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TRAINING REPORT
for the
Workshop on Management of Trees on
Saline, Sodic and Waterlogged Soils

held in

Faisalabad, Pakistan

December 1-6, 1991

By

Nico Marcar
CSIRO, Division of Forestry

April 1991

TRAINING REPORT

TREE PRODUCTION FROM SALINE, SODIC AND WATERLOGGED SOILS

by

Nico Marcar

INTRODUCTION

Pakistan has an estimated 5.5 million ha. of land which is not productive because of waterlogged, saline and sodic soils. This problem is the result of natural phenomena and past water-use practices. The Government of Pakistan is well aware of the problem and is stressing the use of improved water management and farming techniques which may preclude the future loss of additional lands to this serious menace. However a problem of this magnitude requires a major, cooperative effort if the problem is to be resolved. Pakistan's Forestry Department can, through its farm forestry program, gain a leadership role in the challenge of bringing these problem sites into useful production. Much of these waterlogged, saline, sodic sites can grow trees and shrubs which will provide wood for fuel and other products as well as fodder for animals.

Australia has some of the worst salinity, sodic, and waterlogging problem areas found anywhere in the world; their scientific community has been researching these problem sites for over 50 years. Substantial progress has been made in understanding what the problems are and in developing operational techniques that have successfully overcome many of the more serious problems associated with saline, sodic and waterlogged soils. ACIAR (Australian Center for International Agricultural Research) has been and is actively supporting research in Pakistan. The ACIAR contributions have been in the form of grant monies and providing experts to establish field experiments throughout problem areas of Pakistan. It was through this work that ACIAR has developed interest in establishing trees and shrubs on waterlogged, saline/sodic sites. ACIAR capitalized on their experiences and used the services of their experts design and present this workshop.

DATES

December 1-6, 1990

LOCATION

Serena Hotel, Faisalabad

OBJECTIVES

1. To provide "state of the art Knowledge" on the identification of problem areas of waterlogging, sodic and saline soils.
2. To introduce and illustrate methods of establishing vegetation, including trees and shrubs on these problem sites.
3. To provide a current list of the kinds of vegetation that is adaptable to these problem sites.
4. To assemble the materials presented in the course into a practical manual which is directed at the DFO level for field use.

TOPICS PRESENTED

1. Extent of salt-affected/waterlogged land in Pakistan.
2. Important concepts in understanding the nature of soils.
3. Properties of salt affected soils.
4. Field diagnosis and monitoring of salt affected soils.
5. Effects of salinity, sodicity and waterlogging on growth, physiology and nutrition, with specific reference to trees.
6. Optimizing survival and growth on salt affected and waterlogged land.
7. Tree species selection for salt affected and waterlogged land.
8. Shrub halophyte options for salt affected land: example of a profitable system from western Australia.
9. Utilization and reclamation of salt affected and waterlogged land: role of biological approaches.
(Class schedule is in Appendix I)

INSTRUCTORS

1. Dr. Nico Marcar, CSIRO, Australia
2. Mr. Peter Slavich, NSW, Australia
3. Dr. Edward Barrett-Lennard, Dept of Agri, W. Australia
4. Dr. Razi Qureshi, Professor, University of Agriculture, Faisalabad
5. Mr. Mohammad Islam-ul-Haq, SRS, Lahore
6. Mr. M. I. Sheikh, Technical Assistance Team, USAID
7. Dr. George M. Blake, Technical Assistance Team, USAID

PARTICIPANTS

Trainees	19
Invited Participants	13
Instructors	8
Workshop Organizer	2
Guests	7
Total	49

(A complete list of participants is given in Appendix II.)

