

Local trial exploring the value of cover crops in SA

MIKE ROBERTS

Growers and advisors from around SA attended a recent field day on Tom Robinson's farm at Halbury to check the progress of a SANTFA cover crop trial and discuss the value of growing summer cover crops under SA conditions.

Standing in a Halbury paddock surrounded by a mix of green cover crop species poking up through an impressive wheat stubble on a 40°C day in February was an interesting experience.

The paddock, on the property of SANTFA president Tom Robinson, is part of a multi-year, multi-site SANTFA trial project funded by the Australian Department of Agriculture looking at the potential of cover cropping in SA. The trial is being co-ordinated by Growing Solutions principal Leighton Pearce.

According to SANTFA R&D Manager Greg Butler the trial came about because of the significant level of interest in cover crops world-wide. "It's driven primarily by two parts; the cover over the soil and actual plant diversity."

The UN Food and Aid Organisation (FAO) recognises three pillars to conservation agriculture: no-till, stubble retention and crop rotation Greg said.

"Australian growers are considered to be pretty good at stubble retention and no-till but are perhaps being hampered by our ability to rotate crops effectively. Sometimes the market for the break crops able to be grown in some areas does not justify the expense and effort of sowing and managing the crop.

"That has spurred interest in summer or



SUMMER COVER CROPS WILL GROW IN SA, AS THIS MID-FEBRUARY PHOTOGRAPH SHOWS. THE QUESTIONS NOW ARE WHAT SPECIES TO GROW, HOW BEST TO ESTABLISH THEM, AND WHAT IMPACT THEY HAVE ON SOIL CONDITIONS INCLUDING MOISTURE LEVELS.

warm-season crops like radish, sun hemp and Sudan grass that might be able to be grown between harvest and the sowing of the next winter crop. Many of these plants originate in regions where soils are frozen in winter, so if the plants establish cover before the cold they are not necessarily competing with the cash crops in terms of timing.

Experienced no-tillers understand that there is a transition period, maybe five to 10 years.

"The questions for Australian growers include: will these crops even grow in our summers, will we be competing against our cash crops for water use and will we actually get a plant diversity benefit? At this stage the project is trying to satisfy growers' curiosity about whether it is worthwhile doing and identify what the risks might be."

Greg thinks one of the issues might be sowing cover crops too late.

"By the time you take off a cereal crop in late November or December it can be too hot and dry to achieve much with a cover crop. However, if you were to take off a hay crop, a short-season biomass crop or even a very short-season cereal in late August or early September and plant your cover crop straight in, then maybe you would have a better chance of getting something up and away and getting some biomass going."

That does not address concerns about the impact of the cover crop's water use on the following regular-season cash crop.

Greg says hay crops don't use moisture to the depth that cereals do, so it is possible a biomass cover crop sown after a hay crop will be active in the top part of the profile and still not take deep moisture.

"These are all things we need to explore.

"How much moisture is a cover crop going to use and where is it going to be from? And how important is it really to protect deep moisture?

"We know from historical soil moisture probe readings that moisture losses from near the surface are significant simply



SANTFA R&D MANAGER GREG BUTLER.

because of the heat and evaporation of an Australian summer. We also know that moisture below 30cm in the soil tends to be protected just because the soil is a good insulator.”

Each trial site has areas with and without cover crops, with moisture probes in areas with and without cover crops at each site.

At this stage there are more questions than answers, Greg said.

“Imagine you have a soil exposed to evaporation. With a cover crop on it there could be moisture loss from transpiration and evaporation from the soil surface.

“We know that root systems are mostly water, so is the moisture inside those roots protected against evaporation? Is that actually a way of storing moisture? Are they like little storage balloons of water, which can return it to the system when plants are killed off? This is what farmers want to know, so we are going through the exercise of trying to find out.”

Another aspect is determining if the cover crop helps the infiltration of rainfall received later on.

“How does the infiltration rate in a cereal stubble paddock compare with the rate where a cover crop was present when rain arrives in April? Does the soil fill up more quickly or more slowly, and could that be of benefit?”

A key question the research is designed to shed light on is whether or not winter crop performance will be enhanced because there has been an increase in soil microbes due to the presence of the cover



SANTFA PRESIDENT TOM ROBINSON, WHO IS HOSTING PART OF A STATE-WIDE COVER CROP TRIAL ON HIS HALBURY PROPERTY, KNOWS THAT THE SOIL IS THE KEY.

crop in the paddock over summer. Will the diversity of microbes, including beneficial organisms, counter the effects of pathogens that might survive on the ‘green bridge’?

