

Soil management for sugarcane

Simon Eldridge, Soil Scientist, NSW Agriculture, Richmond

This soil pamphlet is intended to help North Coast sugarcane growers maintain sustainable production by protecting their soil from the problems of compaction, erosion, acidity and soil nutrient decline.



Soil management — a very important issue for sugarcane growers.

MAINTAINING SOIL STRUCTURE

Excessive cultivation can damage your soil's structure and result in compaction, surface crusting problems, reduced moisture storage, and lower yields.

Soil structure refers to how soil particles are arranged into individual soil lumps (aggregates) and to the spaces and holes that exist within and between these aggregates.

Well-structured soils have lots of pores (holes) and spaces in the soil to allow good drainage and aeration and easy plant root growth. Organic matter is essential for good soil structure as it helps bind the soil particles together. Earthworms also help improve soil structure by mixing the organic matter through the soil and creating tunnels for drainage and aeration.

Too much cultivation damages soil structure **XX**

Less cultivation + soil organic matter
= good soil structure **✓✓**

1. REDUCE FREQUENCY OF SOIL WORKINGS

Seed bed preparation and planting

- Use **tandem disc ploughs** or **square ploughs**, in preference to more aggressive implements such as rotary hoes.
- **Minimise the use of rotary hoes.** These destroy soil structure by pulverising the natural soil aggregates into tiny particles and by compacting the soil just below the cultivation depth.



Well-structured soils grow the best crops.



Preparing new cane land with a disc plough.

In ideal situations, the **ground preparation for sugarcane planting** may consist of:

- One or two passes with a disc plough to break up the previous crop's ratoons.
- One pass of deep-ripping with a suitable tined implement to remove compacted layers.
- A final pass with a tyne or disc type implement or harrow before planting.

Note: Very little ground preparation (usually only one cultivation pass) is required for sugarcane planting when following a soybean or green manure crop.

Current research on Control Traffic-Permanent Bed Systems by BSES in Queensland may eventually provide a system which does not require the extent of ground preparation that occurs presently at the end of the last ratoon for the following plant crop.

- Use **zero tillage in ratooned sugarcane crops**. The only soil disturbance that is required for a ratooned crop for most soils is that associated with the application of fertilisers.
- **Avoid cultivating the soil when it is too wet or too dry!** This will damage the soil structure and produce a



Deep-ripping breaks up compacted soil layers.

compacted soil layer. Heavy **clay soils** are best cultivated when the soil is dry — avoid cultivating when the soil is too wet.

If a handful of clay soil can be rolled between your hands into a rod which is less than 3 mm in diameter without it crumbling, then the soil is too wet to plough. Light **sandy, silty, or loam soils** are best cultivated when the soil is neither dry nor wet. They should only be cultivated when there is enough moisture in the soil for a handful of it to be squeezed into a coherent ball, but not enough moisture for the soil to feel wet.

Ask your NSW Department of Primary Industries Soil Advisory Officer for an information sheet on assessing soil moisture for cultivation.

Weed control

- Control weeds with **herbicides**. Herbicides are often cheaper than cultivation, and they don't harm soil structure. A trash blanket of crop residue can also help reduce weeds.

2. GROW LEGUME GREEN MANURE/BREAK CROPS

- Legume break crops not only improve your soil's chemical and physical fertility, they can also help in weed control. These crops add valuable organic matter to the soil as they break down. They also add significant amounts of nitrogen to the soil.
- Soybeans and dolichos lab lab have proven to be suitable legume green manure crops for sugarcane farming on the North Coast.



A soybean crop improves the soil's condition.

MANAGING CANE TRASH

- Cane trash protects soil from raindrop impact and **soil erosion**, conserves **soil moisture** and improves **soil organic matter** levels.
- The trash blanket can improve yields on well-drained, sandier soils harvested during warmer conditions where moisture conservation is important.
- The burnt cane trash blanket can be managed by raking the trash from the row.
- The trash blanket after green harvest can restrict the growth of ratoon cane, particularly in clay soils, or after early or late season harvest. The loss of yield can be reduced by raking the trash from the cane row.
- Cane trash can float in some heavy rain or flood situations and block drains and culverts, or smother adjoining crops.



Burnt cane trash blankets provide many benefits to the crop and the soil.

“With ‘trash raking’, you get the best of both worlds. You get the benefit of better soil moisture storage under the trash blanket in the dry times, while being able to avoid the problems of stool rot and poor ratooning during the cooler wet conditions by raking the trash off the rows. Reduced soil erosion and increased soil organic matter are two other benefits of burnt cane trash blankets.”

— Alan Munro, sugarcane grower (Woodford Island).



Soil testing helps growers to successfully plan their fertiliser program.

MAINTAINING SOIL FERTILITY

- **Test your soil regularly.** Regular soil testing can help ensure that the correct amount of fertiliser is applied to the soil to satisfy the nutrient requirements of the crop. It also removes any risk to the environment by avoiding over-fertilising. Soil analysis determines the soil’s current levels of nutrients (its nutrient status). A full soil test should be done before the establishing of each crop.