SUMMARY OF GENERAL COMMENTS AND EVALUATION

A detailed report of the workshop by Dr. Nico Marcar is in the Appendix III. Appendix IV summarize the results of student post-workshop evaluation and the questionnaire used. General comments follow:

1. The objectives of the workshop were achieved.
2. Although all of the materials that were to be covered were presented, because of time constraints some details had to be only superficially addressed.
3. Field trips needed to be longer with more of a case study approach to evaluating and prescribing treatments for specific sites.
4. More field trips would have helped in understanding the principles presented in lecture.
5. There was a wide difference in the level of the participant knowledge and training which resulted in difficulty in maintaining a level of instruction that held the interest of all the participants. All field trips should have been in the afternoon which would avoid the problem of returning to the classroom for lectures.
6. In general the audience was attentive and asked excellent questions. Discussions were open and the participants felt free to ask questions. The Australian accents seemed to be difficult for the participants to understand.
7. There was a good exchange between the foresters and the agriculturists that have been working on Saline problems etc. This rapport must and can be maintained through more joint meetings and could lead to cooperative research projects.
8. Although the Serena Hotel was an very nice place for the meeting, a more academic atmosphere would have been better i.e. PFI or PFRI. There were times when distractions, noise etc., from adjoining conference rooms were disruptive and made teaching difficult.
9. The presentation of "invited" research papers took too much time and did not add much to this type of learning format. In addition it created too many speakers. Future workshops must be limited to as few instructors as possible. This will avoid potential problems with different accents and different teaching techniques.

10. The Instructors were enthusiastic, dynamic, and recognized the need to either slow their presentation pace down or repeat the points they were attempting to make.

PRODUCTS

1. Workshop manual which is available upon request from TAT.
2. Proceedings (based on the papers presented during the workshop, available upon request from TAT)

RECOMMENDATION

1. Within the project area there are vast areas that are partially waterlogged much of the year. These have only minor sodic, salt problems. Eucalyptus camaldulensis will grow at a rapid rate, as much as 4 meters in height a year on these kinds of sites. These sites should be identified and receive top priority for planting. This should hold true regardless of ownership. Those farmers that own these kinds of land should be encouraged to start block plantations as soon as possible. Government lands that also fall into this category should also receive immediate attention.
2. Salt and sodic sites are more difficult to handle, but these sites should be identified (see manual) and at least demonstration areas established to illustrate what can be done to produce fuel, fodder and food from areas that are now limited in production.
3. Because of the magnitude of the problem cooperation between PFI, PFRI, and the Agricultural Universities could result in the concentration of some of the best people in Pakistan on this serious problem. Annual meetings and field trips would be one way to maintain contact among the researchers.
4. The researchers should take advantage of the plantations already established to identify and measure "research evaluation plots" to monitor production and change in site characteristics.
5. DFO's should use the training manual as a teaching guide for on the ground field training for other DFOs, farmers and RFOs in areas where there are problem sites.
6. The manual will be an excellent guide book or reference for soils and nursery classes at PFI.
7. Portable and/or simple pH meters and conductivity meters are critical and should be available in every DFO's office.

**APPENDIX I
TREE PRODUCTION FROM WATER LOGGED/SALINE, SODIC LANDS**

December 1 through December 6, 1990
Serena Hotel, Faisalabad

WORKSHOP COURSE OUTLINE

Day 1 (Saturday December 1)

Opening Ceremony (9:00 - 10:00)

Qirat (Under PFRI arrangements)

Welcome address: Dr. George M. Blake, TAT Winrock International

Inauguration speaker: Dr. M. Ashraf, Secretary Forestry, Wildlife & Tourism (Retired)

Introductory remarks by:

- 1. Sahibzada M. Hafeez Director, Punjab Forest Research Institute**
- 2. Dr. John Swanson, Chief, Agriculture Production & Institutions Division
Office of Agriculture and Rural Development, USAID**

Group photograph and Tea (10:00 - 10:30)

Introduction to Training Course (10:30 - 11:30)

Dr. George M. Blake

Objectives, structure, topics to be covered, expectations from participants, hand out lecture outline, question/answers.

Lunch and prayers (12:00 - 13:30)

Session 1 (13:30 - 14:30)

Mr. M. I. Sheikh, TAT, Winrock International

Overview of the problem of salinity/sodicity/waterlogging in Pakistan as it impinges on plant production, with emphasis both on plantation forestry and farm forestry. Differentiation of problems that occur, e.g. perched vs. regional ground water/ water logging problems.

Session 2 (14:30 - 15:30) (includes tea break)

Mr. P. Slavich, CSIRO

Introduction to some basic concepts of social science (what is soil, distinction between physical, chemical and biological properties etc.) particularly related to plant growth (rather than pedology etc.)

