



Subsoil sodicity the key to poor performance

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in a nutshell

- The Moulamein Cropping Group has formed to attract scientific expertise and extension effort to the area, in an effort to address the slow decline in publicly-funded research and extension
- Last year the group investigated potential limitations in a range of paddocks that 'refused' to yield more than 5 t/ha of wheat
- Subsoil sodicity was identified as a problem in several paddocks
- By understanding the spatial distribution of subsoil sodicity, the landholders now have a better understanding of yield potential across the paddock and can manage accordingly

A cooperative project between the Moulamein Cropping Group and Advanced Soil Mapping has highlighted the depth and severity of subsoil sodicity as the key to a paddock's irrigated performance.

The Moulamein Cropping Group was established by four like-minded farmers around Moulamein, west of Deniliquin in NSW Murray Valley. Its aim is to improve local farmers' understanding of irrigated farming systems to increase profitability. The group aims to attract scientific expertise and extension effort to the area, in an effort to address the slow decline in publicly-funded research and extension.

The Moulamein area has traditionally been poorly represented in research programs and DPI extension is provided from Deniliquin, 120 km to the east of the area. The group is pursuing a small, focussed and responsive program to complement the work of the larger research and development programs. It remains unincorporated and informal to date, as its simple program does not warrant anything more.

The project was funded by the Murray Land and Water Management Plans.

Investigating subsoil sodicity

Ken Bates of Advanced Soil Mapping is providing technical expertise to the group on the subject of subsoil sodicity.

"A highly sodic layer in the soil is like a block of concrete. Moisture can't get in or out of it. For our clay soils, the depth and sodicity of this layer determines the soil's moisture holding ability," Ken said.

The electro-conductivity of a soil can be correlated to its sodicity at any given depth. Hence, EM38 surveys and strategic soil sampling can develop detailed soil sodicity

maps for each soil layer.

Four sites in the group's area were surveyed and sampled, giving maps of moisture before sowing, moisture after harvest, soil salinity and soil sodicity. The sites were selected because they represented a range of soil types and farming systems, also because they belonged to the primary members of the group.

Site 1 "Len Lin", Swan Hill Road, 23 ha

Paul Fitzpatrick's border check site has been in a winter crop rotation for the past 20 years. The site has a heavy grey clay soil that has responded well to a reduced tillage regime, but soil structure deteriorates towards the eastern end. The typical crop yield has never exceeded 5 t/ha and varies significantly across the site, but generally declines at the eastern end. The EM38 survey revealed that the site is generally sodic from 60 cm and highly sodic from 1 m, but a 4 ha area at the eastern end had extreme sodicity at 60 cm. Most of the site probably has an available water holding capacity of 80 mm, but the eastern end's soil has a very limited ability to hold moisture – maybe only 50 mm.

Can improved management push yields past 5 t/ha?

"The water holding capacity of my site is not real high, so it is probably risky and somewhat laborious to aim for higher than 5 t/ha. Perhaps I should try harder for part of the site and observe the results. There is nothing realistic I can do with the eastern end, other than manage for its lower water holding capacity," Paul said.

This probably means lower yield expectations and/or maybe an extra watering at the end of the season. Reduced cultivation has improved establishment density, but the subsoil constraint is permanent.



Site 2 Morton's Road, 20 ha

Adrian Polkinghorne's site has been in a rice rotation for many years. It consistently produces 10 t/ha rice crops, but winter crops only achieve 3–4 t/ha. The EM38 survey showed that it has a consistent high sodicity from 60 cm, excepting 10 acres at the northern end. At this end there is low sodicity right down the soil profile, which lets roots penetrate deep and extract much more moisture. A higher yield expectation can be set for this 10 acres.

Could higher non-rice yields be achieved?

"I will probably fertilise the top 10 acres a bit heavier to fill the higher yield potential, but no amount of gypsum will address the subsoil sodicity on the rest of the paddock," Adrian said.

