Forestry Extension Education, Social Forestry and Agroforestry, Seed and Nursery Technology, Tree Establishment and their Management, Marketing, Irrigation Management, etc.

Special courses are conducted for farmers, NGOs and COs for the transfer of technology especially on seed and nursery technology, tree establishment on farmlands and their management.

3.4 NUMBER OF FOREST TECHNICIANS TRAINED

1. NUMBER OF FORESTERS TRAINED

Year	PFRI	Ghoragali	Bahawalpur	Total
(One year)				
1967-87	-	161	755	916
1987-88	-	7	17	24

a) A short training course of Senior Forest Officers being concluded by award of certificate by Ch. M. Riaz-ul-Hassan, C.F. to Malik Muhammad Khan, C.F.

b) A Batch of NGO Ladies conducting practical in raising polybag nursery in PFRI

(Two years)				
1988-90	-	16	-	16
1989-91	-	26	32	58
1990-92	-	34	13	47
1992-94	-	10	-	10
1993-95	-	11	-	11
1995-97	5	16	-	21
1996-98	-	14	-	14
Total:	5	295	817	1117

2. NUMBER OF FOREST GUARDS TRAINED

Year	Ghoragali	Bahawalpur	Total
(Six month)			
1967-87	1451	1786	3237
1987-88	24	21	45
1988-89	94	-	94

(One-year)

1988-89	-	46	46
1989-90	28	84	112
1990-91	26	70	96
1991-92	41	63	104
1992-93	46	89	135
1993-94 (Spring)	43	90	133
1993-94 (Autumn)	42	58	100
1995-96 (Spring)	-	77	77
1995-96 (Autumn)	70	75	145
Total	1865	2579	4444

3. TRAINING OF SERICULTURE RESEARCH STAFF

SERICULTURE SUPERVISOR TRAINED

Sl No	Duration	Year	No.
1.	One year	1987-88	2
2.	One year	1988-89	2
3.	One year	1992-93	2

a) NGO Ladies Batch participating in short training course in seed and nursery technology in PFRI

b) A Batch of NGO Members undertaking a short training course in social forestry in PFRI

SERICULTURE SEED EXAMINER TRAINEE

Sl No.	Duration	Year	No.
1.	One year	1991-92	5
2.	One year	1992-93	5

3.5 SUMMARISED STATEMENT OF PERSONNEL TRAINED

PFRI Staff

To improve qualifications and capabilities of PFRI scientists and other staff, an opportunity was provided for 206 officials to participate in 48 courses conducted by different organizations.

Forest Department Staff

Similarly, 923 officials of the Punjab Forest Department were provided a chance to participate in 44 short courses arranged by PFRI to refresh their knowledge in the field of Forestry, Forestry Extension Education, Irrigation Management, Computer Science, etc.

Farmers/NGOs/COs

Twenty-eight (28) short courses were arranged by PFRI for the training of 469 Farmers and Members of NGOs/COs in the field of seed and nursery technology, establishment of trees on farmlands and their harvesting and marketing, etc.

Sl No	Category of Trainees	No. of courses conducted	No. of persons trained
1.	PFRI Officials	48	206
2.	Forest Department Officials	44	923
3.	Farmers, NGOs/COs	28	469
	Total	120	1598

3.6 LIST OF TEXT BOOKS/TRAINING MATERIAL PREPARED

Sl.No.	Name of Book/Monograph	Author	Year
1	Importance of forests and Forest Types of Pakistan	M.I.Sheikh & M.Hafeez	1990
2	Seed Supply and Forest Nursery	M.Hafeez & M.I.Sheikh	1990
3	Afforestation and Regeneration of Forests	M.I.Sheikh & M.Hafeez	1990
4	Raising of Important Fast Growing Species	M.I.Sheikh & M.Hafeez	1990
5	Tending of Forest Crops	M.Hafeez & M.I.Sheikh	1990
6	Forest Protection-I	M.Hafeez & M.I.Sheikh	1990
7	Silviculture of Important Forest Tree Species	M.I.Sheikh & M.Hafeez	1990
8	Management of Various Types of Forests	M.I.Sheikh & M.Hafeez	1990
9	Silvicultural Systems	M.Hafeez & M.I.Sheikh	1990
10	Soil Conservation and Watershed Management	Dr.B.H.Shah	1990
11	Research Methods and Simple Experimental Designs Used in Forestry	M.I.Sheikh, R.W.Hussain & M.Hafeez	1990
12	Forest Protection-II	Ch.Ghulam Hussain	1990
13	Soil Science	Dr.Zafar Iqbal	1990

14.	Introduction to Sericulture, Appiculture and Lac-Culture	Mian M. Muslim	1990
15.	Practical Field Training Record for Diploma-in-Forestry	M. Hafeez, et.al.	1990
16.	Practical Field Training Document for Certificate-in-Forestry	M. Hafeez, et.al	1990
17.	Accounts and Procedure	Sh. Saif-ur-Rehman	1990
18.	Elements of Forest Mensuration	S.Hassan Abbas Moosvi	1990
19.	FAO Monograph on "Prosopis cineraria (L) Druce. Its production, management and utilization. FAO Regional Wood Energy Development Programme in Asia GCP/RAS/ 111/NET Field Document (A Monograph)	M. Hafeez	1991
20.	Forest Tree Seed Supply	M.Hafeez & Nighat Naheed	1991
21.	A Manual for Seed Technologists	Dr. Zafar Iqbal	1993
22.	Lecture Notes on Forestry, Wildlife and Fisheries for refresher courses	Anon	1994
23.	Lecture Notes for Trainees of Punjab Forest Schools (Vol.I,II,III & IV)	Dr. Rafique	1994
24.	Handbook of Agricultural and Horticultural Crops for Agroforestry	Wahid Rasheed	1994
25.	Lecture Notes on Forestry Extension Education	Dr. Tanvir, et al	1995
26.	A Handbook on Seed Technology	Dr.Zafar Iqbal & M.Hafeezullah	1995

27	A Handbook on Forest Tree Seeds (Urdu)	Dr.Zafar Iqbal & M. Hafeezullah	1995
28	A Handbook on Forest Nursery	S.M.Hafeez	1995
29	A Training Handbook on Forest Nursery (Urdu)	S.M.Hafeez & M.Mushtaque	1996
30	A Handbook on Social Forestry	M.I. Sheikh	1996
31	A Handbook on Social Forestry (Urdu)	M.I. Sheikh	1996
32	Why to Practice Agroforestry?	M.I. Sheikh	1996
33	An Introduction to Agroforestry (Urdu)	M.I. Sheikh	1996
34	Training Handbook for Tree Farmers(Urdu)	S.M.Hafeez & M.Mushtaque	1996
35	Agroforestry - Its Concept and Potential	S.M. Hafeez	1996
36	Ecological, Socio - Economic and Institutional Aspects of Agroforestry	S.M. Hafeez	1996
37	Classification of Agroforestry Systems and Choice of Species	S.M. Hafeez	1996
38	Existing Agroforestry Systems	S.M. Hafeez	1996
39	Design, Establishment and Management of Agroforestry Systems	S.M. Hafeez	1996
40	Financial Analysis of Agroforestry Systems	Malik Muhammad Khan	1996

4. ACHIEVEMENTS IN FORESTRY RESEARCH

A Programme Committee stands constituted for the approval and review of forestry research and training programme in the Punjab. This Committee approved a research programme which was implemented in PFRI. Annual review and approval of annual research programme was done regularly in the meetings of the standing Forestry Research Review Committee held at PFI, Peshawar under the chairmanship of Inspector General of Forests, Government of Pakistan. The Chief Conservators of Forests of all the provinces are members of this Committee.

Meetings of the National Committee could not be held during 1995 and 1996. An effort was, therefore, made to hold a meeting of Provincial Programme Committee during 1995, but it was postponed by the Chairman (Secretary Forests). A meeting is expected to be held soon for the approval of research and training programmes for the Punjab.

Research programme is problem-oriented and is formulated on the basis of suggestions called from the field officers. Since agroforestry/farm forestry is being practised by the farmers in the Punjab on a large scale, it has become necessary to carry out studies and experiments on agroforestry so as to provide basic information and techniques to the farmers. Agroforestry is, therefore, Priority I subject of research in the Institute.