Dinner with guest speaker (19:00 - 22:00)

After dinner speaker: Dr. Mohammad Afzal Chaudhry, Deputy Secretary, Forestry, Wildlife and Fisheries Department, Government of the Punjab.

Day 2 (Sunday December 2)

Session 3 (9:00 - 12:00) (includes tea break)

**Mr. P. Slavich, assisted by Dr. R. Qureshi (University of Faisalabad) and Dr. I. Haq (NIAB).
Properties of Saline/Sodic/Waterlogged Soils (with main emphasis on particular properties that affect plant growth).**

Session 4 (13:30 - 16:30)

Dr. N. Marcar, CSIRO
Effects of salt, sodicity and waterlogging on tree physiology

Day 3 (Monday December 3)

Session 5 (9:00 - 12:00)

Mr. P. Slavich assisted by Dr. R. Qureshi and Dr. I. Haq.
Field and laboratory methods available for characterization and monitoring of land for presence of salt, sodicity and water logging (to include demonstration of some equipment).

Session 6 (14:00 - 16:30)

Optimizing tree seedling survival on saline/waterlogged land: preconditioning of planting stock, land preparation, planting techniques etc.

(Prepared by Mr. P. Ritson W. A. Water Authority, presented by Dr. Marcar)

Day 4 (Tuesday December 4)

Session 7 (9:00 - 12:00) (includes tea break)

Dr. N. Marcar
Australian tree species: tolerance to salinity, sodicity and waterlogging; field data from Pakistan and overseas; specific issues related to nursery practice; concepts of provenance and tree-to-tree genetic variation.

Session 8 (13:30 - 16:30)

Dr. E. Barrett-Lennard, ACAIR
Forage shrubs, in particular *Atriplex* spp.: salt/waterlogging tolerance (concept of halophyte); establishment practices; species variation; uses.

Local and other exotic tree species: salt/waterlogging tolerance
"Effects of Soil Salinity on Early Development of 4 Multipurpose Trees Species and 2 Provenance of *Acacia nilotica*" Dr. Zafar Iqbal, PFRI

"Exchangeable Sodium, Its Effects on Soil Conditions and Plant Growth" Dr. Arshad, PFRI

Day 5 (Wednesday December 5)

Session 9 (9:00 - 12:00) Trip to NIAB farm.

Session 10 (13:30 - 16:30)

Dr. R. Qureshi.
Overview of biological and engineering management options for utilization and reclamation of saline, sodic and waterlogged land.

Day 6 (Thursday December 6)

Closing Session (9:00 - 12:00) (includes tea break)

General discussions
Question/answer
Workshop evaluation
Closing remarks

APPENDX II

LIST OF PARTICIPANTS

WATERLOGGED, SALINE, SODIC SOILS WORKSHOP FAISALBAD

Trainees

Mr. Abdul Qadeer, DFO, Balochistan
Mr. Abdulnabi Zulfiqar, DFO, Balochistan
Mr. Altaf Hussain, PFI
Mr. Anwar Masrur, CCF, Punjab
Dr. B. A. Wani, DIGF, O/IGF
Dr. K. M. Siddiqui, D.G., PFI
Mr. Mahboob Alam Ansari, Sindh
Mr. Mehboob Ali Bhatti, R.O., Sindh
Mr. Mohammad Khan, SRO, PFI
Dr. Mohammad Iqbal, S.O., NWFP
Mr. Munir Ahmed Awan, Sindh
Mr. Mushtaq Ahmad, DFO, NWFP
Mr. Nasrullah Khan Aziz, DIGF, O/IGF
Mr. Pazir Gul, PFI
Mr. Qazi M. Ashraf, DFO, SFP, NWFP
Mr. Raja Ataullah Khan, PFRI
Mr. Rachid M. Randhawa, Punjab
Mr. Shamsul Haq Memon, Sindh
Mr. Yar Mohammad Khan, NWFP