"It is difficult to supply enough water for yields higher than, say, 5 t/ha without serious danger of waterlogging in this contour layout. A side ditch and better supply and drainage will help. I can aim for 6 t/ha in the top 4 ha, but will probably aim for 5 t/ha in the rest of the site, which is still an improvement on our current yields.

Site 3 "Tooranie", Tooranie Road, 36 ha

Leigh Vial's site has only been in a winter crop rotation for the past six years. It was in unimproved pasture with some opportunity cropping before that. Despite good break crops, numerous irrigations and aggressive nitrogen management, yields have only consistently achieved about 5 t/ha. The crop seems to dry out very quickly after a rain or irrigation event. The EM38 survey showed a uniform highly sodic band starting at about 40 cm. This severely restricts the soil's moisture holding ability, probably to about 50 mm of readily available water.

What would it take to lift yields higher?

"I have been deceived, really." Leigh said. "The topsoil is quite friable, especially after 5 years of no-till, but I have that block of concrete quite shallow in my soil. It backs up our experience; we have tried to push cereal crops past 5 t/ha, but they do not seem willing to go any higher. Now I see that they cannot get the water to achieve a higher yield,

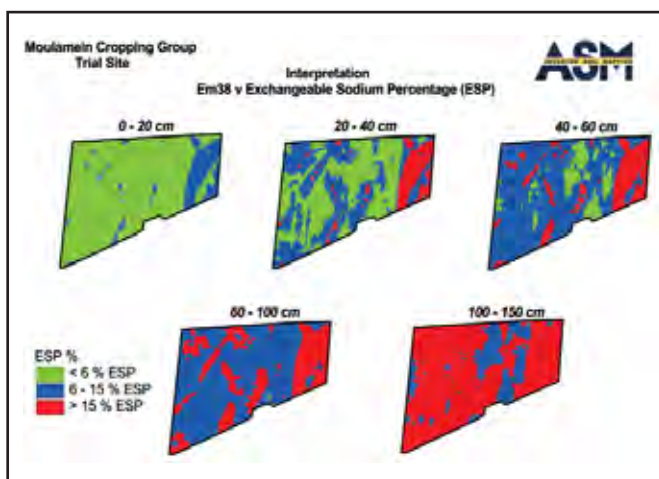


Figure 1: Maps showing soil sodicity at several intervals down a soil profile. This site has good soil characteristics in the top 20 cm but becomes increasingly sodic down the profile, and is extremely sodic below 1 m.

unless I water it maybe four times in the spring. Unless I can do the waterings with less workload, I am not keen to push yields higher"

Site 4 "Tiquito", Barham Road, 45 ha

Michael Gorey's centre pivot site used to be rice country before they cleared the banks and installed the pivots. The site is capable of high yields if sufficient inputs are applied. He has achieved more than 7 t/ha of wheat a couple of times. Compared with the other sites, the yield is quite uniform. It seems to be responding well to the stubble incorporation regime that he has followed for the past six years. The EM38 survey has revealed that it has high soil sodicity from about 60 cm, but has got quite low sodicity above that. He has 60 cm of good soil.

What is the best way to manage the sodicity?

"A centre pivot is probably good irrigation technology for this soil." Michael said. "We only have to work with the top 60 cm of soil and keep topping it up with water regularly with the pivot for a top yield."

Understanding the secrets below

The project has taught all four participants to consider the subsoil much more than in the past. The group was confident that they were satisfactorily addressing issues such as inputs and timing on their individual farms, but they were still unable to lift wheat yields. By looking beyond the root zone they were able to find an answer.

A winter crop's yield is usually driven by its moisture supply in the spring. And with sodic subsoils, moisture supply is driven by how much 'real' soil you have. A layer of sodic subsoil effectively limits the available soil profile in which to farm and store moisture – especially in spring. ☁

Further information

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Figure 2: Moulamein Cropping Group members, from left, Paul Fitzpatrick, Adrian Polkinghorne and John Smith (NSW DPI) contemplate the nature of some of the subsoils in the Moulamein area.