



# Managing soil acidity

Russell Zwar (photo Emma Leonard).

## Farm details

**Location:** Wirrabara, South Australia

**Farm size:** 1,240 hectares

**Rainfall:** annual 450 to 550mm varies across farm.

**Soils:** equal amounts of brown and red brown earth with pH ranging from 4.5 to 7.5 (CaCl<sub>2</sub>).

**Enterprises:** continuous winter cropping – wheat, barley, canola, faba beans, oaten hay. Also small areas of summer crop – sunflower or maize.

## Making the most of his investment in lime inputs is the focus for Russell Zwar who farms at Wirrabara.

**M**anaging soil acidity is always on Russell Zwar's agenda but it was hard to really quantify the improvement lime was making. Working with his brother, Michael who runs AgTech, an on-going program of pH mapping will help track changes in soil pH.

Russell farms with his parents Don and Annette and his wife Davina. The Zwars' were very early adopters of no-till farming and stubble retention. They understand that a healthy soil underpins a productive cropping system.

Historically, they pH tested the soil across the farm, but until

two years ago testing has been limited to random soil tests across a few paddocks, each year.

"Our continuous cropping program can lead to increased soil acidity so we focus our pH testing on the grey silts where pH has historically been low and on the high production paddocks," said Russell.

"The rest of the farm was limited to random soil tests across a few paddocks."

Based on these results the paddocks with the greatest need are limed. Approximately 100 hectares or about eight per cent of the farm is limed per year.

"If the pH falls below pH 5.5 (CaCl<sub>2</sub>) we spread lime at 2.5t/ha across the whole paddock, our aim is to increase the pH on this soil by about one unit."

Monitoring the success or otherwise of this uniform application of lime was based on crop performance.

"We see improved crop establishment resulting in the crop being more competitive with ryegrass. We are also able to grow good yields of faba beans which are more acid sensitive."

Two years after liming some highly acid grey silt soil, faba



(photo Emma Leonard)

**Figure 1** The use of a field pH test is a good indicator of soil pH.

beans yielded 3.2t/ha and Russell now budgets on at least 2.5t/ha of faba beans.

Using lime to increase soil pH can also help crops to make better use of nutrients, especially phosphorus and nitrogen. However, rates of lime above 3t/ha, especially with a high neutralising value, can reduce the availability of zinc and manganese.

Lime is carted in February and spread on dry soil in March, using a Marshall spreader.

The spread width is 9.14m (30ft) and the tractor is fitted with 2cm autosteer. This width has been found to give a very even spread and also matches Russell's controlled traffic tramline system.

"We have seen good results with a range of crops in the year of liming but more recently have focused on liming before sowing faba beans".

***'Mapping really helps open your eyes to pH variation across a paddock.'***

### **pH Mapping**

Initially, Russell had a few paddocks tested using an on-the-go Veris pH machine, this data showed the true value of pH testing and that his farm was well suited to variable lime applications. For the last couple of years, Russell has employed his brother Michael to do his pH mapping. Initially, he

was collecting one sample per hectare but given that the pH in some of his fields can range from below 5 to above 7 in a short distance, he is finding that two samples per ha are giving better maps in this environment. The pH readings of the machine are about 0.3 to 0.4 higher than pH (CaCl<sub>2</sub>) and therefore need to be reduced to bring them in line with pH (CaCl<sub>2</sub>).

Russell plans to map the whole farm over the next couple of years and then to start re-mapping to better understand the on-going pH of his paddocks.

Of the 300 hectares mapped in 2015/2016 only 150ha actually requires lime as it was less than pH 5.5 (CaCl<sub>2</sub>).

In one 35ha paddock about 25% required lime but previously he would not have even tested this paddock as it was not considered acidic.



“Mapping really helps open your eyes to pH variation across a paddock.”

Russell is continuing to spread lime with a Marshall spreader. As this is not set-up for variable rate spreading, he only uses about 3t/ha, which he controls manually. The pH map is loaded on to the Topcon X20 screen and the GPS signal indicates his location in the paddock on this map. As he enters an area that requires lime he switches on the spreader and switches off as he leaves the zone.

### Rate changes with product

Until 2012, the Zwars were back-loading Nutrilime® after delivering grain in their own truck to Port Adelaide. This meant the lime was costing about \$13/t plus spreading. As this product is no longer available, Russell has had to find a new and cost effective source of lime.

When selecting a lime source, the cost of lime, the cost of freight and the lime quality such as the neutralising value and particle size need to be considered to enable an accurate comparison. A high proportion of the particles should be less than 0.25mm (250 microns).



**Figure 2 Zwar’s paddock and view of the surrounding area.**

Russell has selected a lime source from the mid north. Even though the effective cost per tonne of the two products is similar (taking into account the cost of the lime, freight and spreading and neutralising value) approximately 4.2 tonnes of the new source (62% neutralising value) would need to be spread per hectare to achieve the same rate of neutralisation as 2.5 t/ha of Nutrilime® (104% neutralising value).

The rate of 2.5t/ha was calculated on the soil type, target change in pH and logistics of how much lime can be carted and spread.

Russell has considered that the 4.2t/ha rate was too high from

the perspective of incorporation and the logistics of spreading and carting and so therefore for this reason he has selected a more conservative rate of 3t/ha.

With mapping he feels he will have a better idea if the rate is sufficient and will be able to come back and target the areas where low soil pH persists.

Since 2009, the Zwars have used a single disc seeder that gives ultra low soil disturbance. This means that lime is not worked into the soil with tillage but is only leached into the soil after rain. Russell is cautious about re-liming paddocks too often, as he does not want to increase surface pH too much.

“We are lucky that our soil pH actually increases with depth but it would be good to have a long-term trial area to assess how pH changes with depth over time

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<b>Table 1 Cost benefit of pH mapping and patching out liming.</b>		
	<b>Uniform paddock rate 3.0t/ha</b>	<b>Targeted lime application based on pH mapping</b>
Area requiring lime (ha)	35ha	9ha
t/lime required	105t	27t
Cost lime (\$15/t)	\$1,575	\$405
Cost freight and spreading (\$20/t)	\$2,100	\$540
Cost of Mapping (\$10/ha)	-	\$350
Total cost	\$3,675	\$1,295
<b>Saving (\$= cost blanket rate - cost of mapping - adjusted cost) \$2,380</b>		



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