Invited Participants

Mr. Abdul Khaliq, PFRI
Mr. Abdulnabi Khanzada, PSO, Tando Jam University
Mr. Mohammad Afzal, PFRI
Mr. Mohammad Hafeezullah, PFRI
Mr. Mohammad Saleem, PFRI
Dr. Mohammad Ashraf, PFRI
Ms. Debbie Crawford, CSIRO, Australia
Mr. Muhammad Siddique Dogar, R.O., PFRI
Mr. Mumtaz Ahmed Babar, PFRI
Mr. Sansullah Khan, PFRI
Mr. Wahid Rasheed, R.O., PFRI
Mr. Z. Aslam, PFRI
Dr. Zafar Iqbal, PFRI

Instructors

Dr. Nico Marcar, CSIRO, Australia
Mr. Peter Slavich, CSIRO, Australia
Dr. Riz Qureshi, Faisalabad University
Dr. Ed. Barrett - Lennard, ACAID
Dr. M. Islam-ul-Haq, Bio SRS, Lahore
Mr. Mahmood Iqbal Sheikh, TAT
Mr. Mohammad Hafeez, PFRI
Dr. G. M. Blake, TAT

Workshop Organizers

Mr. Tahir W. Malik, TAT
Mr. Imtiaz A. Sheikh, TAT

Guests

Dr. John B Swanson, USAID
Mr. K. Hameedullah, USAID
Dr. Mohammad Afzal Chaudhry, D.S., Punjab
Mr. Mohammad Ashraf, Punjab
Dr. Kausar A. Malik, C.S., Head Biol. Divn. NIAB
Mr. Khurram Shah, Bio-Saline R. Stat, NIAB
Dr. Chuck Hatch, TAT

APPENDIX III

TREE PRODUCTION FROM SALT-AFFECTED AND WATERLOGGED LAND A workshop held December 1-6, Faisalabad, Pakistan

POST-WORKSHOP EVALUATION

Dr Nico Marcar, CSIRO Division of Forestry, P.O. Box 4008,
Queen Victoria Terrace, Canberra, ACT, 2601, Australia.

Introduction

This workshop was organised by the Forestry Planning and Development Project run by Winrock International in Pakistan. The oral and written presentation of technical material for the workshop was subcontracted to CSIRO Forestry in Australia, both because CSIRO has ongoing related research in Pakistan on this topic and because Australia has a comparative advantage in dealing with revegetation of a wide variety of dryland and irrigated saline soils with salt-tolerant trees and shrubs.

The major aim of this workshop was to 'train' district forest officers in Pakistan in up-to-date techniques for growing trees and shrubs on salt-affected and waterlogged land. Specific objectives were to 'review' methods for saline soil characterisation, species choice for such sites and methods for establishment (see Attachment A of contract). However, it was also intended to review more elementary and fundamental concepts of soil science and plant physiology related to salt, sodic and waterlogging stresses. Because the intention was to 'educate' DFOs in interpretation rather than to present 'recipes' for different conditions, the workshop and lectures were designed to demonstrate concepts and principles (see Attachment A).

General Comments

Overall the objectives of the workshop were successfully met.

All intended lectures were well-delivered and the planned field visits were held successfully. The two main lecturers (Dr Marcar and Mr Slavich) were present during the entire workshop, as intended. However, because several Pakistani speakers were also invited to present short reviews or experimental results at the last minute, there was insufficient time for the main speakers to present all intended material.

The makeup of the participants differed from what was originally expected, in that there were more senior forestry officials and researchers present. This meant that the content and level of presentation may not have been as appropriate as desired in some cases (e.g. some emphasis on elementary concepts). A greater emphasis on field visits and application would also have been desirable, however, plans were constrained by venue location and sponsor ideas. Nevertheless, the workshop covered subject areas dealing with the two main expectations of participants viz. 'availability of latest knowledge' and 'species/soil matching recommendations'(see question 3, Workshop Assessment-Students).

The workshop successfully brought together several agencies in Pakistan with an interest in revegetation of salt-affected land and promoted fruitful exchange of ideas between participants. This interchange between practitioners, administrators and researchers was in itself an extremely useful outcome, since dissemination of results from research trials and demonstration projects is very limited within Pakistan.

