Where to start is the cover crop challenge

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Alan Sundermeier knows long-term no-till works; he has the trial results to prove it.

What he is not so sure of is how best to achieve those outcomes in Australian conditions, although he is confident that cover crops will have an important role.

Alan, an Associate Professor at Ohio State University, told growers at the SANTFA conference that US and Australian farmers need to do a better job managing their soils to build soil carbon levels and improve crop performance, and it seems likely governments will demand and enforce better soil management, including requiring maintenance or increase of soil carbon levels, through taxation regimes or similar.

In Ohio, where conditions are warming and the State has been re-classified as Growing Zone 6 instead of Growing Zone 5, the community is having to deal with greater weather extremes, he said, and growers are beginning to realise they need to deal with those extremes 'any way they can'.

One of those ways is to increase soil organic matter so their soils are better able to buffer plants against temperature extremes and store more water, which can be achieved by smarter soil management.

Soil organic matter, he suggests, can be increased by:

- cover crops
- crop rotation
- improving residue quality
- slowing decomposition of organic matter to reduce carbon loss
- reducing tillage

Such measures will increase organic matter and soil carbon levels and improve crop performance, as shown by results from an on-going Ohio trial that has been running for more than 50 years.

The trial was established in 1964 to compare soil properties and the performance of continuous corn, corn-soy bean and corn-soy-clover hay rotations under mouldboard tillage and no tillage regimes in Ohio's high-moisture, heavy-soil cropping conditions. In the no-till treatments the hay is left on the soil surface. In the tillage plots it is worked into the soil.

ALAN SUNDERMEIER, ASSOCIATE PROFESSOR AT OHIO STATE UNIVERSITY.

Recent yields from the continuous corn/continuous no-till treatment were 8.37t/ha; considerably more than the 5.73t/ha from the continuous corn/plough tillage plots.

No-till without cover crops had many benefits, but didn't do much to stimulate microbial activity in the soil.

There was 1% more total carbon in the top 10 cm of the no-till soil than in the ploughed soil and the no-till soils contain more active (available) carbon.

When the trial was set up in 1964, soils at the trial sites contained 180ppm of total carbon. In 2004, after 40 years, the no-till soils contained about 400ppm of active carbon.

These results suggest soil productivity can be improved by adopting no-till practices, Alan said, and that long-term no-till crop production and cover crops may benefit the environment by sequestering more soil carbon than intensive tillage systems while maintaining or improving crop yields.

No-till farmers in Ohio did not begin to maximise the benefits of no-till until they began to include cover crops in their systems, he said.

"No-till without cover crops had many benefits, but didn't do much to stimulate microbial activity in the soil. Growers are beginning to understand the value of cover crops, but it isn't easy to get a good active protective blanket of vegetation on the soil surface."

Nor is it cheap, since establishing a cover crop requires increased labour and management, with issues species selection, the cost and availability of cover crop seed, planting and management costs and soil moisture management.

Ohio growers are finding extra benefits from growing cover crops following application of animal manure because the cover crop captures the nutrients from the manure and holds them in the topsoil.

This is in addition to more general benefits including reduced soil compaction and erosion – water erosion is a major issue in many parts of Ohio – weed control and increased yield from following crops.

There are also indications that a combination of no-till and cover crops increases crop yields during drought conditions, with grower respondents to a recent survey reporting dramatic yield benefits from no-till cover crop systems in drought conditions. These 'drought' benefits were in addition to yield benefits in more 'normal' conditions, apparently as a result of reduced evaporation and higher water-holding capacity due to higher soil organic matter levels.

It is important to establish a cover crop as soon as possible after harvest to capitalise on any moisture left under the crop, Alan said, even if that meant broadcasting seed from the air.

In Ohio, corn growers aim to sow their cover crops into standing crop so leaves falling from the dying crop form a mulch for the ground cover plants. This method, which can gain a grower 30 days extra cover crop growth in the short Ohio growing season, is also proving effective in soy bean, he said.

This prompted him to wonder if a similar approach might work in Australian wheat

paddocks, particularly if there was some rain during harvest that was too late to help the maturing crop but would still be available for a cover crop once the grain had been removed.

Options for establishment in those conditions could include aerial seeding, using an air-seeder or even adapting a spray boom to stream cover crop seed onto the soil surface under the crop.

There were no set rules, he said. The key was to work with nature rather than against it and find a method that worked in the prevailing conditions.

For instance, in some situations using only two or three varieties and sowing them in separate rows might be more efficient than attempting to handle a mixture of diverse species with different seed characteristics.

He also suggested growers consider whether cover crop seed would benefit from being sown on the grain crop row where the soil was likely to be more friable and where the seedlings would have the best chance of using the root channels left as the crop roots decayed to penetrate deeper into the soil where there could be more moisture and possibly nutrients.

A cover crop, particularly one that included deep-rooted species, could provide similar benefits for a following grain crop, he said, with the possibility of additional benefit from a higher soil temperature due to heat from the breakdown of root matter in the soil.

He advocates that growers working to improve their soils:

- have them tested for active carbon, a sub-set of total soil carbon he sees as an indicator of soil heath and biological activity
- look deeper than the topsoil, since improving soils can increase microbial activity to 300mm in Ohio conditions
- measure the percentage of aggregated colloids, a good indicator of soil structure, in their soils.

Jim Hoorman, another Ohio-based crop scientist, suggested another option for Australian growers wanting to build cover cropping into their farming systems might be to sacrifice one year of cash crop and grow a stand of something like forage sorghum, which has the potential to produce a large bulk of organic matter to provide an injection of organic matter to 'jump start' a cover crop system.