Appreciable achievements have been made in forestry research which are given in the following pages.

4.1 ARTICLES/PAPERS/TECHNICAL NOTES/REPORTS/ TRAINING MATERIALWRITTEN

1. Research and Review Articles, Technical Notes = 63
2. Papers presented in Workshops/Conferences = 17
3. Technical Reports, Progress Reports = 21
4. Study Reports, Position Papers, Plans and Brochures = 21

5	Forestry Text Books, Monographs, Manuals	=	45
	Total	=	167

4.2 RESEARCH PROJECTS COMPLETED AND ON-GOING

1	Research and other projects completed	=	85
2	On-going Research Projects	=	48

4.3 MORE IMPORTANT ARTICLES/PAPERS/RESEARCH FINDINGS

1. Development of suitable agroforestry model for growing Poplar in Agroforestry System
2. Identification of better performing salt tolerant tree germplasm.
3. Development of culturable wastelands for production of wood and other needs.
4. Selection of bamboo species for planting in the Punjab.
5. Energy crisis and mesquite.
6. Diversification of fodder resources.
7. Improved Sericultural techniques.
8. Development of silkworm races.
9. Identification of best Poplar clones for planting in the Punjab.
10. Propagation of *Eucalyptus camaldulensis* through its root-shoot cutting.
11. Suitable size of polythene tubes for raising plants in the nursery.
12. Regeneration of Eucalyptus camaldulensis through coppice.

13. Allelopathic effect of Eucalyptus camaldulensis

14. Selection and marking of plus trees of important commercial tree species

15. Selection and demarcation of seed production areas

16. Establishment of progeny test plantations of commercial tree species.

17. Growth and management information for multipurpose tree species like, kikar, jand, prosopis pallida, siris, Eucalyptus, shisham.

18. More economical utilization of Eucalyptus wood.

19. Effect of watering frequency on the performance of tree species under rainfed conditions.

20. Quantitative assessment of reduction in survival and yield due to weeds in Irrigated Plantations.

21. Effect of shade on the growth and quality of seedlings in nursery stage.

22. Effect of watering level on the growth and quality of seedlings in the nursery stage.

23. Use of high density polythene as nursery plant container.

24. Monograph on Prosopis cineraria (Jand)

25. Effect of trees of Eucalyptus and Poplar on the yield of agricultural crops.

26. Current status of tropical forests and scope of multipurpose tree species.

27. Forestry Text Books/Training Material.

28. Agroforestry and its strategies for Pakistan. (Dissertation written as a part of the training course requirements of the University of Oxford, U.K.)

29. Social Forestry - Need, Present Status and Future strategy

30 Benefit Cost Analysis and Effect of Trees of Acacia nilotica growing in Wheat Fields.

31 Fuelwood Trade in Rural Areas of the Punjab.

32 Suitable age/size of Eucalyptus plants for outplanting.

4.4 SDI SERVICE

Important professional articles concerning forestry and allied subjects which appear in renowned international and national journals are selected and sent to all Senior Forest Officers in the Punjab. The articles sent so far are listed below:

1. Forestry Programme Fights Rural Poverty.
2. Energy Crisis and Mesquite.
3. Interest in Farm Forestry.
4. Farm Forestry and Wasteland Development.
5. Social Forestry Development.
6. People, Trees, and Rural Development - The Role of Social Forestry.
7. Extension in Social Forestry: Problem Areas and Needed Solutions.
8. Use of Leucaena by Kenyan Farmers Inspires others to do same.
9. Future Directions for Social Forestry Extension.
10. Promoting Prosopis juliflora in Saline Lands.
11. Range Improvement through Water Conservation in Pakistan.
12. Ipil Ipil - A High Potential Fodder Crop.
13. Forestry in the Old World.

14. Current Status of Tropical Forests and Scope of Multipurpose Tree Species.

15. Prosopis: Problems and Potential for Pakistan.

16. Dialectics of Change in Pakistan.

17. A Tree Before Breakfast.

18. The Green House Effect.

19. Forests to Offset the Green House Effect.

20 Fast Growing Species for Meeting Rural and Industrial Needs of Punjab - Present Status and Future Research Needs.

21. Pakistan: New Dimensions in Forest Policy.

22. Agroforestry ... A very Social Science.

24. Perspective, Planning and People's Participation in Proposed Social Forestry Models for Economic Development and National Productivity.

25. Leucaena.

26. Trees - Let's Take a Balance View.

27. Grevillea robusta - Australian Tree Finds Success in Africa.

28. The Green House Effect.

29. Economic Analysis of Agroforestry Options for Small Irrigated Farms in Punjab Province, Pakistan.

30. Financial Analysis of Selected Shelterbelts Systems in Pakistan

31. Women in the Forest Service: The Early Years

32. Forest, A Heritage for the Future.

33. Tropical Forestry Research, Past, Present and Future.

34. Authenticity in the Forest Profession.

35. Women s Income from Non-Timber Forest products.

36. Problems and Prospects at the Urban-Forest Interface.

37. New Approaches to Forest Management: PART One of Two Parts.

38. New Approaches to Forest Management: PART Two of Two Parts.

39. Public Participation in National Forest Planning.

40. WHAT's all This Debate About Over Cutting?

41. VIEW Point: On Living with the Land.

42. A Brochure for Punjab Forestry Research Institute.

43. Living With the Land.

44. The Global Competition for Land.

45. The Politics of the Environment.

46. Planning the Use of Land for the 21st Century.

47. Why Farmers Adopt Production Technology?

48. Religion and the Environment: Providing Leadership for Ecological Values

49. Range Improvement Interventions.

50. Agroforestry in Pakistan: Two Commentaries.

51 On Being Professional The Responsibilities of a Worthy Vocation

52 Public Regulation of Private Forestry Proactive Policy Responses

53 'Toward Sustainable Forestry Worldwide'

54 'To Effective Public Interaction Happin Natural Resource Professionals Adjust their Attitudes'

55 'With two crops, can you also grow trees'

56 'Research on Allelopathy on Eucalyptus in India and Pakistan'

57 'Before you begin your Inventory'

58 'Farmers and trees A survey of attitude in western India'

59 'Trees and Crops Competition for Resources Above and Below the Ground

60 'Goats, trees and other things Agroforestry for small farms on sloping land in the Philippines'

61 'Casuanna enhances Fruit-Tree production on an arid site in India'

62 'Prosopis cineraria Promising multipurpose tree for arid lands'

63 'Agroforestry a new horizon for wood production and increased farm income-III Role in ecosystem stability'

64 'Desertification The way Forward'

65 'Ancient ways Guide Modern Methods'

66 'Artificial Planning of Immature Oak stands is not profitable'

67 'What is community Forestry'?

a) Agroforestry (Poplar plus Maize) Experiment in PFRI Research Garden

b) Expriment to determine optimum shade requirement at nursery stage of *Eucalyptus camaldulensis* and other species

3. Benefit : cost analysis and effect of tree of *Acacia nilotica* growing in wheat fields.

Acacia nilotica trees grown in line along wheat field reduced the yield of wheat grain and bhoosa upto value of Rs. 359/Ha. On the other hand ,the trees gave and income of Rs. 1071/Ha. during the same period of 6 months. Thus there was a net profit of Rs. 712/Ha during six months by growing these along wheat field. This gain can be further improved through transfer of technology and through improvement of marketing.

4. Better method of raising *Acacia nilotica* on farmlands.

Methods of direct sowing of kikar seed was compared with the method of planting its tubed plants on farmland. It was concluded that method of planting tubed plants is better and preferable for raising kikar on farmlands along field boundaries.

5. Effect of spacing on the growth of *Eucalyptus camaldulensis* under agroforestry systems.

An experiment at PFRI Campus indicated that wider spacing between tree rows has a positive and significant effect on tree diameter growth. The spacing of 1.9 x 3.8 m as compared with narrower spacing (1.9 x 3.2 m) was found more useful for Eucalyptus plantation which, in addition to giving increased number of agriculture crop rotations, also enhanced the tree volume per unit area. Moreover, wider spacing provides better opportunity to the farmer for soil working and increased utility of his land resources by harvesting crops for a longer period of time.

