

Saline Agriculture for Irrigated Land in Pakistan: *A handbook*

R.H. Qureshi and E.G. Barrett-Lennard



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'Subirrigated land' or land affected by 'cancer'? If we think about saltland in a different way we can begin to make it productive. [PHOTOGRAPH: E. BARRETT-LENNARD]

Contents

Saline Agriculture for Irrigated Land in Pakistan: A handbook

| | |
|--|----|
| Preface | 1 |
| Acknowledgments | 2 |
| Units of measurements | 3 |
| Currency exchange rates | 4 |
| Chapter 1 – | |
| Introduction: Pakistan and its Salinity Problem | 5 |
| Overview | 5 |
| 1.1 The Land | 6 |
| 1.2 The People | 6 |
| 1.3 The Climate | 7 |
| 1.3.1 Rainfall | 7 |
| 1.3.2 Temperatures | 8 |
| 1.3.3 Evaporation | 8 |
| 1.4 The Irrigation System | 8 |
| 1.4.1 The canal system | 8 |
| 1.4.2 Groundwater | 11 |
| 1.5 The Salinity and Waterlogging Problem | 11 |
| 1.5.1 Depth of watertables — seasonal effects .. | 14 |
| 1.5.2 Classification of salt-affected soils | 14 |
| 1.6 The Impact of Salinity on the Community | 15 |
| Chapter 2 – Three Approaches for | |
| Managing Saline, Sodic and Waterlogged Soils | 19 |
| Overview | 19 |
| 2.1 The Engineering Approach | 20 |
| 2.1.1 The problem of canal seepage | 20 |
| 2.1.2 Development of the SCARP program | 20 |
| 2.1.3 Left Bank Outfall Drain | 20 |
| 2.1.4 Does the engineering approach work? | 21 |
| 2.2 The Reclamation Approach | 22 |
| 2.3 The Saline Agricultural Approach | 24 |
| Chapter 3 – Classification, Sampling and | |
| Analysis of Salt-Affected Soils and Water | 25 |
| Overview | 25 |
| 3.1 Classification of Salt-Affected Soils | 25 |
| 3.1.1 Saline soils (local name <i>thur</i>) | 25 |
| 3.1.2 Sodic soils (local name <i>bara</i>) | 25 |
| 3.1.3 Saline–sodic soils (local name <i>thur bara</i>) .. | 26 |
| 3.2 Sampling Salt-Affected Soils | 26 |
| 3.2.1 Composite sampling | 26 |
| 3.2.2 The soil pit | 27 |
| 3.3 Analysis and Description of Salt-Affected Soils .. | 28 |
| 3.3.1 Salinity of soils | 28 |
| 3.3.2 Sodicity of soils | 28 |
| 3.3.3 Drainage of soils | 30 |
| 3.3.4 Physical characteristics of soils | 31 |
| 3.3.5 Quality of irrigation water | 33 |
| Chapter 4 – | |
| Salt and Waterlogging: Effects on Plants | 37 |
| Overview | 37 |
| 4.1 Types of Plant Response to Salt | 37 |
| 4.1.1 Halophytes and non-halophytes | 37 |
| 4.1.2 Salt tolerance in crops — the Maas and Hoffman categories | 38 |
| 4.2 Waterlogging in Saline Environments — Effects on Plant Growth | 40 |
| 4.3 Breeding for Salinity Tolerance | 46 |

