SOILpak: increasing the awareness of the soil resource

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Cotton growers began to realise in the late 1970's that compaction of clay soils may have been a cause of declining yields. Research over the last 10 years has confirmed those suspicions. Compaction can be a widespread and severe limitation to yield; it can also be avoided or repaired.

Research findings are of little use on their own. Users must be convinced of the magnitude of the problem and be given ready access to information which can help them overcome a problem. The SOILpak project set out to address these issues by promoting the importance of good soil management, by drawing together existing research results and practical experience, and by presenting the knowledge in a decision-support system.

A loose-leaf manual was the medium chosen to deliver the decision-support system. This medium makes the information easily accessible, especially in the field where many management decisions are made.

Different farms have different resources of machinery, manpower and finances; different growers have different aspirations. A decision-support system must therefore guide the user through the decision process but still allow the freedom to choose an appropriate option. Hard and fast rules are rare in SOILpak. Rather, the knowledge of experts is presented as guidelines, leaving the user in control.

The soil management strategies in SOILpak make use of the main features of cracking clays. These features are outlined below.

Cracking clay soils have a high clay content, and much of the clay is smectite, a clay mineral with strong swelling and shrinking in response to changes in water content. Cracking on drying assists rapid water entry. Consequently, cracking clays have a moderate to high water-holding capacity but also a potential to waterlog after flood irrigation. The swelling on wetting closes the cracks and limits further water intake; there is little water loss by deep drainage. When wet, cracking clays are soft and are easily smeared or remoulded, but cracking on drying gives them the potential to repair their structure. Wetting and drying produces a mulched surface, a great aid in seed-bed preparation.

The low organic matter content of cracking clays predisposes them to slaking on quick wetting. Slaking is an advantage in producing a mulched surface, but can be detrimental to the development or maintenance of large structural units.

Some cracking clays are sodic in the subsoil and the consequent excessive subsoil swelling can close off pores and inhibit deep root extension. Care is needed to avoid exposing subsoil when levelling land. One advantage of subsoil sodicity is that it further inhibits water loss by deep drainage. Occasionally, mild subsoil salinity restricts plant water uptake.

The above features of cracking clays form the basis of SOILpak's soil mangement strategies. These strategies aim to avoid excessive disturbance (tillage) or trafficking of wet soil; to maintain existing soil pores by permanent bed technology; to repair damage by using plants to impose drying cycles ('biological tillage') and judicious tillage when needed; and to treat sodicity with gypsum or lime.

The message through SOILpak is: 'Examine the soil, assess its structural condition and then make a management decision'. This approach helps the user avoid costly, unnecessary and possibly damaging operations and to employ appropriate strategies to improve or maintain the soil in good physical condition. However, assessing a soil's structural condition is not easily learnt from a manual; practical, field-based training workshops have been an important associated activity.

SOILpak is designed as a decision-support system, containing current knowledge of soil management for cotton on cracking clays. The manual has a second role: that of creating awareness of good soil management. Thus it acts as a platform for launching extension campaigns. The manual on its own does not teach the necessary skills to diagnose soil structural condition. The manual must be combined with practical workshops and it then becomes a reference. In developing the manual, the project team identified some areas of weakness in current knowledge: in particular the need for simple, objective methods of assessing soil structure. Thus the manual has many roles, but the main point is to get the message across to the farmer.

The project has been a joint effort, with contributions of research results and practical experience from researchers and extension officers in NSW Agriculture, CSIRO, Queensland Department of Primary Industries, University of Queensland (Agriculture Department and Gatton College) and University of New England, and consultants and growers in the cotton industry. Thanks to the Cotton Research and Development Corporation for financial assistance.