6. Effect of shade of Poplar (*Populus euramericana* CV-I-214) on yield of wheat.

A study conducted in Changa Manga plantation indicated that the Poplar crop planted at 15 x 15 feet spacing did not affect the wheat yield even in its 3rd year of age. It was a useful indication for Poplar in agroforestry.

7. Survey of existing Agroforestry systems in barani tract of the Punjab.

The survey conducted during 1987 has given very useful information. 26% farms were found without any tree, 54% farms had artificially planted trees and others had naturally grown plants; 72% had scattered planting, 23% had linear and 5% had block planting. Main tree species grown were kikar, bakain, shisham, phulai, ber, mulberry and *E. camaldulensis*. Main functions of the agroforestry systems are production of fuelwood, timber, fodder, forage, soil and moisture conservation, and production of food, edible oil, milk, meat, manure, income, fencing, shade and

baskets. Main constraints were noticed as protection problem from livestock, scarcity of water ,erosion, poverty, nonavailability of loans, mesquite invasion and nonavailability of planting stock. Similarly lot of data has been obtained which will be finally compiled in a short course of time.

8. Socio-economic conditions and end-uses of MPTS on small farms in barani areas of Pakistan

A survey conducted in the barani areas of the Punjab showed that farmers are interested in multi-purpose uses of trees. The species most preferred by the farmers were found to be kikar, shisham, phulai and ber. The tree uses in which the farmers are interested are fuel, timber, fodder, market sale and fencing. This survey also indicated the main problems of the small farmers like scarcity of water for irrigation, soil erosion, protection from animals, tree-crops competition, fertility of the soil, etc. It also gave useful indications for research needs in this tract.

9. Effect of forest (shisham) versus fruit (mango) trees on wheat crop.

Fruit trees (mango)have more adverse effect on wheat crop than shisham trees. Total loss per acre in case of shisham trees was Rs.422/= and in case of mango trees was Rs.1172/= Additional income due to shisham trees was Rs.500/= per acre and due to mango trees Rs.690/= per acre. Overall, shisham was found more beneficial.

10. Economics and feasibility of bamboo cultivation on farmlands.

Economics and feasibility of growing bamboo on farmlands was studied and it indicated that bamboo cultivation is more economical than any other agricultural crop as no agricultural crop gives so much net income per year per unit area. Moreover, raising of agricultural crops within bamboo plants would contribute additional income from the same piece of land. In fact cost of bamboo cultivation would be recovered from sowing of agricultural crops during first 2-3 years. Moreover, bamboo crop would be yielding revenue continuously every year after first harvest till its maturity. Bamboo cultivation on farmlands was, therefore, found very much feasible technically, financially as well as economically.

11. Effect of *Eucalyptus camaldulensis* tree rows on the yield of wheat crop.

Various agricultural farms were visited for data collection to study the effect of tree rows of *E. camaldulensis* on wheat crop. Three farms were selected in Faisalabad district with tree rows

of different orientation. Average height of trees was 11m except in one case where it was 17m Plant to plant distance of trees within the row was 1m and in some cases 4.5m

(I)Tree row was south east - north west oriented and wheat field was situated on south west side of the tree row. The tree row decreased wheat yield upto a distance of 8m, and then the yield increased upto 20 m as compared with control.

(II)Tree row was north west - south east oriented and wheat field was situated on north east side of the tree row. The tree row decreased wheat yield upto 20m as compared to control.

Tree row was north west - south east oriented and wheat field was on south west side. The wheat yield was decreased upto 8m distance from tree row and then it increased upto 20 m as compared to control.

Tree row was north east - south west oriented and wheat field was on north west side of the tree row. The wheat yield was decreased upto 8m and then it increased upto 20 m as compared to control.

(III)Tree row was north west - south east and the wheat field was on south west side of the tree row. The wheat yield was decreased upto 12 m from the tree row and then it increased upto 20 m as compared to control

12. Social Forestry: Need, Present Status and Future Strategy

This paper explains well the need for social forestry in Pakistan to meet the challenge of energy crisis and food emergencies. It also gives strategy for action i.e. adoption of agroforestry and social forestry. It gives brief description of the present status of social forestry in the Punjab and also recommends a number of measures for further mobilizing public support for tree planting.

13. Why Social Forestry and Agroforestry in the Punjab?

The paper stresses the need for social forestry and agroforestry in the Punjab to meet the challenge of "Energy Crisis and Food Emergencies". Strategy for action on agroforestry and social forestry has been proposed.

14. Social Forestry in the Punjab - A Major Break Through

The paper has reviewed the evaluation of social forestry and development of agroforestry in the Punjab during the past over two decades. Various problems in agroforestry have been discussed and recommendations have been given for successful agroforestry programmes in future.

15 Agroforestry Systems

Agroforestry is a new subject. This paper has defined agroforestry and has given classification of agroforestry systems. It is a good paper for those interested to know what is agroforestry and agroforestry systems.

16. Existing Agroforestry Systems in Pakistan

The paper gives a methodology for the diagnosis and design of agroforestry systems. It has also listed major agroforestry systems and practices in Pakistan which is a valuable information for all the foresters and others interested in agroforestry.

17. Fodder Trees for Arid and Semi-Arid Regions of Pakistan

A paper on the subject was written and presented in the International Seminar on Farming Systems Research in context of Food Security held at D.G.Khan on 4th to 5th August, 1996. inaugurated by the President of Pakistan. Recommendations were given for increasing fodder resources in arid and semi-arid areas of Pakistan.

18. Fuelwood Trade in Rural Areas of the Punjab

The existing system of fuelwood collection, its transportation, and its distribution were studied through literature. Trade difficulties and constraints were identified and future strategy was recommended in the paper presented in the National Training workshop on Fuelwood Trade during May, 1996 at Peshawar.

II. TREE IMPROVEMENT AND GENETICS

1. Establishment of Seed Orchards in the Punjab

Under this project, 416 plus trees of *Eucalyptus camaldulensis*, shisham, simal, chir, bakain, kikar, *E. citriodora*, kail, mulberry, white siris, etc., were marked in different areas of the Punjab for collection of quality seed for progeny test plantations and for supply to field officers. Progeny test plantations of more important species were raised over 26 acres which are now producing seed of good quality. Field planting of *E. camaldulensis* through root-shoot cuttings gave promising results and this technique is being further perfected for recommending to the field officers.

2. Selection of suitable Poplar Clones for Large Scale Plantations in the Punjab

As a result of trial of 48 clones of Poplar at Jallo, Changa Manga and Daphar, a few like I-B.L, 1-4/64, I-48, A-65/27, I-116/60, Y-707 were found more promising for large scale introduction.

3. Forest Tree Seed Supply Situation in the Punjab

This paper reviews the role of seed in our forestry and the present practice. It has also attempted the calculation of current annual requirements of pure seed of different species. Useful suggestions have been given to develop adequate sources of good seed for future.

4. Establishment of Forest Tree Seed Supply System in the Punjab

Establishment of tree seed supply system in the Punjab has been suggested. Requirements of planting stock and seed of various species for the period 1993 to 1998 have been indicated. A separate unit for establishing seed supply system under the charge of separate CF/Director alongwith D.F.Os/SDFOs/Seed Technicians and other supporting staff has been recommended. Training of technical staff and requirements of transport and equipment required for seed collection, extraction, testing and storage etc., have been listed.

5. An Overview of Research on Vegetative Propagation of Important Tree Species in the Asian Pacific Region

It is an important review of research on vegetative propagation including tissue culture of important tree species in the Asian pacific Region. It is a useful work reviewing the latest

techniques of vegetative propagation for various species in this region. It would be an interesting document for the senior field officers.

6. Selection of Bamboo Species for Planting in the Punjab

Eleven bamboo species of higher economic value brought from Bangladesh were tried at 4 research stations in the Punjab. Statistical analysis of the growth data indicated that *Dendrocalamus giganteus* and *D. longispathus* excel other species, both in diameter and height growth. The *Bambusa vulgaris* and *D. hamiltonii* were found next in their growth performance. The field officers should propagate these species for further distribution.