| | |
|---|------------|
| Chapter 5 – | |
| Crops and Grasses for Salt-Affected Land | .51 |
| Overview | .51 |
| 5.1 Salt-Tolerant Plants | .52 |
| 5.2 General Issues for Growth of Crops and Grasses | .52 |
| 5.2.1 Land preparation | .52 |
| 5.2.2 Use of manure and soil amendments | .52 |
| 5.2.3 Seeding rates | .53 |
| 5.3 Growing Crops on Salt-Affected Land | .54 |
| 5.3.1 Rice | .54 |
| 5.3.2 Wheat | .55 |
| 5.3.3 Cotton | .56 |
| 5.3.4 Salt-tolerant varieties of other crops | .57 |
| 5.4 Growing Salt-Tolerant Grasses | .58 |
| 5.4.1 <i>Chloris gayana</i> Kunth | .58 |
| 5.4.2 <i>Elytrigia elongata</i> (Host) Nevski | .59 |
| 5.4.3 <i>Leptochloa fusca</i> L. Kunth | .60 |
| 5.4.4 Other grasses with potential for saline agriculture in Pakistan | .62 |
| Chapter 6 – Trees for Salt-Affected Land | .63 |
| Overview | .63 |
| 6.1 Raising and Planting Trees | .64 |
| 6.1.1 Sources of seed | .64 |
| 6.1.2 Nursery techniques | .64 |
| 6.1.3 Land preparation and planting | .66 |
| 6.2 Salt-Tolerant Trees for Fuel and Forage Production | .68 |
| 6.2.1 <i>Acacia ampliceps</i> Maslin | .68 |
| 6.2.2 <i>Acacia nilotica</i> (L.) Willd. ex Del | .69 |
| 6.2.3 <i>Albizia lebbek</i> (L.) Benth | .71 |
| 6.2.4 <i>Casuarina equisetifolia</i> Forst | .73 |
| 6.2.5 <i>Eucalyptus camaldulensis</i> Dehnh | .75 |
| 6.2.6 <i>Leucaena leucocephala</i> (Lam.) de Wit | .77 |
| 6.2.7 <i>Parkinsonia aculeata</i> L. | .79 |
| 6.2.8 <i>Prosopis cineraria</i> (L.) Druce | .80 |
| 6.2.9 <i>Prosopis juliflora</i> (Swartz) D.C | .81 |
| 6.2.10 <i>Sesbania bispinosa</i> (Jacq.) W.F.Wight | .82 |
| 6.2.11 <i>Sesbania sesban</i> (L.) Merr | .84 |
| 6.2.12 <i>Tamarix aphylla</i> (L.) Karsten | .85 |

| | |
|---|-----|
| 6.3 Salt-Tolerant Fruit Trees | .87 |
| 6.3.1 <i>Grewia asiatica</i> L. | .87 |
| 6.3.2 <i>Manilkara zapota</i> (L.) P. Royen | .88 |
| 6.3.3 <i>Phoenix dactylifera</i> L. | .89 |
| 6.3.4 <i>Psidium guajava</i> L. | .90 |
| 6.3.5 <i>Syzygium cumini</i> (L.) Skeels | .91 |
| 6.3.6 <i>Zizyphus mauritiana</i> Lam. | .92 |

| | |
|--|------------|
| Chapter 7 – | |
| Saltbushes for Highly Salt-Affected Land | .95 |
| Overview | .95 |
| 7.1 Description of Plants | .96 |
| 7.2 Adaptation Studies | .97 |
| 7.3 Establishment of Saltbushes | .98 |
| 7.3.1 Raising seedlings in the nursery | .98 |
| 7.3.2 Transplanting seedlings in the field | .102 |
| 7.4 Utilisation of Saltbush Forage | .102 |
| 7.5 Saltbush Productivity | .104 |
| 7.5.1 Harvesting management | .104 |
| 7.5.2 Soil conditions | .105 |
| 7.6 Saltbush Improvement Through Cloning | .108 |
| 7.6.1 Selection for productivity | .108 |
| 7.6.2 Selection for tolerance to salt and waterlogging | .109 |
| 7.6.3 Relevance of cloning to Pakistan | .110 |

| | |
|--|-------------|
| Chapter 8 – Building Farming Systems – | |
| Integrating the Elements | .113 |
| Overview | .113 |
| 8.1 Water Use by Trees | .114 |
| 8.1.1 Trees as 'biological pumps' | .114 |
| 8.1.2 Measuring water use | .114 |
| 8.1.3 Comparison of water use at different locations | .114 |
| 8.2 Trees and Alley Farming | .115 |