Specific comments

Participant reactions to the workshop could be evaluated by comments indicated on the workshop assessment proformas as well as from discussions and conversations held during the workshop.

Nearly all participants felt that their expectations were only partially rather than fully met. Very few participants indicated why this was so. However, perusal of answers to later questions indicated some possible reasons for this.

1. Note-taking guides were only considered to be partially helpful. This was due to differing expectations of participants and lecturers as to the nature of the guides that should be available.

2. Field trips were considered to be only partially relevant to the course material (and participant needs by innuendo). It would have been desirable to include visits to several types of salt-affected land (particularly where waterlogging and sodicity were more prevalent) and species/treatment trials. Unfortunately, this was not possible due to the location of the venue and time available. It would have been impossible to satisfy everyone's needs. Details in the manual coupled with demonstrations in the field should be sufficient to enable a critical evaluation of site characterisation and species/treatment application.

3. It is possible that full understanding of the concepts presented may have been partially affected by difficulties of understanding the accents of some of the lecturers.

4. The flow of the presentations was somewhat interrupted by 'last-minute' talks presented by local researchers.

5. There was a strong feeling that practical application should have been stressed more. Whilst this would have been useful, it would have detracted from presentation of 'principals and concepts' and would have entailed more field visits. The organisers were interested in avoiding the 'cookbook' approach. Nevertheless, future workshops should have a larger field component.

All participants felt that the workshop had been of valuable assistance in their current/future dealing with salt-affected land and in the advancement of their personal knowledge/ability. Many participants felt that they would like to obtain more information on appropriate technology; this is a logical outcome of exposure to concepts and principals.

Suggestions for future activities

1. Information dissemination

There is clearly a significant gap in the extension of results that have been obtained from research trials to the practising foresters and forestry/natural resource administrators. This is partly due to the inability of various organisations to interact on an administrative level and partly because of the lack of communication of research and other results at the extension level.

It is clear that there are some valuable trials in progress on salt-affected land in all the provinces of Pakistan. Results of some of these trials have been written up in the Pakistan Forestry Journal (not externally refereed) but much valuable data has probably not been published. Even though many of these trials and demonstrations suffer from inadequate site characterisation, the results should be collated and made available (with recommendations etc.) to forestry practitioners and landholders. An attempt has been made to summarise some of this information in the manual from this workshop.

Several types of publication could be produced at the provincial or federal (PFI) level:

- a. glossy information FACT sheets
- b. regular newsletters
- c. books or booklets (cf. 'Kallar Grass' compiled by NIAB)

These publications could inform a wide range of research/extension personnel and foster closer links between organisations.

As a direct outcome of this workshop the following are recommended (subject to further funding):

(a) an additional publication be produced containing summaries and reports of current research endeavours with trees and shrubs on salt-affected land in Pakistan. Some articles would already be available for publication with minor modification.

(b) a PC computer database be developed to collate all trial results in Pakistan with trees and shrubs on saline land in Pakistan. The program is already available at CSIRO Forestry and Winrock in USA and activities could be coordinated (for example) by ACIAR projects 8633 and 8619, PFI, PFRI, Univ. of Karachi (Botany Dept.) and Winrock. Several Pakistani scientists could be approached to assist with this activity.

2. Further workshops/meetings etc.

Workshops and meetings are a valuable means of gathering persons with similar interests together at the one location. This workshop successfully initiated a potentially expanding line of communication between organisations and individuals interested in the revegetation and reclamation of salt-affected land.

Since the nature of salt-affected land (e.g. heavy textured saline, sodic, waterlogging-prone soil to lighter textured saline soil), management options (e.g. irrigation with canal or tubewell water to no irrigation) and climate differ considerably across Pakistan, it would seem that regular meetings at the provincial and sub-provincial level might be worth focussing on, with more infrequent meetings at the whole country level.

Further meetings should now focus on more practical matters and be more field orientated and should involve more dialogue between foresters and landholders. Constant reference can be made to the manual from this workshop. People should be encouraged to try innovative ideas. Researchers should plan their trials in consultation with practitioners and landholders should be encouraged to be innovative.