7. Screening of clones of *Populus deltoides*

Sixty clones of *P. deltoides* were procured from P.F.I. Peshawar for further trial. Three years results at nursery stage have shown the superiority of the following clones:

1. S7C-1
2. S7C-2
3. S7C-4
4. S7C-13
5. S7C-20
6. ST-165
7. ST-150
8. ST-109
9. ST-74
10. ST-66
11. AY-48
12. I-77/51
13. I-72/58

III. SEED, NURSERY AND AFFORESTATION

1. Optimum Watering Level for *E. camaldulensis* Seedlings in Nursery Stage

Different watering levels (240, 195, 155 and 115) were tried during nine months (June-February) nursery stage of *E. camaldulensis*. The difference in the effect of various watering levels was found to be non-significant. It indicated that 52% reduction in number of irrigations is possible without affecting the quality of plants. This study also indicated that Eucalyptus plants attain plantable size within 6 months period, because there was no significant difference of height growth from 7th to 9th month. The plants which received lesser number of irrigations in the nursery stage showed slightly better performance in the field because of the hardiness they attained during nursery stage.

2. Suitable Shade for Nursery Seedlings

An experiment conducted to find out a suitable intensity of shade during nursery stage for *E. camaldulensis*, kikar, ipil-ipil and jand gave the following indications:

I. For jand and ipil-ipil, 1/2 shade (single layer of kana chick with every alternate stick removed) is the best.

Ii. For *E. camaldulensis* and kikar, no shade gave the best performance.

3. Economical size of polythene tubes for raising nursery of *E.camaldulensis*

An experiment conducted at PFRI to find out an optimum size of polythene tube for raising seedlings of *E. camaldulensis* gave indication that polythene tubes of 7.5x15.0 cm and 10.0x13.0 cm are preferable for raising plants of these species for a period of 6 months in the nursery keeping in view the economics and quality of plants (different sizes tried were 7.5x10.0 cm, 7.5x15.0 cm, 9.0x18.0 cm, 10.0x13.0 cm, 10.0x20.0 cm and 15.0x23.0 cm).

4. Cost Efficient Techniques for Raising *E. camaldulensis* Seedlings

A study was made using high density polythene tubes as container for *E. camaldulensis* seedlings in the nursery. Use of high density polythene bags gives reduction in cost from 62% to 72%. Use of smaller size (3"x7") tubes instead of larger (3.5"x8" or 4"x9") tubes gives further reduction in the cost of raising plants in the nursery. Similarly, using 4 to 5 months old plants of *E. camaldulensis* for field planting, results in further decrease in nursery cost.

5. Identification of Better Performing Salt Tolerant Tree Germplasm

Twenty-six woody tree species were procured from Australia for trial on saline and partially waterlogged areas. As a result of experiments a few species have been identified for planting in saline areas. A few such selected species are *E. camaldulensis, Casuarina cunninghamiana, C. glauca, C. obesa, C. equisetifolia, Acacia saliciana*, etc.

6. Energy Crisis and Mesquite

Review of literature and actual experience has shown that mesquite (*Prosopis juliflora*) is an ideal candidate for energy plantations in semi-arid and marginal lands, not only to meet the fuel

wood demand, but also to improve the soil fertility because this plant is fast growing, hardy and nitrogen fixing leguminous tree. The article contains an advice for the foresters to change their hostile attitude towards mesquite and develop amicable terms with it to direct its aggressiveness towards their benefit.

7. Development of waste lands for fuel wood energy and other rural needs

A country report regarding Pakistan prepared by the Director, PFRI for an FAO Regional Workshop in India gave the following important indications:

(I) Nearly 12 million ha of land are lying as waste lands in Pakistan. In view of acute shortage of fuel and other needs for the ever-increasing human and livestock population, a country like Pakistan cannot afford to let these lands lie as such. Their scientific management is essential not only for well being of the people living in them, but also for preservation and development of our natural resource base.

(II) These lands suffer from various hazards like salinity, waterlogging, aridity, erosion, etc. Given an appropriate package of technology, institutional, financial and social support, these lands constitute a potential resource for the production of fuel wood and other rural needs. The entire wasteland area should be surveyed for its land capability classification and then lands requiring minimum inputs should be tackled first.

8. Cultivation of medicinal plants in forest areas in the Punjab.

This is a final technical report regarding a PC.1 Project on the subject. This report contains very useful information about the cultivation of medicinal plants, brief description of about 20 species of medicinal importance, experimental data and marketing of herbal drug plants. A few important conclusions and recommendations were as under:

(I) Planting, cultivation and harvesting of medicinal plant crops requires much investment in human labour and are , therefore, often not economical.

(II) Marketing of medicinal plants produce is another problem which restricts their cultivation on large scale.

(The report can be referred for further recommendations)

9. Effect of Watering Frequencies on the performance of tree species under rainfed conditions

Seven tree species namely: ipil-ipil, siris, phulai, shisham, kikar, ber and *E. camaldulensis* were planted in Pabbi Hills (Kharian) during spring and monsoon, 1989 in a replicated RCB design. Four watering levels applied were:

Watering level	Watering Frequency		
	1st Year	2nd Year	3rd Year
T1	Weekly	Fortnightly	Monthly
T2	Fortnightly	Monthly	Monthly
T3	Monthly	Monthly	Monthly
T4	Only once at planting time		

Periodic data collected upto 5th year age showed no significant difference in the performance of various species under different watering frequencies.

This shows that under average rainfall conditions of Kharian irrigation at the time of planting only is enough to raise any of these species.

10. Use of Polymer for Dry Afforestation in Cholistan .

An experiment was conducted, using 10 tree species, to find out if polymer could be of some assistance for dry afforestation in the vast tract of Cholistan. Alkasorb (a water absorbing polymer) was tried in 4 levels (2 grams, 4 grams, 6 grams and 0 gram per litre of water) with ten species namely; lahoora, kikar, jand, siris, ber, malah, *E. camaldulensis, A. cynophylla, A. victoriae, A. tortilis*. The alkasorb did not have any significant effect on the performance (survival, height growth) of species. However, the experiment indicated that lahoora, ber, *A. tortilis*, jand and kikar can be planted with only one irrigation at the time of planting. Lahoora and malah also faired well in this tract (Maujgarh-Cholistan).

11. Development of Culturable Wastelands for Production of Wood and Other Needs

This review paper contains valuable information regarding planting techniques and the recommended species for afforestation of various categories of waste lands in different ecological zones of Pakistan

12. Proposal for the Development of Forestry in the Punjab

The paper says that given required financial input, there is much scope of improvement of existing forests, afforestation of blank areas and planting on farmlands. There is a brief proposal for each forest type i.e dry hill forests, scrub forests, irrigated forest plantation, riverain forests and also for planting of farmlands. The development of watersheds and range lands has also been proposed. Constraints in faster development of forestry have been enlisted and a strategy for future has been recommended.

13. A strategy for Afforestation in the Punjab

This paper gives valuable proposals for increasing tree wealth in the Punjab on Government-owned lands like; hilly areas, irrigated plantations, scrub forests, linear plantations, waste lands with Revenue and other Departments, Government agriculture farms, open places near villages, etc; and on private lands like non-agricultural lands in the hilly, agricultural lands in the hills, private agricultural lands in the plains, etc. Feasibility study by a team of consultants and execution of Master Plan has been suggested.

14. Regenerating *Eucalyptus camaldulensis* through Coppicing

The experimental results have indicated that *E. camaldulensis* can best be regenerated through coppicing. This is a very economical method of regeneration as compared to planting of poly-bag plants.

15. Economical Size of Polythene Tubes for Raising Seedlings of *E. camaldulensis* in the Nursery

Different polythene tube sizes were tried in the nursery to find out more economical size for raising plants of *E. camaldulensis*. Two sizes, 2.0" and 2.5" diameter were proved more economical.

IV. INTRODUCTION OF FAST GROWING MPTS

1. Multipurpose Tree Species Research Network Field Trial in Pakistan

Three species i.e. *Leucaena diversifolia*, *Acacia mangium* and *Acacia auriculiformis* of humid sub-humid zone were tried at PFRI to study their performance under our local conditions. Both the provenances of *L. diversifolia* have shown best results in respect of survival, height and diameter growth. *Acacia auriculiformis* has also faired well. These species can be recommended for growing in suitable areas having irrigation water. At the same time these shall be tested further on pilot project scale.

