

RESTORATION OF SOIL STRUCTURE IN CRACKING CLAYS

SUMMARY

Introduction

This project was aimed at providing a rational approach to restoring soil structure after it becomes degraded under intensive irrigated cotton production. The project investigated mechanical loosening (deep tillage) and crop rotation ('biological tillage').

Four experiments were done:

1. a comparison of deep tillage and deep drying over a range of soil structural conditions - good, intermediate and poor;
2. the effects of wheat and safflower on soil structure (at Warren);
3. the effects of wheat and safflower on soil structure (at Narrabri);
4. deep tillage at different soil moisture contents.

Soil structure was assessed by SARAN coating intact soil clods to measure their shrinkage. In one experiment Rhodamine dye was used to trace large pores. Where cotton was grown, lint yields were measured as an indication of soil structural condition.

Results

1. Previous tillage effects can persist under bare fallow.
2. Deep tillage should be approached with caution. A cracking clay which is not dried to permanent wilting point to depth should not be deep tilled.
3. A vigorous rotation crop, grown under conditions which force the crop to dry the soil thoroughly, can promote good structure in cracking clays and obviate the need for deep tillage.
4. Although rotation crops promote good structure, they also deplete the soil of nutrients. Adequate fertiliser should be applied for a subsequent cotton crop to reach its yield potential.

Difficulties encountered

1. The establishment of different soil moisture profiles in the field is subject to the weather.
2. Time is needed for a crop to bring the soil to a particular moisture content. The longer it takes, the more the crop grows and the more organic matter is produced on that treatment. Different amounts of organic matter interact with the nutrition of a subsequent test crop. Earlier prepared treatments spend more time in a prepared condition and may benefit from the action of weather in mellowing the seed bed.

Recommendations for future research

1. Considerable knowledge of cotton soil management has been accumulated. Future efforts should aim at presenting this knowledge in a form that is accessible to cotton growers. One way of doing this is through a computer-based decision-support system for soil management. A proposal for such a system ('Compuclod') will be put to the Cotton Research Council for funding in 1988/89.
2. Under continuous cotton, there seems to be little opportunity to grow a non-irrigated crop between successive irrigated cotton crops. There is a need to find ways of deep drying the soil profile in a continuous cotton system.
3. The assessment of soil structure by the SARAN technique is time consuming. Quicker methods are needed.
4. The interaction of tillage system and nitrogen nutrition is being investigated in project DAN 25L (Effect of tillage practice on nitrogen fertiliser strategy and soil structure).
5. Project DAN 3L (Waterlogging of cotton in a cracking clay) is addressing the plant growth and yield aspects of poor soil aeration. More work is needed to define the critical levels of soil aeration and soil strength for unimpeded root growth in cracking clays.

Applications to industry

1. Non-irrigated rotation crops are recommended for improving soil structure in cracking clays used for cotton.
2. The nitrogen nutrition of cotton following a rotation crop needs careful attention. Assistance is available through NRATE, a decision-support program on the SIRATAC package.
3. Deep tillage is not recommended as a routine operation. However, when it is carried out, the soil should be previously dried to permanent wilting point to the depth of tillage.

Approved allocations

	Salary \$	Travel \$	Operating \$	Capital \$	Total \$
1984/85	12,500	1,200	2,600	2,000	18,300
1985/86	13,494	1,200	2,600	1,500	18,794
1986/87	15,739	-	2,600	-	18,339
GRAND TOTAL					55,433