| | |
|--|------------|
| 8.3 Calculating Tree Requirements for the Control of Salinity | 118 |
| 8.3.1 <i>Spacing belts of trees</i> | 119 |
| 8.3.2 <i>Proportion of the landscape planted to trees</i> | 119 |
| 8.4 Salt Accumulation in the Root-Zone | 121 |
| 8.5 'Degrading' versus 'Sustaining' Farming Systems | 122 |
| 8.5.1 <i>The 'degrading' farming system</i> | 122 |
| 8.5.2 <i>The 'sustaining' farming system</i> | 123 |
| 8.6 A Final Word to the Farmer | 123 |
| Glossary | 125 |
| References | 129 |
| Index | 139 |

Note: To locate information on plant species by local name, see Index



'Saline agriculture is a rich collection of possibilities involving combinations of salt tolerant trees, shrubs and crops ...' This scene shows saltbushes (foreground—right-hand side), newly planted trees (foreground—left-hand side), salt-tolerant rice (middle distance) and mature trees (distance) all growing on salt-affected land at Satiana. [PHOTOGRAPH: E. BARRETT-LENNARD]

The Authors

R.H. Qureshi

Department of Soil Science, University of Agriculture,
Faisalabad, PAKISTAN

E.G. Barrett-Lennard

Natural Resource Management Services, Agriculture Western
Australia, South Perth, WA, AUSTRALIA

This book is dedicated to the memory of Dr G.R. Sandhu, former Member for Natural Resources at the Pakistan Agricultural Research Council, and early enthusiast and champion of saline agriculture in Pakistan.

Preface

'Saline agriculture' can be defined as the profitable and integrated use of genetic resources (plants, animals, fish, insects and microorganisms); and improved agricultural practices to obtain better use from saline land and saline irrigation water on a sustained basis.

Saline agriculture is not one simple thing. It is a rich collection of possible systems for the use of saline land, involving combinations of salt-tolerant trees, shrubs and crops. The components of these systems can vary according to the needs of the farmers, the capabilities of the land, and the ingenuity of the farmers and their advisers who are developing the systems.

Much of the saline land throughout the world is caused by the presence of shallow watertables. Many farmers have thought of salinity as a form of 'land cancer', and what a terrible simile that is. When we think of cancer we think of debilitating disease with little prospect of cure. However, we believe that there is an alternative view; much saltland can be considered to be 'subirrigated', albeit with saltier water than one would normally use for irrigation. When considered in this perspective, agricultural options for saltland automatically come to mind. Obviously, the plants which can be grown on such subirrigated land will not be normal agricultural species, which are not sufficiently salt tolerant. However, we do have access to salt-tolerant trees, shrubs, grasses and crops. Using these, saline agricultural systems are being developed.

We believe in two basic propositions. Firstly, nearly all salt-affected land is *potentially* productive. Secondly, not all salt-affected land is *equally* productive; we need to revegetate saltland mindful of the condition of the land and the different tolerances of plant species to salinity and waterlogging. If these two propositions are indeed true, then saline wasteland exists primarily because we are either ignorant of its potential or we consent to its remaining as wasteland.

This handbook is written for farmers, and agricultural extension officers in government and nongovernment organisations. Our aim is to provide a simple accessible account of saline agricultural practices for irrigated land in Pakistan.

R.H. Qureshi and E.G. Barrett-Lennard

June 1998

Acknowledgments

This handbook is based on the experience of farmers and a number of researchers. We are particularly grateful to the farmers who have been prepared to adopt and develop saline agricultural systems on their own land. It is a privilege to be partners with them in the development of this new field.

We are grateful for the contributions to our knowledge of saline agriculture which have been made by our colleagues at the University of Agriculture (Faisalabad), the Nuclear Institute for Agriculture and Biology (Faisalabad), the University of Wales (Bangor), Agriculture Western Australia (South Perth), CSIRO Division of Forest Research (Canberra), the North West Frontier Province Agricultural University (Peshawar), the University of Karachi (Karachi), and the Atomic Energy Agricultural Research Centre (Tando Jam).