ACIAR 8633 will be holding a workshop in March 1991 to evaluate research findings with trees and shrubs on salt-affected land in Pakistan and overseas. Forestry personnel from outside the project will be encouraged to attend.

3. Pilot plantings

Forestry departments should be encouraged to try pilot plantings on different categories of saline land with ~~best-fit~~ management practices and tree/shrub species. Sites should be carefully characterized (refer manual) and tree survival/growth regularly monitored.

Objectives of the plantings should be properly defined. For example, (1) end-product use (e.g. pulp vs firewood) should be defined, (2) quantity and quality of irrigation water (if any) to be used, (3) whether land utilisation and/or 'reclamation' is of major interest. If possible, species and treatment trials could be initiated on the same site(s) as the main pilot plantings. This strategy is being considered for initiatives near Hyderabad (Sind Forest Department) and Mardan (PFI).

Distinctions should be made between re-planting of portions of established irrigated plantations (administered by forest departments) that have become saline (e.g. at Shorkot), establishing new plantations on salt-affected land and smaller-scale planting on farm land to provide flexible management options.

It is possible that international agencies (e.g. AIDAB, USAID) will financially these and larger-scale activities.

4. Regional planning

It is imperative that provincial and state forest departments improve their links with planning organisations (e.g. WAPDA) and agricultural departments to determine appropriate land use systems for different categories of salt-affected land. This should include the possible reuse of saline drainage water emanating from engineering solutions to land drainage.

5. Use of technologist consultancy

Several commercial companies and government departments in Australia and other countries (e.g. USA (California)) are concerned with large-scale revegetation and reclamation of salt-affected landscapes. These companies and organisations could be approached to ascertain the ease of some appropriate technology transfer (e.g. land preparation (mechanical mounding and ripping), production of clonal seedlings) during pilot and larger-scale plantings. A list of some possible organisations is given below:

- a. CSIRO (Divisions of Forestry, Water Resources and Soils)
- b. Irrigation and Salinity Research Institute, Tatura, Vic.
(salt-tolerant grasses, halophytes, reuse of saline water)
- c. Australian Revegetation Company, Perth, W.A. (shrub halophytes, direct seeding)
- d. Western Australian Department of Agriculture (halophyte shrubs, direct seeding)
- e. Alcoa of Australia, Perth, W.A. (tree clonal material)

6. Provision of equipment

Provision of simple and more specialised equipment especially for site analysis and monitoring is very important. For example:

- a. soil testing kit (pH)
- b. portable (field) EC meters
- c. EM38 machine (Geonics, Canada)

Further contacts should be made between PFI, PFRI, University of Agriculture (Faisalabad), NIAB and Agriculture Departments regarding equipment purchase and sharing.

APPENDIX IV

**TREE PRODUCTION FROM SALINE/SODIC SOILS
WORKSHOP ASSESSMENT PROFORMA - STUDENTS**

SUMMARY OF REPLIES

Total performae handed out	35
Number returned	22

Note: Numbers/remarks against each question indicate the number of Yes/No replies/remarks to each question or part of a question.

- Ques 1.** **How far in advance did you find out about the workshop?**
- | | | | | |
|--------|---------|---------|-------------------------|--|
| 1 week | 2 weeks | 3 weeks | 4 weeks before workshop | |
| 1 | 6 | 6 | 11 | |
- Ques 2.** **When did you receive the final information concerning the details of the workshop?**
- | | | | |
|---------|---------|-------------------------|--|
| 2 weeks | 3 weeks | 4 weeks before workshop | |
| 11 | 5 | 2 | |
- Ques 3.** **What were your expectations concerning the workshop?**
- | | |
|------------------------------------|---|
| Availability of latest knowledge: | 9 |
| Knowledge about Agro forestry | 6 |
| Will make concrete recommendations | 1 |
| Spp/soil matching recommendations | 8 |
| Refresher course | 1 |
| No response | 2 |
- Ques 4.** **Were your expectations met?**
- | | | | | |
|-----|-------|-----------|-----|--|
| Yes | Fully | Partially | No | |
| 1 | 6 | 15 | Nil | |
- Ques 5.** **Were the Note Taking Guides helpful for you?**
- | | | | | |
|-----|-------|-----------|-----|--|
| Yes | Fully | Partially | No | |
| 2 | 3 | 17 | Nil | |
- Ques 6.** **Level of instruction:**
- | | |
|-----------|-----|
| Very Good | Nil |
| Good | 18 |
| Poor | Nil |
- Ques 7.** **Technical aspect of material presented:**
- | | |
|------------------|-----|
| Highly technical | Nil |
| Adequate | 16 |
| Elementary | 6 |
| Non technical | Nil |

Ques 8. Were the field trip relevant to the course material?

