Research Projects

Research Project information from CSIRO Land and Water

Sheet No.19
May 2000

Reducing Recharge from Rice Fields

Australia's rice industry is a valuable part of the farming economy, generating $600 million annually. These economic benefits are offset by the contribution of ponded rice to rising water tables and soil salinity.

Rice growing is only permitted on soils that have very slow leakage rates through the top two to three metres of soil. However, relatively small areas of undetected 'leaky' soil, which may exist within a paddock, can double the overall leakage from a rice field. That's why it is so important to identify and then treat any leaky areas within an otherwise suitable rice paddock.

Deliberate compaction of soils may go against the grain for most farmers, yet a team including scientists from CSIRO Land and Water has shown that impact compaction can dramatically reduce additions to the water table from leaky rice soils.

The compaction method has the following features and benefits:

- it decreases the amount of water going to the water table
- it can be used to seal small areas of leaky soils in paddocks which are otherwise suitable for rice
- rice crop growth and yield are unaffected
- it is economic (costing about $300/ha), provided the effect of decreased infiltration lasts for at least three years.

CSIRO

CSIRO LAND and WATER

Background

Rising water tables and salinity threaten the sustain-ability of Australia's major irrigation areas. Rice growing contributes about half of the additions to the water table in areas where rice is grown and farmers are under pressure to reduce this recharge from rice.

Puddling (cultivating wet soil using a rotary hoe) can significantly reduce the downward movement of water. However, adoption of this technique has not been high, partly due to the time it requires during what is inevitably an extremely busy period for farmers.

Preliminary studies of impact compaction of rice soils (carried out by Robert Clark in 1996-97) suggested that this method merited further investigation. The major attraction with compaction is that it can be carried out well ahead of rice sowing. Moreover, it appeared to seal leaky areas effectively.

Compacting the soil

Selected rice soils in southern NSW trials were treated using specialised heavy machinery known as *impact compactors.* The compactors have massive cam-shaped drums that have three to five sides. The cam shape raises the drum and the continued rotation propels a flatter section of the drum down, slamming it onto the soil surface as the machine travels forward at ground speeds of 12-15 km/hour.

Case studies

There were four variables in the trials: the machines used, the number of passes, the soil types and the soil water content at the time of compaction. The effect of compaction on infiltration was measured in infiltration rings covered with a lid to prevent evaporation (see photos).

Compaction plugs leaky soils

The amount of water leaking to the water table was significantly reduced by compaction, provided soil water content in the profile exceeded about 20 per cent (20 grams of water/ 100 grams of soil) at the time of compaction. Compaction was very effective when it was carried out on moist or even very wet soil, but had virtually no effect when the soil was dry and hard.

Water savings through compaction were significant. Compaction reduced infiltration by between 40 and 60 per cent on soils that had relatively low infiltration rates in the first place, and by 70-80 per cent on very leaky soils (see Fig 1).

Crop growth and yield were not affected by compaction (see Fig 2).

What happens to the soil?

The effects of impact compaction were seen at depths of up to 0.5 metres below the soil surface at some sites. These effects included visible signs of shearing, higher soil strength and reduced rate of water flow through the soil. More needs to be known about the effects of compaction on soil structure (whether changes caused by compaction are reversible and how to restore the soil structure to its original state) before considering its application to large areas.

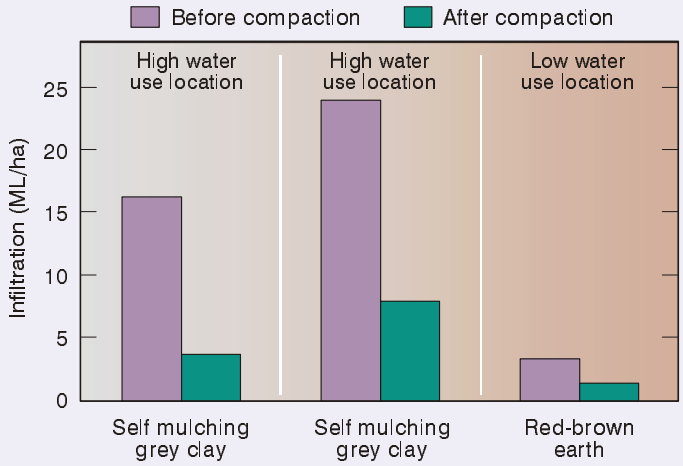

Fig 1 Effect of compaction on water infiltration

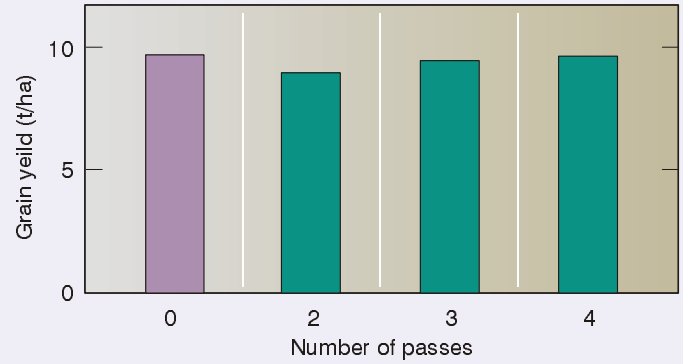

Fig 2 Effect of compaction on rice yeild on the self mulching grey clay soil

Reversibility is an important consideration for farmers, as it will influence the longevity and therefore the economics of the treatment, It may also affect the ability to grow other crops and pastures in rotation with rice. Results to date suggest that compaction can reduce infiltration for at least two consecutive rice seasons.

So is compaction the answer?

Compaction appears to provide a solution to a serious problem in rice production - how to seal leaky soils. This method, however, should only be used for small areas - it should not be regarded as a solution to sealing entire paddocks that would otherwise be unsuitable for rice, at least until the long term effects of compaction are known. The potential to reverse the process and how to do this are issues that must be addressed before the practice could be recommended for widespread application.

Research partners

This work was supported with funds from the Rural Industries Research and Development Corporation (Rice Research and Development Committee). Other research partners were CSIRO Land and Water, Robert Clark, Landpac Pty Ltd and NSW Agriculture. The contribution from farmers Stuart Robilliard and Bruce Cameron - from Berrigan, NSW – is also acknowledged.

Further reading:

Humphreys, E; Clark, R and Beecher, HG (1998). Effect of impact compaction on recharge from rice. *Farmers Newsletter - Large Area No 152, pp 62-69.*

Humphreys, E; Clark, R and Beecher, HG (1998). Effect of compaction on recharge from rice. *CSIRO Land and Water Consultancy Report 98/38.*

Further information

Dr Liz Humphreys
CSIRO Land and Water
Griffith, NSW, 2680
Phone: (02) 6960 1500
Fax: (02) 6960 1600
E-mail: liz.humphreys@grf.clw.csiro.au
Web: www.clw.csiro.au/division/griffith

Mr Robert Clark
Realea Pty Ltd
PO Box 113
Berrigan, NSW, 2712
Phone/Fax (03) 5885 2325

CSIRO

CSIRO LAND and WATER

Produced by the Communication Group, CSIRO Land and Water