Bryan Granhaw with the soil testing rig.

Soil science delivers productivity gains for farmers

Local farmers and researchers are using new soil health tactics to help stop the loss of nitrogen into the atmosphere as a potent greenhouse gas.

From the back of a HiLux ute Bryan Granshaw drives a mechanical probe into the ground to test, among other things, the soil's water and nutrient-holding capacity.

The job can be difficult and the ute needs to be anchored so it does not tip as the probe pushes to get past the usual 400-millimetre stopping point to reach deeper into the soil.

Mr Granshaw, until recently a fourth-generation sugarcane farmer at Dalbeg, says a soil's water-holding capacity is closely linked to its health and its ability to use nutrients, including nitrogen.

"Sugarcane roots should be able to grow to a depth of 1.6 metres. But common practice in the Burdekin region, where I'm now based, sees sugarcane roots grow to just 400 millimetres. The soil's inability to let the roots travel down any further is just one aspect of soil health and biology, but it can have a domino effect."

Using probes to test the soil is a new job for Mr Granshaw, in his new role as a soil specialist for Trimble's Soil Information System.

As with many of the other sugarcane farms in the Dalbeg district, Mr Granshaw's farm was sold to Tropical Forestry Services to become an Indian sandalwood plantation.

Although sad to move on, the principles practiced each day on his farm are helping Mr Granshaw in his new advisory role.

"Finding out everything you can about the soil is the best way to improve what is already there," he says.

"On the farm, we spent the past 20 years investing in our soils. We wanted to do a better job with what we had, which led to productivity and profitability gains."

One of the first things he and his father John and brother Terry examined was their soil's water-holding capacity.

"Irrigation was our second biggest cost," he says. "We wanted to control what our outgoings were because we couldn't control what we were paid for our sugarcane. So our initial motivation was to make sure our farming system could deliver a profit by using less inputs."

Mr Granshaw says many farmers see a paddock not performing and therefore increase their use of nitrogen and phosphorus inputs. "We wanted to understand what was happening first."

The process led to controlled-traffic farming, in which machinery keeps to set wheel tracks to avoid soil compaction on the rest of the property, and no-till farming.

"About 90 percent of our soil was compacted and we were able to reduce that by half using controlled-traffic farming."

With other on-farm improvements, such as legume rotations, intercropping and split fertiliser applications, the Granshaws saw productivity increase to six percent above the district average and inputs drop to 30 percent less than the district average.

The positive results from these on-farm changes are echoed by the National Agricultural Nitrous Oxide Research Program (NANORP), which is looking at ways to increase nitrogen use efficiency on farms to improve the agricultural economy and reduce environmentally damaging nitrous oxide (N_2O) emissions.

The program found that management options farmers can use to improve nitrogen use efficiency, reduce nitrogen losses and minimise N_2O emissions include better matching fertiliser applications with a crop's actual nutrient needs, and growing a legume crop during the fallow period to reduce the need for nitrogen fertilisers in the next crop (the roots of legumes fix nitrogen into the soil).

Using enhanced efficiency fertilisers, such as nitrification inhibitors, can also reduce N_2O emissions by about 60 percent.

Although the NANORP work covers a range of agricultural industries, it is particularly important to the sugarcane industry where up to one kilogram of nitrogen per hectare per day can be lost to the atmosphere as N_2O, a greenhouse gas about 300 times more potent than carbon dioxide.

N_2O is also an indicator of nitrogen use inefficiency and much larger losses of gaseous nitrogen (N_2), which is difficult to measure but could be up to 50 times the amount of N_2O emitted.

One such research project that aims to reduce these emissions and improve on-farm productivity is being undertaken by Professor Scott Donne from the University of Newcastle.

The aim of his research is to develop a slow-release nitrogen fertiliser based on activated charcoal. The intent is for the activated charcoal to release the nitrogen needed for crop growth and at the same time lower greenhouse gas emissions as N_2O from the soil.

Preliminary studies have shown that 'best-bet' materials chosen for the work function effectively to lift crop yields and better use the nitrogen contained in the charcoal, suggesting that the slow-release fertiliser would reduce N_2O emissions.

For Mr Granshaw, any improvements to soil health and nitrogen use efficiency are important. "The soil is our greatest asset. With the technology available now we can understand how the soil is working and how we can help improve it."

Left: Drawing on experience as a Queensland sugarcane grower and soils specialist, Bryan Granshaw, aims to reduce applied nitrogen losses, and in turn, reduce greenhouse gas emissions of nitrous oxide.

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