Digging Deep

The state of soil acidification in Australia

Sustainable farming doesn't start from the ground up. It starts deeper down. Graymont speaks with leading Australian soil scientist, Dr Jason Condon, to discover why we need to dig deep and what soil management practices need to change.

As the saying goes, the grass is always greener on the other side. In the 1980s wheat was the preferred crop, until plants started going yellow. In most cases, this is a sure sign of nitrogen deficiency. But was it really?

Soil tests showed plenty of nitrogen in the ground, and the soil wasn't waterlogged either. However, the wheat plants hadn't managed to form roots – the first indication of soil acidity.

As it turns out, years of agricultural production and harvesting of products had turned the soil acidic, as agricultural products remove alkali from paddocks. Acidity causes the soil pH to drop, which in many cases creates the right conditions for aluminium to appear.

But that's normal we hear you say. And yes, to a point it is, but it is not ideal. Aluminium toxicity retards root growth, restricting plant access to water and nutrients, and significantly reduces yields. Hence, acidic soil is a major environmental and economic concern.

The state of soils in Australia

While the application of lime on agricultural soils in Australia is common practice, it's rather irregular and not always carefully calibrated. Although, frequent testing of agricultural soils takes place, we are often only testing the top layers of soil, which won't detect the soil acidity lurking below. The result? Soil acidity that is worse than first thought resulting in limited root growth, less nutrient uptake, poor legume crops and unsustainable farming.

So, what can be done? Dr Jason Condon, Senior Lecturer in Soil Science at Charles Sturt University, Australia says we need to dig deep. "The right approach is being taken... to a point. Lime is being applied; soil tests are being administered and farmers are moving away from tilling practices. All good practice."

But soil acidification is still a widespread problem. Contributing to this is the application of lime on the surface and the practice of testing in 10cms increments.

Testing below the surface

Condon says testing soil in 10cm intervals doesn't pick up the presence of acid layers within the soil. "A 10cm sample with a pH of 5.5 could easily have layers of pH 4.5 in it. The test doesn't see it, but the plant will."

"The surface 5cm layer tends to be a higher pH due to plant residues returned to the soil surface and from surface applied lime. However, the most acidic layer is often in the 5-15cm depth, which means sampling to a depth of 20cm in 5cm intervals is the best way to identify the presence of acid layers."

Once the pH drops below 4.8, Condon says aluminium becomes available to plants and can quickly become toxic. "In the past, growers have used this 4.8 value as a trigger point for liming. That is, apply lime once aluminium becomes a problem."

"However, the problem is we're farming until we feel the pain, adding lime, and then reapplying once the pain emerges again. We're not actually fixing the problem so we never feel the pain." "We need a paradigm shift in our thinking; a change in our soil management."

Researchers and soil experts, Dr Jason Condon and Helen Burns check pH levels in soils after lime application

Photos permitted and provided by ACM and Jason Condon with thanks.

Dr Jason Condon says sampling to a depth of 20cm in 5cm intervals will help identify the presence of acid layers in Australian soils.

What the research says

Research by NSW Department of Primary Industries (DPI) has shown that maintaining pH above 5.5 in the top 10cm allows excess alkali to move deeper in the soil. The pH of the 10-20cm layer increased by 0.9 pH units over 18 years.

"This means that for long-term gain we need to set our re-liming trigger point to pH 5.5 and lime to a target above that," says Condon. "Let's not wait until we hit a pH level of below 5 to apply lime. Let's shift the target to pH 5.5 so we never feel the hurt and instead start focusing on the long-term benefits."

Soil Quality Australia has estimated that at least 50% of Australia's agricultural land has a pH less than, or equal to, a pH of 5.5, below the optimal level to prevent subsoil acidification. In Western Australia and New South Wales, 12-24 million ha are thought to be extremely or highly acidic, with a pH less than or equal to 4.8. Despite farmers in Western Australia's wheatbelt applying lime to their soils for years past, it became evident that the amount needed to be increased and the application carefully targeted in the light of soil testing results, particularly of subsurface layers. Growers have responded accordingly, while recognising that the problem will take years to resolve. Crop yields are gradually increasing as pH levels rise.

Changing methods and mindsets

Condon says: "As growers, we're much more productive than we were 20-30 years ago so our previous application method of putting 2.5 tonnes of lime on our soils every 10 years doesn't make sense anymore. The better solution is putting lime on so we never see a problem, sampling at 5cm intervals and maintaining a pH level over 5.5," he says.

This will not only require a change in management practices, but a change in grower mindset. "Nature is awesome the way it looks after itself," says Condon. "But we've got to do our part. We are seeing change beginning to take place with the application of lime going up and higher pH targets. That will enable us to see benefit over time."

"There's no denying we've made our soils acidic," says Condon. "Intensive farming practices and greater production of our soils has taken the alkali out and we need to put that back in. Lime is the best option to do that but the practice of liming needs to change if we want to farm sustainably."

But, not all lime is created equal, so applying high neutralising lime is integral to the regeneration of the soil, adds Condon.

The creation of a resilient system

There's also early evidence indicating the long-term benefits of liming extend to a decrease in the need for herbicide and insecticide application and result in healthier plants. By getting rid of acidity, farmers can get rid of one of the fundamental stresses affecting plants!

All the more reason to dig deep!

Dr Jason Condon is a soils-based agricultural researcher, experienced in nutrient and fertiliser management, soil degradation and many aspects of soil fertility.

*NB: All pH numbers in this article refer to pH measured in calcium chloride.