2. Current Status of Tropical Forests and Scope of Multipurpose Tree Species

This is an important paper which cautions about the forest resource and its destruction, causes of deforestation and degradation and fuel wood deficits in the world tropics. It also provides valuable answers to the following questions:

i. What will happen if the process of deforestation is not reversed?
ii. What action is required?
iii. What extent of tree planting efforts needed?
iv. What MPTS can contribute?
v. What the action will reward?

It emphasizes the involvement of millions of people who live within and beside the forests and depend upon them to help and satisfy their basic needs.

V. MANAGEMENT TECHNIQUES AND UTILIZATION

1. Economical utilization of *E. camaldulensis*

This project was undertaken to compare the economics of use of *E. camaldulensis* as firewood and ballies. The results showed that Eucalyptus trees should be converted into ballies of various sizes instead of converting the trees into firewood. Conversion into ballies gives 36% additional revenue as compared to that of conversion into firewood.

2. Multiple land-use: Poplar Plantation with Poplar Nursery

It was concluded from this study that 19% of the expenditure is saved by raising Poplar nursery and Poplar plantation together instead of growing them separately. Their combination of one year old Poplar plantation with 2nd stage Poplar nursery gave net return of Rs.5300/- per acre. The conclusion was that 2nd stage Poplar nursery should be grown with new Poplar plantation for economical utilization of land.

3. Selection of Suitable Formula for the Volume Measurement of Shisham Logs

An assignment was given to PFRI by the Administrative Department to find out a suitable formula for measurement of volume of shisham logs. Field work was undertaken for this purpose and different formulae were used for the measurement of volume of the same logs and difference in the resultant volume was noted. Smalian formula gave the highest volume over the other two i.e., Hubers and Quarter Girth formulae. For under-bark volume measurement, percent ratio of Smalian, Hubers and Quarter Girth formulae came to 100: 86:68, while Hubers and Quarter Girth formulae gave 100:79 ratio respectively. The department has an economic benefit on sale of shisham timber by giving 1" bark allowance per foot girth instead of selling it on under-bark volume basis. It is upto the Chief Conservators of Forests to select anyone formula.

4. Volume Estimation for Shisham and Kikar for Canalside Plantations

On the request of C.F. Canalside Plantations, local volume tables for shisham and kikar were prepared for a distributory in Bahawalnagar district. The difference of volume table figures from the actual volume figures alongwith basis of difference was indicated in this.

5. Under-planting of Bamboo in Irrigated Plantations

The experiments conducted in Daphar, Chichawatni, Shorkot and Changa Manga plantations showed that given proper protection from browsing cattle and porcupine, the bamboo can grow as an understorey in irrigated plantations in recently thinned-out areas.

6. Introduction of Sisal in the Punjab

In an effort to find a substitute of jute, attention was concentrated on sisal (*Agave sisalana*). Trials conducted at Jallo, Islamabad and Daphar to study the pattern of its cultivation and effect of irrigation showed that irrigation does have beneficial effect on the growth of sisal. It was

concluded that porcupine control is essential for the success of sisal plantations. Hard clay soil is not relished by it.

7. Under-planting of Sisal in Irrigated Plantations

The interim results obtained from experimental underplanting of sisal in irrigated plantations, revealed that control of damage by porcupine and other animals is very essential for the success of this species in recently thinned-out areas as understorey.

8. Effect of Chemical Fertilizer on the Growth of Hybrid Poplar

The conclusion was that in good and rich soils like that of Changa Manga plantation, there is no need of any fertilizer application. The soil already contains enough food for supporting Poplar crop.

VII. MISCELLANEOUS PROJECTS

1. Current Trends of Forestry Research Priorities

Due to growing human and animal population and severe food and fuelwood supply problems in the world, the emphasis in national development has bent towards forestry for local community development. Consequently, there has been a parallel increase in the need for research on topics like farming systems that incorporate tree and watershed protection, production and use of energy, utilization and marketing, integration of forestry into national development etc. Forestry research priorities have, therefore, been indicated in view of this latest trend.

2. Proposal for the Development of Murree-Kahuta Hilly Areas

This paper contains a few suggestions and ideas for the development of Murree-Kahuta Hilly Areas. It has given causes of degradation of land, a proposal for feasibility survey, preparation of master plan, phased programme, integrated development and involvement of local community. It has also mentioned some special problems of hilly region.

3. Development of Integrated Model Farm for the Improvement of Scrub Forests in Jhelum District

This technical report of a PARC - sponsored project contains the following useful messages for planners, foresters and others:

i. Experimentation is needed in Pothwar tract to determine the water requirements of various species for their successful afforestation. (Consequently, experiments were conducted by PFRI to study the effect of watering frequencies on the performance of various species. Its results are available in a separate article).

ii. The dependence of local population for firewood on the adjoining scrub forests goes on increasing with the decrease in their annual income and vice versa.

iii. The demand for firewood from forest area increases with the decrease in number of trees on agricultural lands and vice versa in the neighbouring areas. This means increased number of trees on farmlands shall reduce biotic pressure on state forests.

iv. With the increase of family size, their dependence on 'jungle' for firewood increases proportionately.

v. The dependence for firewood on the neighbouring forests is inversely proportional to the size of land holdings of farmers.

vi. A decrease in size of holdings results in the increased dependence of livestock population for grazing on state forests and vice versa.

vii. 60 percent of total population around the scrub forests depends on forests for their firewood needs. Whereas 96 percent of the total population depends on state forests for grazing of their livestock. It is an indication for the foresters to grow multipurpose species in these forests for the production of fuel wood and fodder to improve the socio-economic conditions of the people of this tract.

viii. In case of different micro-catchment techniques used for afforestation in scrub forests, trench planting gave the best results as compared to pit-planting and trough-planting.

ix In various experiments *Leucaena leucocephala* gave better survival than *E. camaldulensis*.

x. Similarly when different types of mulching material like plastic mulching, straw mulching and stone mulching were compared, plastic mulching gave better results.

ix. In case of different super-absorbents tried as an aid for afforestation, one gram of Alcosorb AB3 per plant and 20 gram of Terra-sorb per plant gave better survival percentage than other doses. Economics will not allow their use for the time being.

4. Assessment of Dependence of Local Population on Scrub Forests in District Jhelum

This article gives an important indication that multipurpose tee species should be introduced in scrub forest area to provide fuelwood and fodder for the surrounding human and livestock population to improve their over-all socio-economic conditions.

VI. SERICULTURE

1. Development of pure races of mulberry silkworm *Bombyx mori*. Ten pure races have so far been evolved. These are:

i. Japanese strain: Pak 3, M 101,M 103, M 107.
ii. Chinese strain: Pak 2, Pak 4, M 104,M 108,
iii. European strain: ZM 76.

These races are now being deployed for producing hybrid seeds and being supplied to the farmers for commercial rearing.

2. Artificial hatching of silkworm eggs by aid treatment.

Treatment of silkworm eggs, after 21 hours of oviposition, with 14.5 % HCl solution for a period of 5.5 minutes was found to be most suitable for obtaining maximum useful hatchability (98%) under local conditions. This investigation has made it possible to effect artificial hatching of eggs for multiple rearing.

3. Artificial hatching of silkworm eggs after chilling.

The silkworm eggs of local variety (Pak 1xPak 2) F 1 laid in spring at 26 C, stored at 22 C for 61 days and refrigerated at a temperature of 4 C to 6 C for 93 days, when treated with 20% HCl solution at 46 C for a period of 6 minutes gave maximum useful hatchability (92.3%) under local conditions. By this investigation, the spring laid eggs can be used for autumn rearing through artificial hatching.

4. Investigations on the method of cold storage and artificial hatching of autumn eggs for spring rearing.

The best useful hatchability (97.6%) was obtained in F 1 hybrid eggs (Pak 3 x Pak 4) produced in autumn and refrigerated, 55 hours of oviposition, at 5^0 C for 45 days and at 2.5^0 C for 39 days when treated with 18% HCl solution at 48^0 C for 5.5 minutes. By this method, the eggs produced in autumn can be utilized for spring rearing through artificial hatching.

5. Trials on autumn silkworm rearing in Pakistan

Autumn silkworm rearing was successfully conducted under local conditions during September-October. The cocooning ratio (86%) and cocoon shell ratio (20%) was found to be satisfactory. The practices of autumn rearing shall enhance the silk production and farm income to two folds with the existing rearing facilities with the farmer.

