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]

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'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]

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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

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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.

Metric unit	Abbreviation	Conversion to other units: 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 (10^9).

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