“We soil test about six paddocks each year. During the fallow period leading up to planting, we can have a full soil test done and get the results back in two weeks. This keeps a watch on the main nutrients the cane needs. Keeping these records over time allows us to monitor the longer-term trends in soil acidity.”

— Alan Munro, sugarcane grower (Woodford Island).

- **Soil pH.** Most soil nutrients are available to the crop in the pH range of 5–7 (CaCl₂ method). Strongly acid soils (pH less than 5) require the addition of fine agricultural lime or dolomite to allow better uptake of soil nutrients by the plants.
- **Fertiliser applications.** Consult your advisers and fertiliser company on the best rates and types of fertiliser for each crop.

Refer to: *Australian Sugarcane Nutrition Manual* — D.V. Calcino (BSES).

PREVENTING SOIL EROSION

- **Avoid steep slopes.** Although sugarcane cropping is not common on the sloped land of the North Coast, it is important that soil erosion control measures are adopted in the few sloped areas where it is cropped. The risk of soil erosion increases dramatically when slopes exceed 10% (6°). Restrict cropping to areas with slopes less than 10%.
- The adoption of **reduced tillage** and **zero tillage** farming systems help reduce soil erosion.
- Retaining a cane **trash blanket** cover on the soil surface helps protect the soil from erosion.
- **Seek erosion control advice.** Advice on suitable erosion control practices can be obtained from your local adviser and the soil services of the Department of Lands. This advice should be sought early in the planning stage.

MANAGING ACID SULFATE SOILS

The acid sulfate soils problem is due to the presence of a layer of iron sulfide-rich mud which underlays much of the soils of the flat coastal lowlands. This layer is not a problem while it is underwater, but once it is exposed to the air, it oxidises and releases sulfuric acid. This severely affects soil and water quality. Current evidence suggests that, once oxidation has occurred, this material will remain acid even under wetter conditions. As a response to this problem, regulations and guidelines have been developed for any future draining of these coastal lowlands, as well as for the management of existing drains.

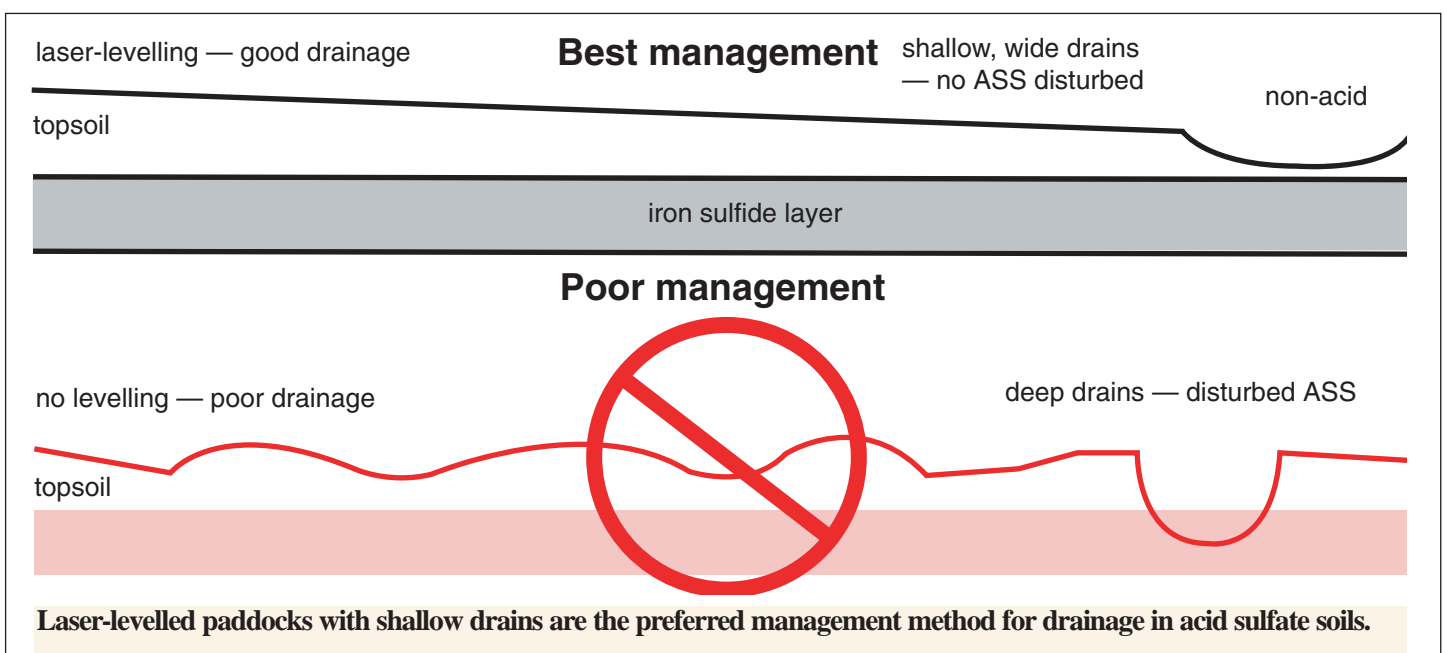
Some sugarcane farms have this soil material in their subsoils and need to manage it carefully. Current practice is to avoid further inappropriate drainage of these soils and to manage existing drained lands and drains to minimise movement of acid off-site into the waterways.

