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Agricultural Water Management 53 (2002) 3–4

Agricultural water management

www.elsevier.com/locate/agwat

Preface

Texture-contrast duplex soils cover 60% of the agricultural cropping zone of Western Australia. Previous studies have shown that in the strongly Mediterranean-type climate with mild wet winters and hot dry summers, crop yields in the medium rainfall areas (350–450 mm annual rainfall) are constrained on these soils by transient waterlogging in the wet winter months and terminal drought in the spring. The results of these previous studies were reported at a workshop held in Perth, Western Australia, in 1992 and in the publication 'Crop Production on Duplex Soils' (edited by N.C. Turner, M.W. Perry, P.J. Gregory and R.K. Belford, CSIRO, Melbourne, 1992).

The replacement of native perennial vegetation by annual crops and pastures within this zone has resulted in water leaking past the roots as deep drainage, causing the development of waterlogging and secondary salinity in lower parts of the landscape. There has been considerable interest in placing trees back into the landscape to use water that would otherwise leak past the root zone of the crops. However, there are few studies that have quantified the water use by trees, especially belts of trees in an agroforestry system and particularly on duplex soils. An alternative perennial that was identified in the mid-1990s for use of out-of-season rainfall was the deep-rooted legume, lucerne. Although a perennial, it could be grown in short rotations and maintain the pasture/crop farming system. The observation that on deep sands lucerne could survive 6 months without rainfall, provided grazing was carefully managed, suggested that it might be a useful perennial for phase farming in Mediterranean-type climates. However, there was no experience of lucerne on duplex soils. Therefore, a new project was commenced in 1995 to determine the role of belts of trees on water use and the potential of lucerne to use water and prevent leakage to the groundwater. A site was identified where the owners and managers, Bronte and Peter Rundle had planted belts of trees adjacent to drains to reduce waterlogging and secondary salinity lower in the landscape. Two adjacent blocks each at least 4 ha in size, similar in soils and located between two belts of trees and drains were identified and one planted to lucerne while the other had the annual pasture upgraded with subterranean clover seed. After 3 years under pasture, both blocks were sown to crops, wheat in year 4 and canola in year 5, to determine the influence of the perennial and annual pasture on the growth and water use of subsequent crops.

The site was heavily monitored over 5 years by staff from the Western Australia, Department of Agriculture, CSIRO Divisions of Plant Industry, Land and Water, Forestry and Forest Products, the Centre for Legumes in Mediterranean Agriculture (CLIMA) and the Botany Department at the University of Western Australia. The monitoring program involved the measurement of tree, pasture and crop water use, pasture and crop growth,

0378-3774/02/$ – see front matter
PII: S0378-3774(01)00152-4

the incidence of transient perched waterlogging, runoff and overland flow through the drains, and groundwater levels below the plots and throughout the catchment. A conference/workshop was held from 13 to 14 June, 2000, that brought together the participants in the project to combine their findings and also brought together other researchers from Western Australia, interstate and overseas to put the observations and conclusions in their national and international context.

The papers in this publication are taken from presentations at the workshop, revised to include comments and suggestions made during discussion. Papers include presentations made by farmers, that provide a solid grounding of the practical applications of the research, and are an essential part of the workshop proceedings. This publication represents the combined wisdom of all the attendees at the workshop, and provides a snapshot of current thinking of the ways in which vegetation types interact to affect hydrology at the small catchment scale.

As workshop organisers, we would like to thank the Grains Research and Development Corporation, the Rural Industries Research and Development Corporation, the Land and Water Resources Research and Development Corporation, the Cooperative Research Centre for Plant-based Management of Deyland Salinity and CSIRO Centre for Mediterranean Agricultural Research for financial support, Agriculture Western Australia in Albany, particularly Stephen Porritt and Diedre Hatton for assistance with local arrangements and Virginia Skipworth for dedicated assistance with both the workshop and publication.

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