Yes	Fully	Partially	No
3	6	12	1

Ques 9. How would the workshop assist you in the performance of your work? (tick all applicable)

Identification of problem sites	16
Assessment of problem sites	19
Formulation of plans	13
Assisting other departments/organizations with similar problems	11
Extension/training activities for:	5
Enhancement of personal knowledge/ability	19

No help: (Please state why?)

Teaching at variance with the area visited.
40% (+) and 60% (-) teachings, micro treatment of the subject was done.

Ques 10. Suggestions/recommendations for additional training with Waterlogged/Saline/Sodic soils?

1. Level of participants:

CF	DFO	Range-Officer	Other (Specify) _____
3	8	12	Farmers/Researchers 1/7

2. Medium of instruction

English	Urdu
18	10

3. In which subject area would you like more in depth training.

Technical aspects	6
Fodder, tree and shrubs spp matching	3
Practical work	4
Identification of sites	6
Implementation of such projects	1
Agro-forestry	1

4. Do you intend to seek more information in any of the subject areas?

Yes in

Range science	2
Selection of spp.	2
Appropriate technology	11
Agro-forestry	1
Use of EM 38	4
Marketing	1

No Nil

Did not respond 4

5. Do you feel that you have sufficient knowledge now to teach this subject?

Yes	No
3	16

Did not respond 3

6. Other suggestions: (use extra sheets if needed)

More practical work should have been done	7
More workshops of this type should be done	6
Training in Australia to be given	2
More discussion and less lectures format	1
Better training aids to be used	1
Inter provincial visits to sites should be made	1
No Suggestions	2

Ques 11. Suggestions for the holding/improvements of/in similar or other workshops in future:

More time required	3
More local instructors	4
More outdoor practice	6
More demo of Australian methodology	2
Broader spectrum of participants	1
Visit to Australia for firsthand information	2
No suggestions	2

Ques 12. As a result of this workshop, either through the formal sessions or in discussions with other participants; have you identified major gaps in knowledge available for methodologies/technologies necessary for tree planting on salt affected or waterlogged land in Pakistan?

Please itemize these gaps:

Soil assessment techniques	4
Spp matching to site conditions	4
Soil/water analysis	1
Comm gap between researchers/dept/users	6
Planning	3
Use of equipment	2
Social aspects were not considered	1
More discussions on this should continue	1
Visit to soil testing lab	1
Monitoring of results	1
Research	2
Extension	1

Miscellaneous points raised in the proforma:

- 1. Difficulty in understanding instructions due to accent of the Australians.**
- 2. Practical demonstrations were poor and not in conformity with the teaching.**
- 3. Instructors had good elementary knowledge but lacked applied knowledge, as was evident by their evading some questions.**
- 4. Some notes were not provided in time, but during or after the class.**
- 5. Poor use of AV aids/small size of transparencies made it difficult to follow the subject.**
- 6. Workshop should have been held near a forest area to present real life situation.**
- 7. Some instructors method of instruction was weak.**
- 8. A very valuable beginning. Follow up workshops should be held every year to assess the work done/being done.**
- 9. Instructors did not stick to the sequence in the Note taking guides this made following the lecture difficult.**
- 10. PFI/PFRI should take up trials on the subject.**
- 11. Future workshops should have own researchers under foreign supervision.**
- 12. Detailed survey of areas should be made to ensure proper classification in waterlogged/saline/sodic.**
- 13. Instruments/equipment should be made available to all DFO level people for assistance.**
- 14. Farmers/industrialists should be made part of the next workshop.**
- 15. Proceedings/manual should be sent to all participants.**