A NEW VERSION OF SOILpak FOR THE COTTON INDUSTRY

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Introduction

The Australian cotton industry now has a new version of the SOILpak manual.

Published by NSW Agriculture, and entitled 'SOILpak for Cotton Growers, Third Edition', it will help cotton growers and their advisers to deal with such challenges as:

- soil assessment when interpreting yield maps;
- on-going monitoring of soil condition;
- prevention of salinity and erosion problems;
- maximising water use efficiency;
- soil survey procedures prior to the development or redevelopment of cotton fields.

The manual also contains detailed information about the measurement and management of soil compaction. It is an improved version of material supplied in the previous edition of SOILpak by Daniells and Larsen (1991).

Most of the revisions to SOILpak are based upon soil research and extension activities funded by the Cotton Research & Development Corporation and the Cooperative Research Centre for Sustainable Cotton Production. Interviews with leading cotton growers also provided valuable information.

This paper summarises the main features of the new SOILpak manual, and describes how it can be used to boost farm profitability and improve environmental sustainability.

Background

The SOILpak manual released in 1991 ($SOILpak_{\beta}$) helped cotton growers to improve their soil management. The history of its development is outlined in the paper by Daniells *et al.* (1996). However, $SOILpak_{\beta}$ required rewriting because of the large amount of relevant soil research conducted since 1991, and because of new land management challenges facing the cotton industry. These include the introduction of Global Positioning Systems (GPS) and yield monitoring equipment (Precision Agriculture), and the offer of environmental accreditation schemes such as 'ISO 14000'. Yield mapping of cotton crops is showing very large differences

in performance between the best and worst sections of some fields – much of the irregularity appears to be due to soil variation.

Soil diagnostic procedures that can be used in the field have improved greatly since 1991 (eg. Greenhalgh 1995, McKenzie 1996, Field *et al.* 1997), and many of the soil management options have been refined.

The revised manual, 'SOILpak for Cotton Growers, Third Edition', is in loose-leaf format. It is inter-linked with the NUTRIpak and MACHINEpak manuals, and with the 'Best Management Practice' documents for pesticide use. It will be accompanied by a portable pocket version of the information required for soil examination in the field.

The new version of SOILpak will help growers of irrigated and dryland cotton to improve their profitability. This will be achieved by improving the accuracy with which they assess and monitor their soil fertility, and by providing better soil management options. 'Best practice' soil management will also help cotton growers to minimise the environmental impact of their activities.

Contents of the manual

The main messages in SOILpak are:

- measure soil condition, and relate it to the features of an 'ideal' soil for cotton;
- aim to overcome soil limitations to crop growth, where economically viable;
- once soil conditions have been optimised, aim to maintain them in that condition.

The SOILpak diagnostic procedures have been made as simple and as fast as possible. They can either be used directly by growers, or by their consultants and district advisers. When interpreting the results, management options are given rather than strict instructions – this allows the grower to take responsibility for the final decision about soil management.

The contents of 'SOILpak for Cotton Growers, Third Edition' are as follows:

Part A. Introduction

Chapter A1: Aim of the manual
Chapter A2: The ideal soil for cotton
Chapter A3: District soil management problems

Part B. Quick help

Chapter B1: Trouble-shooting guide
Chapter B2: Soil preparation options after a dry cotton harvest
Chapter B3: Harvesting cotton on wet soil

Chapter B4: Soil preparation options after a wet cotton harvest
Chapter B5: Soil preparation options after a rotation crop
Chapter B6: Nursing a cotton crop in a damaged soil
Chapter B7: Applying nutrients to the soil
Chapter B8: Managing variable fields (Precision Agriculture)
Chapter B9: Soil survey for cotton development or redevelopment
Chapter B10: Soil preparation after landforming
Chapter B11: Cotton soil management and the environment
Chapter B12: Case studies

