

# Introduction

The north-eastern cropping region of Australia lies in a subtropical environment of extreme rainfall variability. Successful crop production depends upon the buffering influence of stored soil water to sustain growth during the prolonged periods between significant falls of rain.

The greatest challenge for farmers in this region is to cope with this high level of uncertainty of the weather and the associated uncertainty about the accumulation of water in the soil. This climate variability and nitrogen availability are the most critical determinants in crop production. Most farmers would like to replace their gut feel about the state of these two variables with reliable measurements.

Farmers have, for many years, monitored the soil using practical methods such as the push probe to determine the depth of wet soil, and the appearance of a crop and the protein content of its grain as measures of fertility.

This manual describes those techniques but also provides alternatives to improve both the quality and quantity of the information. This is especially valuable for crops such as dry-land cotton because of the high investment that is at risk.

## Confidence in soil management

Farmers have to adopt all cost-effective means to reduce uncertainty in the production system. If the amount of soil water and available N have been measured directly, or estimated from suitable rainfall and soil information, the farmer can make more

confident decisions. These include when, or even whether, to plant a crop, the expected yield, and the profitability of an investment in fertiliser nitrogen.

Nitrogen is especially important because it is the one plant nutrient whose availability may fluctuate between sufficiency and almost total absence in the course of a single cropping season.

Farmers and their advisers have requested a simple explanation of the key soil processes to better understand this resource and practical guidance to making relevant soil measurements. Our experience in APSRU with on-farm collaborative research has highlighted many issues for which a ready source of reference would be valuable.

This handbook is intended to fill these basic needs whilst pointing to sources of more detailed information on many technical aspects of soil properties and behaviour.

## Exploring your soil

The APSRU booklet – *Exploring the soil on your farm* (Foale et al. 1993) – provided an introduction to the use of soil coring as a crop management tool. However, the widespread interest in soil monitoring techniques has shown the need for further guidance to best practice.

This manual provides details of the basic soil properties and processes, and is a comprehensive guide to soil sampling, analysis, synthesis of information, and the practical application of results.

### The scope of this manual

This manual comprises a set of modules that provide background information on, and describe the best practice in, soil monitoring. The simple explanation of soil and plant processes enables the results of soil monitoring to be used with confidence to achieve more profitable and sustainable crop management.

### Five modules

All modules and the appendices are bound in the main book. The database of Module 5 is a separate booklet to allow for updating of data.

#### 1. Understanding your soils

**Module 1** explains the formation of the soil, and the physical, chemical and biological properties relevant to a dry-land crop production system. There is particular emphasis on soil properties that impact dry-land cropping systems.

#### 2. A guide to soil sampling

**Module 2** is a comprehensive guide to soil sampling. It includes sections on when, where, how deep and how often to sample; what tools to use; and how to process, store and transport the samples. This is useful for the farmer who wants to perform his own sampling, but is particularly aimed at commercial operators seeking to provide a high-quality soil sampling service along with relevant advice.

#### 3. Calculating water and N

**Module 3** shows how to convert the results of the analyses for water and nitrogen content into values useful in management. It describes how to apply these values to management decisions prior to planting, or to gain insight into efficiency of water use by previous crops.

#### 4. Determining Plant Available Water Capacity

**Module 4** outlines the field procedures for characterising the soil with respect to storage of soil water and its uptake by different crops. Characterisation is a specialised task, undertaken for each soil type of interest and is generally carried out collaboratively by the farmer and consultant. The module describes measurement of variables to calculate plant available water capacity—information of crucial value in the use of simulation as a tool to add value to soil monitoring data.

#### 5. Soil characterisation data

**Module 5** contains a description of soils of the northern grain region; this should be used, where appropriate, in conjunction with the enclosed soil map and key. A database of information that includes the plant available water capacity for a range of common soil types and crops is provided in a separate booklet, allowing updated and new data to be included.

#### Appendices

The appendices provide supplementary information for those wishing to source or manufacture soil sampling equipment or to read more about the topics covered in the manual.

Appendix 6 contains proforma calculation sheets for soil water and soil nitrogen. These should be photocopied for all field workings.