6. Field trials on autumn silkworm rearing in Pakistan.

The trial was conducted through 10 farmers in Jauharabad district. The average yield of cocoon (17.585 Kg) per packet, cocooning ratio (82%) and cocoon shell ratio (21.15%) were found to be satisfactory under the local conditions.

7. Trials on the multiple silkworm rearing in spring post-spring season.

Of the three overlapping rearings of the race (SHUNER X SHOGESTSU) conducted in spring post-spring season, the Ist rearing (February 19 to March 19) and 2nd rearing (March 3 to March 31) resulted in 94.67% and 94.87% cocooning ratio, 1.786 gram and 1.481 gram single cocoon weight and 23.00% and 22.21% cocoon shell ratio respectively and were considered highly satisfactory whereas the results of 3rd rearing (March 21 to April 16) were considered on

low side. Two overlapping crops in spring post-spring season have been introduced, enhancing the farm income and silk output.

8. Trials on the cold storage of silkworm eggs after being treated for artificial hatching.

The eggs treated for artificial hatching, hatched well (84.95%) without any bad effect, after having been stored upto 20 days at 5 C and 1 to 3 days after treatment was considered the fittest time of storing. This investigation has made it possible to protect the silkworm eggs treated for artificial hatching, under unavoidable circumstances, which otherwise were apt to hatch and die.

9. Development of gene pool of mulberry varieties.

The indigenous and exotic mulberry varieties procured from various sources and propagated and cultivated at close spacing of 1.50m x 0 90m are maintained in bushy form by training in low cut form at Changa Manga forest plantation, compartment NO.79. These varieties include; local Mulberry, Japanese Hybrid variety, Japanese Early variety, Japanese Late variety, Chinese Husung variety, Chinese Evergreen variety, Chinese Lun40 variety, Korea Gaeryung Suban variety, Srilankan variety *Morus indica*. It is useful for making selection, comparative study of various varieties and providing material for further propagation.

10. Introduction of Improved mulberry varieties for silkworm rearing.

Four promising mulberry varieties; Chinese Luin-40, Chinese Husung, Japanese Hybrid and Japanese Early variety on the basis of their high leaf yields (12834.225, 13455.945, 12076.650 and 8129.205 kg per acre), fast growth rate (29.25, 32.9, 28.55 and 27.58 m per plant per growing season respectively) and being early sprouting with longer growth period were introduced for extensive cultivation. These varieties are being cultivated on mass scale both on state as well as farmland for supporting the silkworm rearing programme in the province.

11. Trials on the Spacing of Mulberry Cultivation for Silkworm Rearing.

The average leaf yields (5148.613, 6213.866 and 6791.466 kg per acre for the adopted spacings (1.5 m x 0.9 m, 0.9x0.6 m and 0.3 m x 0.3 m respectively) concluded that the spacing of 0.9m x 0.6m was more suitable for obtaining optimum leaf yield and easy management in respect of the Japanese hybrid mulberry when maintained in low cut form.

12. Trials on the Inducing of Rooting by Ringing Twigs in Mulberry (Morus sp.)

Ringing induced rooting in mulberry when six months old twigs were ringed at the bottom by removing 1 cm bark during monsoon, although the extent of rooting varied from variety to variety. The rooted twigs, when planted in the earthen pot, sprouted well. It has developed the possibility of successful vegetative propagation by hard wood cutting during monsoon.

13. Effect of Dusting Lime-bleaching Powder on Silkworm in the Control of "Muscardine" Disease

Application of lime-bleaching powder had a positive effect on the control of "Muscardine" disease. This fatal disease can effectively be controlled by this treatment.

5. PEST CONTROL ACTIVITIES

A Pest Control Forest Division headed by a D.F.O./SRO is looking after the aspect of protection of forests from insects and wild animals. Its function is to control insects to save the standing trees as well as converted or used wood including control of damage by wild animals such as porcupine, wild boars, etc. Due to decreasing allocation of funds every year for pest control, its activities are reducing. Its yearly activities are given below:

Year	Spray of Firewood (cft.)	Spray of Nurseries (acres)	Control of Porcupine (acres)
1987-88	6,34,000	1410	-
1988-89	10,52,640	2480	1,98,843
1989-90	50,00,000	17500	88,200
1990-91	5,000	3069	77,009
1991-92	7,21,835	1431	1,46,118
1992-93	1,80,500	3523	1,00,423
1993-94	1,36,000	6480	1,63,328
1994-95	3,02,200	9559	1,21,331
1995-96	-	2185	51,647

6. FUTURE PLANS AND PROGRAMMES

6.1 TRAINING PLAN

I. Regular Course/Pre-service Training

1. Diploma-in-Forestry (2 years) Course

Classroom studies with short tours from Ist September to 31st August.

Practical Field Training in respective divisions during 2nd year from Ist September to 12th August.

Final evaluation from 13th August to 31st August.

2. Certificate-in-Forestry (1 year) Course

Classroom studies with short tours from Ist September to 28th February and Ist March to 31st August.

Practical field training in respective divisions from Ist March to 12th August and Ist September to 10th February.

Final evaluation from 13th August to 31st August and 11th February to 28th February.

II. INSERVICE TRAINING/REFRESHER COURSES

1. Levels of training

Officers in BS-18/19
Officers in BS-17
Officers in BS-16
Foresters and Forest Guards
Office staff of the level of Assistants and above.

Office staff of the level of Senior & Junior Clerks.
Tree Farmers
NGO Members

2. Nature of Training

(a). For Officers BS-16 and above:

Concept of social forestry and agroforestry

Forestry extension education and public relations

Seed and nursery technology, tree establishment and their management.

Management of irrigation

Watershed management

Range Management

Preparation of working plans

Research methodology, research planning and preparation of study plans

Modern teaching techniques

Computer training
Project identification, preparation and analysis

Office procedure and financial discipline

Other topics as per need of the department.

(b) For Foresters and Forest Guards

Communication and puiblic relations

Seed technology and raising of nurseries

Afforestation and choice of species

Tending operations and harvesting

Preparation of estimates for forestry operations and engineering works

Forest Law and Procedure

Social forestry and extension education

Other topics as per need of the department

(c) For Office Staff

Accounts and Procedure

Rules and regulations regarding establishment

Typing and maintenance of files

Lease and contract cases

Computer training

3. Extent of Training

Each official of every category should attend a course at least once in 5 years.

Duration of each course can vary according to category of staff and nature of training. It may vary from one week to 4 weeks.

The training courses can be arranged as per need of the department.

4. Venue of Training

For Officers:	Officers' Hostel, PFRI
For Other Staff	Forest Schools, Ghoragali and Bahawalpur.
For Tree Farmers and NGOs	Officers' Hostel, PFRI, Forest Schools, Ghoragali and Bahawalpur.

6 2 LOCAL TRAINING TARGETS

(1) SOCIAL FORESTRY TRAINING IN THE PUNJAB PC.1.

Level of Training	194-95	1995-96	1996-97	1997-98	Total
CF/DFO	-	10	10	10	30
SDFO/F.R.	-	20	20	20	60
Foresters/Forest Guards	300	100	100	100	600
Farmers/NGOs/COs	100	500	600	300	1500
Farmers(Open University System)	-	1500	1500	1000	4000
Senior Office Staff	-	20	20	20	60
Junior Office Staff	-	40	40	40	120
S F Workshop	-	150	150	150	150
Total (No)	400	2340	2440	1640	6820

(2) PUNJAB FOREST SECTOR DEVELOPMENT PROJECT PC I

Level of Training	1995-96	1996-97	Total
CF/DFO	28	62	90
SDFO/F.R.	70	110	180
Foresters/Forest Guards	290	70	360
Farmers/NGOs/COs	250	470	720
Total (No.)	638	712	1350

6.3 PROPOSED PRIORITY RESEARCH AREAS/BROAD RESEARCH PROGRAMME

Because a high proportion of Department's tree planting activity will be on farmlands and agricultural wastelands, therefore, agroforestry research regarding the scope for incorporating trees into farm systems and development of Agroforestry systems will be the Priority-I area of concern.

1. Agroforestry - Designing of Agroforestry Systems:

i. Introduction and selection of fast growing and multipurpose tree species and provenances suitable for on-farm and agricultural waste lands planting.

ii. Genetic tree improvement and development of improved seed sources including tissue culture.

iii. Forest tree seed technology - production, storage, testing and supply of quality seed of forest tree species.