Part C. Diagnosing soil condition
Chapter C1: Soil pit digging: where, how and when
Chapter C2: Features of the description sheets
Chapter C3: Soil moisture (before tillage), soil texture and available water
Chapter C4: Structural condition
Chapter C5: Structure after rotation crops and tillage
Chapter C6: Stubble
Chapter C7: Salinity
Chapter C8: Other tests (pH, mycorrhiza, rate of soil loss, pesticide residues)
Chapter C9: Using moisture probe data
Chapter C10: Monitoring soil condition

Part D. Practical soil management: response to the diagnosis
Chapter D1: Avoiding soil structure and waterlogging problems
Chapter D2: Improving soil structure
Chapter D3: Managing nutrients
Chapter D4: Avoiding salinity problems
Chapter D5: Minimising erosion and pesticide movement
Chapter D6: Maximising water use efficiency
Chapter D7: Achieving a suitable pH
Chapter D8: Dealing with gilgais
Chapter D9: Red soil management
Chapter D10: Extra notes for dryland growers

Part E. Background information
Chapter E1: Australian cotton soil
Chapter E2: Compaction and hardsetting processes
Chapter E3: Effects of sodicity and salinity on soil structure
Chapter E4: Clay minerals
Chapter E5: Organic matter and soil biota
Chapter E6: Root growth in response to soil structure and temperature
Chapter E7: Water movement

Appendices

Sources of information; Further reading; Unit conversion; Glossary; Supply of soil description sheets; Index

To utilise the manual, it is not necessary to read it from cover to cover. Use of the index and trouble-shooting guide will direct soil managers to sections of the manual that are relevant to their situation.

Training courses

Extension staff from the major cotton producing districts in eastern Australia were introduced to a draft of the new manual at a 'Train the Trainers' course at Narrabri in October 1997. It was supervised by Dr Des McGarry and Dr David McKenzie. This was followed by 'hands-on' soil management training courses for cotton consultants, agronomists and leading growers at Warren and Moree in November 1997 and at Emerald in June 1998. Another five courses will be held in the second half of 1998.

The Narrabri, Warren, Moree and Emerald courses confirmed that the most effective way of extending the contents of SOILpak is via the use of soil inspection pits on commercial cotton farms.

Future directions

The 'Cotton SOILpak' initiative is closely linked to activities of the Technology Resource Centre at the Australian Cotton Research Institute, Narrabri. Their staff intend to make the SOILpak manual available to users via the ACRI Web site, as well as supplying 'hard copies' when necessary.

This arrangement will make it easier for users of SOILpak to be supplied with updates to chapters. For those clients without access to the Internet, updates will also be available from district advisory staff. This regular updating process means that the SOILpak manual will continue to be a 'Best Management Practice' document.

Where to obtain a copy of the SOILpak manual

Details of how to get a copy of 'SOILpak for cotton growers, Third edition' can be obtained from the Technology Resource Centre, Australian Cotton Research Institute, Narrabri NSW 2390 (http://cotton.pi.csiro.au).

References

Daniells, I.G. & Larsen, D. (eds.) 1991. *SOILpak$_\beta$: a Soil Management Package for Cotton Production on Cracking Clays*. NSW Agriculture, Narrabri.

Daniells, I.G., Larsen, D.L., McKenzie, D.C. & Anthony, D.T.W. 1996. SOILpak: a successful decision support system for managing the structure of Vertisols under irrigated cotton. *Australian Journal of Soil Research* **34**, 879–889.

Field, D.J., McKenzie, D.C. & Koppi, A.J. 1997. Development of an improved Vertisol stability test for SOILpak. *Australian Journal of Soil Research* **35**, 843–852.

Greenhalgh, S.E. 1995. *An Evaluation of Field Soil Structural Assessment Techniques for Grey Cracking Clays under Irrigated Cotton Production.* Master of Rural Science thesis, University of New England.

McKenzie, D.C. 1996. *Measurement and Management of Compaction Damage on Vertisols under Irrigated Cotton.* Ph.D. thesis, University of Sydney.

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