

Introduction

Background

Soil constitutes the fundamental building block of all agricultural pursuits. Soil hydraulic characteristics, especially hydraulic conductivity and soil water holding capacity, are important to the design and operation of irrigated agriculture systems. The performance of irrigation systems and practices depends highly on soil hydraulic properties. For example, sprinkler irrigation systems provide well controlled water application and thus offer advantage over surface irrigation systems in minimising deep drainage from irrigation on “leaky” soils, while surface irrigation systems may result in an acceptable level of deep drainage and be more cost effective than sprinkler irrigation on “non-leaky” soils.

Information on soil hydraulic properties is also useful for irrigation scheduling and management including when, how much and at what rate water should be applied. In addition, soil hydraulic properties are often critical input parameters to irrigation and water management models, for scales ranging from plot, through paddock and farm, to catchment. Despite its importance, information on soil hydraulic properties is generally scarce. The reasons for the lack of such information include the high cost involved in collecting field data and the large spatial variability of soil hydraulic properties.

Victoria’s irrigation regions are undergoing land use changes. Information on soil hydraulic properties is required to assist in the siting and management of existing and proposed irrigation developments, appropriate restructuring of irrigation delivery infrastructure, the targeting of incentive schemes, and regulatory controls on water use.

This project aims to provide a tool to facilitate land use changes consistent with the principles of water use efficiency and sustainability. The tool contains regional scale soil hydraulic property information of major soil types in the SIR.

Study Area

The Shepparton Irrigation Region (SIR) produces 25% of Victoria's export earnings and about \$4.5 billion in economic output each year. The SIR contains about 300,000 ha of irrigated land. Surface irrigation is the most widespread method of irrigation in SIR, which accounts for about 90% of the total irrigated land.

The SIR has a wide range of soil types. Detailed soil maps for the SIR were developed during the period from 1942 to 1964 (Butler, 1942; Johnston, 1952; Skene and Poutsma, 1962; Skene, 1963; Skene and Harford, 1964). The agricultural industries in the region have used these maps extensively, in particular for crop suitability guidance. During the development of the maps, soil hydraulic properties were not measured. Prior to this study, there have been only a few measurements of soil hydraulic properties on some soil types for specific purposes. Although broad association has often been made between soil permeability and soil groups, overall there is a poor understanding of the hydraulic properties of the soils in the region. The availability of information on soil hydraulic properties adds significant value to the existing soil maps and will assist in land use planning, irrigation design, water management and irrigation related policy initiatives.

Objectives

The overall objectives of the project were to:

- describe trends and variability of soil hydraulic properties of the region,
- develop an affordable method to enable the production of farm scale maps of soil hydraulic characteristics for use by whole farm planners, irrigation designers and land holders, and
- develop a decision support tool to assist in the planning of land use changes and the targeting of irrigation related policy initiatives.

Project Activities

The project work was conducted over a period of two years starting July 2002. Using the existing regional soil maps as a reference, measurements of soil hydraulic properties of 34 soil types at 79 sites in the SIR was carried out. Soil water capacities were determined in the laboratory on undisturbed soil cores from the field. In situ measurements of saturated hydraulic conductivity were made at Horizons A, B1 and B2. Final infiltration was measured at top of Horizon B1. On 8 sites, intensive measurements of soil hydraulic properties were carried out to describe paddock scale variability of soil hydraulic properties. In addition, a number of other soil physical and chemical properties of Horizons A and B1 were measured to explore relationships between soil hydraulic properties and other variables which are less costly to measure. Soil hydraulic property data were assembled in the form of lookup tables, arranged by soil types and by soil groups. Pedotransfer functions for indirect estimation of the soil water retention characteristic from easily measurable soil physical properties were developed for soils of the SIR.

During the implementation of the project, two technical workshops were organised to discuss the project plan and results with stakeholders.

Report Structure

This main report addresses each of the project objectives in detail. Details of the project work and database are provided in Attachments 1 and 2.