Iv. Nursery practices - development of cost-efficient techniques for production of quality plants.

V. Tree and crop establishment on farmlands.

Vi. Documentation and evaluation of existing Agroforestry/Tree planting practices of farmers,

Vii. Intercropping system and identification of potential agroforestry combinations.

Viii. Tree/crop interface study for competition for water, nutrients and light for Eucalyptus camaldulensis, Poplar, Semal, Shisham and Kikar with wheat, cotton, sugarcane, maize, barseem and rice.

Ix. Investigations into ways of optimizing environmental resource sharing.

X. Physical and chemical studies on soils and their correlation with the productivity of the area, long term soil changes brought about.

Xi. Allelolpathy and inhibitors.

Xii. Plant management in agroforestry, and growth and yield of plantation species.

Xiii. Improvement and designing of agroforestry systems.

2. Improvement of natural waste lands through choice of species and development of planting techniques (for areas affected by salinity, water logging, aridity, erosion), etc.

3. Range management - social range and scrub forest:

I. Introduction trials of forage and fodder species under different climatic and edaphic conditions including assessment of forage yield, feed quality, enhancement of productivity and economic evaluation.

ii. Ecological studies (Syn/Aut) including establishment of enclosures, determination of abundance, frequency, cover and yield of different f forage/fodder species, range conditions, and trend.

Iii. Grazing studies - determination of carrying capacity, grazing systems, stocking rate, preference, palatability and economic evaluation.

Iv. Testing and evaluation of different types of participatory approaches for achieving sustainability on public and private rangelands.

4. Sericulture - development of parent silkworm races and their F1 hybrid and improvement of sericultural practices:

I. Isolation of pure races/lines of silkworm.

Ii. Trials on cross breeding of pure races of silkworms so far obtained.

Iii. Survey of morphological characters of different mulberry varieties and introduction of suitable varieties in the field including farmlands with the assistance of Extension Staff of Punjab Forest Department.

6.4 PRODUCTION AND SUPPLY OF QUALITY TREE SEED

1. Development of seed sources.

2. Collection, processing, testing, storage and supply of quality seed to farmers and forestry field staff.

SUPPLY OF QUALITY SEED OF MAJOR TREE SPECIES (TARGETS)

Year	No.of plants to be raised (Million)	Approx. Quantity of seed required (Kg)
1995-96	100	60400
1996-97	110	66440
1997-98	120	72480
1998-99	130	78520
1999-2000	140	84560
2000-01	150	90600
Total:	750	453000

7. ABSTRACT

Punjab Forestry Research Institute, Faisalabad is a comparatively recent organization and is just 10 years old, which is a very small period in a long-term field of Forestry. Inspite of so many constraints, which are but natural, in the initial development of a research and training organization, the Institute has made fairly good progress in the field of forestry research and training. The salient achievements, very briefly, are as under:

7.1 TRAINING ACHIEVEMENTS

1. Regular Training:

I.	Diploma-in-Forestry Course Trained	=	201 Trainees
II.	Certificate-in-Forestry course Trained	=	1207 "
III.	Sericulture Supervisors Trained	=	6 "
IV.	Sericulture Seed Examiners Trained	=	10 "

2. Special/Inservice Training:

I.	No. of courses conducted	=	72
II.	No. of persons trained	=	1392

7.2 RESEARCH ACHIEVEMENTS

1.	Research and other projects completed	=	85
2.	On-going research projects	=	48

ARTICLES/PAPERS/TECHNICAL NOTES/REPORTS WRITTEN

1.	Research and review articles, technical notes	=	63
2.	Papers presented in Workshops/Conferences	=	17
3.	Technical reports, progress reports	=	21
4.	Study reports, position papers, plans and brochures	=	21
5.	Forestry Text Books, Monographs, Manuals	=	45
	Total		167

7.3 SDI SERVICE

No. of professional articles from International and National Scientific Journals sent to Senior Forest Officers. = 72

7.4 TRANSFER OF TECHNOLOGY

At present transfer of technology is being done in routine through the following means:

- Research articles published in Pakistan Journals of Forestry.
- Annual Progress Reports (giving detailed accounts of all research and training activities). Copies are sent to the Administrative Department, all C.C.Fs and later on to all C.Fs.
- Important articles are sent to the Administrative Department, all C.C.Fs and sometimes to all C.Fs.
- SDI Service. This regular service is also utilized sometimes to convey our own articles to the Senior Officers.
- Conducting special courses for NGOs and Farmers.
- Conducting special courses for Forest Officials.
- Common but unscheduled visits of farmers to our research garden.
- Arranged visits of farmers to PFRI.
- Agroforestry and Social Forestry Seminars.
- Radio Talks.
- Personal contacts.
- Distribution of planting stock/clones of selected species.
- It is proposed to bring out Quarterly News Bulletin from PFRI, which will be doing this transfer of technology regularly in future.
- Facility of publishing in "Zarai Digest" of UAF which is most commonly read Journal of Farmers, is also available to us.

ESTIMATION OF YIELD AND INCOME FROM FARM-GROWN TREES

Tree Species	Age (Years)	Girth (Inches)	Vol. per tree (cft.)	Wt. Per tree Maund(40Kg) (Freshly cut)	Price/Maund (Rs)	Income/Tree (Rs)
Poplar	6	22-24	10.0	6.5	60	390
	7	24-28	14.0	9.5	60	570
	8	28-32	18.0	12.0	65	780
	9	32-36	22.0	15.0	65	975
	10	36-38	26.0	18.0	65	1170
Eucalyptus	6	20-22	6.0	3.0	55	165
	8	24-26	10.0	5.0	55	275
	10	28-30	14.5	7.0	55	385
	12	30-32	17.0	8.5	55	468
	14	32-34	19.5	10.0	55	550
Simal	11	45-47	22.0	9.0	135	1215
	12	48-50	35.0	14.0	135	1890
	13	50-52	39.0	15.0	135	2025
	14	52-53	42.0	17.0	135	2295
	15	55-57	45.0	18.0	135	2430
	16	57-60	47.0	19.0	135	2565
Toot	10	21-22	4.0	2.5	150	375
	12	24-26	5.5	3.0	150	450
	14	27-29	7.5	4.0	150	600
	16	30-32	10.0	5.0	150	750
				(Dry Wood)		
Shisham	10	22-25	7.0	4.0	65	260
	15	31-32	16.0	10.0	65	650
	20	39-41	30.0	17.0	65	1105
Kikar	10	21-23	7.0	4.0	60	240
	15	33-35	19.0	11.0	60	660
	20	42-44	51.0	30.0	60	1800

* Prepared by Punjab Forestry Research Institute, Faisalabad, January, 1994.

8. LIST OF PUBLICATIONS OF PFRI SCIENTISTS

Sl No.	Title	Year	Author(s)
1	"Yield Tables and Sample Plot in West Pakistan". Proceedings of the Second Pakistan Silvicultural Conference, Peshawar. October 1-5, 1966 - Pages 42.	1966	Qadri, S.M. Alam and M. Hafeez
2	"Volume Tables - A Review and Future Plan". Proceedings of the Second Pakistan Silvicultural Conference, Peshawar. October 1-5, 1966 - Pages 60-71.	1966	Qadri, S.M. Alam and M. Hafeez
3	Volume Tables for *Acacia arabica*, Willd" Forest Research Series, Forest Record No. 1.	1969	Qadri, S.M. Alam and M. Hafeez
4	"Provisional Volume Tables for Babul (*Acacia arabica*, Willd) in Linear Plantations". Division of Forestry Research. Bull. No.1. (Silviculture Branch)	1971	M. Hafeez and M.A. Cheema
5	"*Eucalyptus camaldulensis*, Dehn ". Provenance Trials in West Pakistan". Pak. Jour. For. Vol. 22 No. (4) Pages 407-416.	1972	M. Hafeez and M.I. Sheikh
6	"Provisional Mine Timber and pit props Tables for *Acacia arabica*, Willd. (Babul) (Riverain Forest and Linear Plantations for Southern part of West Pakistan". Division of Forestry Research. Bull. No.4. (Silviculture Branch).	1973	M. Hafeez
7	"Provisional Yield Tables for Riverain Forests of West Pakistan, *Acacia arabica*, Willd. (Babul)". Division of Forestry Research. Bull. No.5. (Silviculture Branch).	1973	M. Hafeez
8	"Volume Tables for Shisham (*Dalbergia sissoo* Linn f)(Linear Plantations of West Pakistan". Division of Forestry Research. Bull. No.6. (Silviculture Branch).	1973	M. Hafeez, M.A. Malik and S.H.A. Moosvi
9	"Polythene Tube Size in Relation to Seedling Growth in the Nursery" Pak. Jour. For. Vol 23.No.(1) Pages 18-26.	1973	M. Hafeez
10	"Characteristics of Soil under *Cedrus deodara*. An interaction of litter, humus and mineral soil towards improvement of site quality". Pak. Jour. For. Vol 23.No.(1) Pages 74-83.	1973	Malik M.N, M. Jamilur Rehman and M. Hafeez
11	"Effect of various factors on rooting of poplars in Pakistan". Pak. Jour. For. Vol.23.No.(3) Pages 227-234.	1973	M. Hafeez and M.I. Sheikh
12	"Forests and Forestry in the Hills". Proceedings of the Pakistan Forestry Conference, Peshawar, Pages 22-23.	1974	M. Hafeez

