

Introduction

Soil compaction in the cotton industry has been identified as a major limitation to crop growth. This led to the establishment of several CRDC funded research projects dealing with the management of soil compaction. However, it has proved difficult to diagnose this problem in the field. In mid-1987 the Macquarie Valley Soil Management Service was set up to aid growers with their soil management decisions; they found that in about 30% of cases, it was difficult to make recommendations about the degree of soil compaction. A majority of this uncertainty was due to poorly defined techniques for assessing soil condition.

The aim of this project was to evaluate, and where necessary refine, the techniques currently available for soil structural assessment in the field. The techniques for the assessment package, where possible, have to be rapid and repeatable, with low degrees of operator subjectivity. They will help farm agronomists, consultants and extension personnel to make better soil management decisions, and monitor the changes in structural condition from year to year. The package will be incorporated into the **SOILpak** manual.

Several sites were chosen in the Macquarie and Namoi Valleys on a number of different types of grey cracking clays. At each of these sites there were two treatments - undamaged and damaged. This ensured that the techniques for measuring soil structure were tested over a wide range of different soil types and soil conditions. The soil and plant characteristics measured included bulk density; air-filled porosity; soil strength (penetrometers); root morphology; plant development; yield; cation exchange capacity (CEC); exchangeable cation percentages; electrical conductivity (ECe); pH; clod shrinkage; nutrient content; organic matter; and soil structural description using traditional survey schemes.

This report summarises results obtained from 6 farms in 1989/90. They are presented as a series of case studies. Once results from the 1990/91 season have been collated as part of project DAN 50C, they will be combined with the 1989/90 data to provide detailed conclusions. Some promising techniques have been identified. Soil strength and root morphology measurements fit the required criteria of being rapid and easily repeatable, as well as accurately describing the soil condition. There are limitations with these techniques, but further analysis and sampling should overcome them.

Summary of Key Results

- 1 Most promising techniques for use by advisory staff in the field are penetrometers and root morphological characteristics.
- 2 Soil smearing may not have significant effects on plant growth. It was previously thought to have a very detrimental effect on plant growth.
- 3 Crop management can override the effects of soil compaction on plant growth.

Future Research Recommendations

- 1 More experiments are required to further refine the procedures for soil physical assessment.
- 2 The 'Rimik' penetrometer and Handheld penetrometer need to be calibrated for the different types of grey clay in the Macquarie and Namoi Valleys.
- 3 Further adjustments to the modified Peerlkamp Soil Assessment Scheme made by Dr Tom Batey (soil husbandry consultant and lecturer Aberdeen, Scotland) are required for the Australian grey cracking clays.
- 4 When using the above procedures, the location and intensity of soil sampling within cotton fields needs to be established.
- 5 Critical limits for cotton root development under a range of moisture regimes need to be determined for a broad range of cracking clays.

N.B. These future research needs are being addressed by the CRDC funded project DAN 50C.