This pamphlet only deals with this issue in an introductory manner. Consult the *NSW Acid Sulfate Soils Manual*¹ for more detail on management options for these soils.

1. NEW DRAINS

- **Regulations.** Consult Local and State Government departments about the procedure for gaining approval to install drains in potential acid sulfate soil areas.
- **Shallow drains.** Once approval to drain an area has been obtained, the building of a well-designed shallow drain system is the best option. These drains do not create acid drainage problems if they are above the iron sulfide layer.
- **Laser levelling.** Paddock surface drainage can be improved by using laser graders to regrade flat land to give it some slope. This improves drainage, reduces the compaction damage to the soil by harvesting machinery during wet periods, and also allows better trafficability for farm machinery. Laser levelling can also help reduce the amount of acid run-off entering the waterways from paddocks with acid sulfate soils.

¹ Stone Y, Ahern CR, Blunden B. 1998, *NSW Acid Sulfate Soils Manual*, Acid Sulfate Soils Management Advisory Committee, Wollongbar.





Laser-grading of paddocks.

Consult your local industry adviser about getting your paddocks laser-graded.

2. EXISTING DRAINS

Identifying an acid problem

Some indicators that you may have an acid sulfate soil problem are:

- drain water with a pH less than 4.0 which is clear or has a milky-green colour
- rust-coloured stains on drain surfaces, yellow mottles in drain walls or spoil heaps
- bare drain spoil heaps where vegetation cannot grow.

Maintenance of old, deep drains

- Acidic drain spoil heaps should be limed to neutralise any acid within them. It is worthwhile liming the floors and walls of the acidic drains when they are empty during dry periods.
- Weeds can be controlled by using herbicides registered for that purpose or by removing them with a specially designed excavator weed bucket which minimises the removal of any acid soil material from the drain.
- Seek advice on modifying existing drains to make them shallower and wider.
- Floodgates and drop boards can be manipulated to minimise the amount of acid leaving the site. A new approach which has yielded some promising early results involves using drop boards to set the water levels in the drains at a level which is equal to the watertable depth in the paddocks adjacent to the drains. To do this successfully requires a good knowledge of the levels across the length of the drains, and some watertable monitoring. For more information, ask the Acid Sulfate Soil Advisory Officer at Wollongbar.



A heavy application of lime will help neutralise the acid in the drain banks and floor.

Refer to the *NSW Acid Sulfate Soils Manual* (1998) ISBN 07347008 — a copy of this manual should be available at local mills.

FURTHER INFORMATION

- *Soil Sense-Soil Management for North Coast Farmers* (1995), available from NSW Agriculture.
- Information and leaflets on managing acid sulfate soils are available from the Acid Sulfate Soil Project Officer at NSW Department of Primary Industries, Wollongbar.
- Soil Sense leaflets available from NSW Department of Primary Industries and the Department of Infrastructure, Planning and Natural Resources.
- Information leaflets on sugarcane growing are available from the agricultural advisers at the NSW Sugar Milling Co-operative offices at Condong, Broadwater, and Harwood.

'In the last three years, I have laser-levelled half of my paddocks and infilled about 4 km of 1 m-deep lateral drains. Laser-levelling alone has increased the productivity of the cane by 10–20%. Laser-levelling has reduced the amount of acid discharge off the property by 80%. It has done this by eliminating all of the low points in the land where the acid comes to the surface and concentrates. In the next three years, I intend to finish laser grading the other half of the property as well as infilling a further 4 km of drains.'

— Robert Quirk, sugarcane grower (Tweed Valley).

WHAT THE FARMERS SAY



— Alan Munro (Woodford Island)

‘The two main advantages of zero tillage in ratoons are that it saves you time and labour costs and that it leaves your paddock in a better condition after a wet harvest. No tillage also helps to conserve soil moisture in the dry periods and the trash blankets help with this as well.’

‘We’ve found soybeans to be the ideal legume to put in our fallow ground. The clay soils we have in this area tend to pack down.

The soybeans rooting system combined with the humus helps to break up the compaction. It’s much easier to work the soil to seed bed condition. A crop of soybeans improves the soil structure, keeps the weed growth down, and helps to control soil movement in heavy rain.

— Bert Plenkovich (Broadwater)



The nitrogen benefit to the soil and the income from the grain are an added bonus.’



— Robert Hawken & Robert Quirk
(Tweed Valley)

‘Heavy lime applications to the drain banks and floors during dry times have proved successful in helping to neutralise the acid from the drain banks in the sugarcane paddocks. The benefit of this is strictly for the environment. We are doing this to minimise the impact of the low pH water on the environment.’

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DISCLAIMERS

The information contained in this publication is based on knowledge and understanding at the time of writing (July 2004). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date, and to check currency of the information with the appropriate officer of NSW Department of Primary Industries or the user’s independent adviser.

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