13	"Eucalyptus species for plains of Pakistan". Pak. Jour. For. Vol.25 No.(2) Pages 87-96.	1975	M. Hafeez
14	"Plastic aprons as a mulch" Pak. Jour. For. Vol.25 No.(2) Pages 108-119.	1975	M.I. Sheikh, Abdul Aleem and M. Hafeez
15	"Forests and Forestry in Pakistan" Pages 1-139.	1975	M.I. Sheikh and M. Hafeez
16	Trials on Autumn Silkworm Rearing in Pakistan. Pak. Jour. For. April 1977.	1977	M. Muslim
17	Artificial Hatching of Silkworm Eggs by Acid Treatment. Pak. Jour. For. July, 1977.	1977	M. Muslim
18	Forestry Planning Statistics for the Punjab (Pakistan).	1984	Ashraf, Dr. M and M. Hafeez
19	Isolation and Development of Pure Races of Silkworm. Pak. Jour. For.	1985	M. Muslim
20	Annual Progress Report of PFRI, Faisalabad for the Year 1983-84 & 1984-85.	1985	Anon
21	Annual Progress Report of PFRI, Faisalabad for the Year 1985-86.	1986	M. Hafeez
22	Agroforestry and its strategies for Pakistan. (Dissertation written as a part of the training course requirements of the University of Oxford, U.K.)	1986	M. Hafeez
23	Trials on Multiple Silkworm Rearing in Spring, Post Spring season in Pakistan. Pak. Jour. For. Jan., 1986.	1986	M. Muslim
24	Study Report regarding Post Graduate Studies in the University of Oxford, Oxford Forestry Institute, Oxford U.K. 1986. P.40.	1986	M. Hafeez
25	Annual Progress Report of PFRI, Faisalabad for the Year 1986-87.	1987	M. Hafeez & M. Saleem
26	"Energy Crisis and Mesquite" Pak. Jour. For. Vol. 38 (1).	1988	M. Hafeez
27	Development of an integrated Model Farm for the improvement of Scrub Forests in Jhelum District - Final Technical Report.	1988	M. Hafeez & L. H. Jafri
28	"Development of Wastelands for Fuelwood Energy and Rural Needs" FAO Regional Workshop on Development of Wastelands for Fuelwood Energy and Rural Needs . 1-9 Nov. 1988. Vandodara, India.	1988	M. Hafeez

29	Annual Progress Report of PFRI, Faisalabad for the Year 1987-88.	1988	M. Hafeez & M. Saleem
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35	"Assessment of the dependence of local population on the scrub forests". Pak. Jour. For. Vol.39 (2).	1989	M. Hafeez & M. Afzal
36	Current status of tropical forests and scope of multipurpose tree species. Proceedings of National Organizing MPTS Meeting held on 14-16 Feb. 1989 at PFI, Peshawar.	1989	M. Hafeez
37	Multipurpose tree species research network field trial in Pakistan. Proceeding of National Organizing MPTS Meeting held on 14-16 Feb. 1989 at PFI, Peshawar.	1989	M. Hafeez and A. Khaliq
38	Agroforestry Systems,. Proceedings of National Workshop on Agroforestry Research 3-5 April, 1989 held at PFRI Faisalabad. (Under print).	1989	M. Hafeez
39	Existing Agroforestry Systems in Pakistan. Proceedings of National Workshop on Agroforestry Research. 3-5 April, 1989 held at PFRI, Faisalabad. (Under print).	1989	M. Hafeez
40	Diversification of Fodder Resources. Presented in Regional Workshop on Problems of Himalayan Pasture Lands, 20-26th Nov. 1989, PFI, Peshawar.	1989	M. Hafeez
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44	Rules and Regulations for Diploma-in-Forestry and Certificate-in-Forestry Courses for Punjab Forest Schools. P.99. (Ist Edition).	1989	M. Hafeez & M. Saleem
45	Syllabus for Diploma-in-Forestry and Certificate-in-Forestry Courses for Punjab Forest Schools. PFRI Education Bulletin No.2. p.43.	1989	Anon
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58	Annual Progress Report of PFRI, Faisalabad for the year 1989-90	1990	M. Hafeez & M. Saleem
59	A Brochure on PFRI, Faisalabad, 2nd Edition.	1990	Anon
60	Practical Field Training Record for Diploma-in-Forestry. P. 44	1990	M. Hafeez, Dr. Zafar Iqbal, Dr. M.Arshad, Dr. Zahid Javid, Raja Attaullah and M Saleem Sulehria.

61	Artificial Hatching of Silkworm Eggs after Chilling, Pak. Jour. For. April, 1990.	1990	M.Muslim
62	Present Status of Sericulture in Punjab. Pak. Jour. For. April, 1990	1990	M.Muslim
63	Investigation on the character of Parent Silkworm Races PAK 1 & PAK 2 and their cross Hybrid (Pak-1 X Pak-2). The Journal "Pakistan Entomologist " Vol.XII No.1-2, 1990.	1990	M.Muslim
64	Effect of Waterlogging on the early development and performance of three important forest tree species and provenances of *A. Nilotica*. Presented in the Workshop on "Tree Production from Saline, Sodic and Waterlogged Soils" (USAID) 1-6 Dec. 1990, Serena Hotel, Faisalabad.	1990	Dr. Zafar Iqbal
65	Exchangeable Sodium, its effect on Soil Condition and Plant growth. Presented in the Workshop on "Tree Production from Saline, Sodic and Waterlogged Soils" (USAID) 1-6 Dec. 1990, Serena Hotel, Faisalabad.	1990	Dr. M. Arshad
66	Effect of Soil Salinity on the early development of important tree species and provenance from Pakistan. Presented in the Workshop on "Tree Production from Saline, Sodic and Waterlogged Soils" (USAID) 1-6 Dec. 1990, Serena Hotel, Faisalabad.	1990	Dr. Zafar Iqbal
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			M. Hafeez,Dr. Zafar Iqbal,Dr.M.Arshad, Dr.Zahid Javid,Raja Attaullah,M.Saleem Sulehria
75	Practical Field Training Document for Certificate-in-Forestry. P 34	1991	
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118	An overview of seed technology work at PFRI, Faisalabad. Presented at National Workshop on Tree Seed Technology, Nov.21-26,1992,PFI, Peshawar.	1992	M.Hafeez & Dr.Zafar Iqbal
119	Establishment of forest tree seed supply system in the Punjab. Presented at National Workshop on Tree Seed Technology, Nov.21-26, 1992,PFI, Peshawar.	1992	M.Hafeez
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178	Review on Forestry Research.(1939-January, 1996). Spp. *Azadirachta indica* (Neem).	1996	M Mushtaque
179	Review on Forestry Research (1939-January, 1996). Spp. *Morus alba* (Tool).	1996	M Mushtaque

180	Fodder trees for arid and semi-arid regions of Pakistan. Presented in International Seminar on Farming Systems Research in context of Food Security, 4-5 May, 1996, D.G. Khan.	1996	M. Hafeez
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