Funding for this research has come from a number of sources including the Pakistan Agricultural Research Council, the Australian Centre for International Agricultural Research, the Board on Science and Technology for International Development (BOSTID) and the British Overseas Development Authority.

At the present time, the most extensive example of the practice of saline agriculture has been in the Satiana Markaz under the Joint Satiana Pilot Project. This activity has been a partnership between farmers and the Pakistan Agricultural Research Council, the International Waterlogging and Salinity Research Institute, the University of Agriculture Faisalabad, the Punjab Department of Agriculture Extension Wing, the Nuclear Institute for Agriculture and Biology, and the Punjab Forest Research Institute. The activity has received funding support from the Australian Agency for International Development, the United Nations Development Program, the Pakistan Agricultural Research Council and the Australian Centre for International Agricultural Research.

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Units of measurement

This book uses metric units where possible. These can be converted to other units commonly used in Pakistan as shown below.

| | | Conversion to other units | |
|-----------------------------------|----------------------|--------------------------------|-------------------|
| Metric unit | Abbreviation | To convert to: | Multiply by: |
| Length | | | |
| millimetre | .mm | inches | .0.0394 |
| metre | .m | feet | .3.2808 |
| kilometre | .km | miles | .0.621 |
| Area | | | |
| square metres | .m ² | square feet | .10.76 |
| | | square yards | .1.196 |
| hectares (10 000 m ²) | .ha | acres | .2.471 |
| | | kanals | .19.768 |
| Volume | | | |
| litre | .L | imperial gallons | .0.220 |
| | | US gallons | .0.2642 |
| cubic metres (1000 L) | .m ³ | imperial gallons | .219.97 |
| | | US gallons | .264.17 |
| | | acre feet | .0.0008107 |
| Weight | | | |
| kilograms | .kg | pounds | .2.2046 |
| | | maunds | .0.02679 |
| | | imperial tons | .0.0009842 |
| tonnes | .t | pounds | .2204.62 |
| | | maunds | .26.7924 |
| | | imperial tons | .0.9842 |
| Flow rate | | | |
| cubic metres per second | .m ³ /sec | cubic feet per second (cusecs) | .35.314 |
| Temperature | | | |
| Celsius | .°C | degrees Fahrenheit | .9/5 and add 32 |
| Salinity^a | | | |
| decisiemens per metre | .dS/m | millimoles per litre | .10 ^b |
| | | parts per million | |
| | | (or milligrams per litre) | .640 ^c |
| Heat | | | |
| joules | .J | calories | .0.239 |

a The salinity of a solution is often measured in terms of its electrical conductivity (units—decisiemens per metre). The abbreviations EC_e, EC_s and EC_w refer respectively to the electrical conductivities of: (a) the soil saturation extract, (b) the saturated soil paste, and (c) irrigation water or a soil solution.

b The conversion of electrical conductivities to units of millimoles per litre is affected by the type of salt being measured (Richards 1954, p.10). The conversion factor of 10 applies to Pakistan, where the soils are affected by a mixture of chlorides and sulfates of sodium, calcium and magnesium.

c The conversion of electrical conductivities to units of parts per million is affected by the type of salt being measured. The conversion factor of 640 applies to Pakistan, where the soils are affected by a mixture of chlorides and sulfates of sodium, calcium and magnesium.

Note: Throughout the text, 'billion' refers to 1000 million (10⁹).

Currency exchange rates

This book occasionally refers to the value of agricultural and forestry products in Pakistan rupees (PKR). Over the last 25 years, the value of the PKR has depreciated by about 85% against the US dollar. The value of the Pakistan PKR against the dollar can be estimated from the following figure (compiled from data published in the Trade Yearbooks of the Food and Agriculture Organization).

Number of Pakistan rupees (PKR) per US dollar