“If you sow a cash crop into a cover crop are there more beneficial organisms in the soil and can they grow faster and serve that plant better than if it’s sown into a soil in which there are very low populations of organisms because there has been no growing vegetation over summer?”

Greg is convinced about the value of



PENNSYLVANIA, USA, FARMER STEVE GROFF HAS DEVELOPED ‘TILLAGE RADISH’ WITH AN AGGRESSIVE TAP ROOT CAPABLE OF PENETRATING DEEP INTO THE SOIL SPECIFICALLY FOR USE IN MULTI-SPECIES COVER CROPS.



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PROBING THE IMPACT OF COVER CROPS

Soil probes are being used to monitor moisture levels and temperatures under areas with and without cover crops.

This aspect of the research is being co-ordinated by Leighton Wilksch, director and agronomist at Agbyte.

At each of the trial sites, paired probes carrying moisture and temperature sensors feed data back to a telemetry station on the fence line. That station also receives data from an automated on-site weather station recording rainfall, air temperature and humidity.

“There are sensors every 10cm down the probe that take a soil moisture reading every 15 minutes,” Leighton said.

“Because readings are taken so frequently we can actually see where there are active roots in the soil because graphs of the moisture readings show a diurnal fluctuation where roots are active. This phenomenon, which shows up as steps on the graph, is caused by plants using more moisture during the day than at night.

“During the day, when the plants are photosynthesising, they suck moisture out of the soil so the moisture level drops. During the night there is no photosynthesis, so the plants don’t use water and the graph flattens out or even starts to rise a bit if water from deeper in the soil moves up into the root zone due to capillary action. Stepping of the graph shows where roots are active.

“At Tom’s site the roots are pretty well active only at 10 and 20cm. At another site, on Anthony Pfitzner’s farm near Eudunda, there are active roots at 75cm. It has been

incredible to be able to see the stepping moving down the soil profile. Five weeks ago it was at 10cm. Then, as the water at that depth was used, the diurnal fluctuation started to show up at the 20cm sensor, followed by the 30cm, 40cm and all the way down to the 70cm sensor as the roots reached down to use moisture deeper in the soil.

“The cover crop at Pfitzner’s is much heavier than what we see here at Tom’s place and it has sucked out an incredible amount more moisture.”

The soil temperature data is also proving interesting, Leighton said.

“Soil temperature has implications for mineralisation and soil biota. There are already some clear differences at the Pfitzner site, with temperatures about 2°C cooler where the cover crop is a bit denser.”

Greg Butler says the jury is still out at this stage.

“It’s not so much about how the cover crop performs as how much moisture it extracts from what depth in the soil and the recharge rates when the cropping season begins.

“We have some warm-season plants from the Northern Hemisphere in the trial and they seem to be growing OK, but we need more data before we can draw any meaningful conclusions.

“The real test will be whether or not there are differences in the normal-season crops following cover crops. This project is a snapshot and these things take time to assess. Would any of us have made a call on the value of no-till after two years?”

diverse microbiology and the macro biology of different root canopy structures of different cover crop species but says the problem is whether it is viable in Australia to grow something that uses up water in a dry, harsh system. “That’s why most of our research is around water use while most other people from non water-limited environments like the NE United States are looking mainly at diversity.”

Measurements being taken as part of the trial include a soil respiration test. This won’t identify which microbes are present but will show the respiration rate of the organisms present, which is an indication of soil health and microbial diversity, with a high respiration rate indicating high numbers of active living organisms.

Getting started

Tom Robinson planted the cover crop trial on his property following a 75mm rain event. Another 20mm followed seeding, but since then it’s been ‘dry and hot as hell’.

“As you can see, it’s pretty variable germination here on what we would consider a Hoyleton soil. It’s got a bit of loam and clay through it but it’s quite heavy and compacts pretty well.”

The mix of species in the trial area on Tom’s property includes two types of sorghum, corn, sunflowers, safflower, tillage radish, mung beans, cow pea and lablab. He is also trying that mix plus field peas, field beans, oats and some volunteer wheat.

“My aim was to get more ground cover over summer, hopefully increase the microbial diversity in the soil and get the tap roots to break up the hard pan.”

Tillage radish

Growers at the field day included Pennsylvania farmer Steve Groff who was able to attend thanks to support from the Southern Farming Systems group.

Steve is the founder of Cover Crop Solutions, the company that has developed the Tillage radish.

After 13 years, with his farming system of no-till seeding and the occasional cover crop working well, Steve began to question the need to continue with cover crops and a professor from the University Maryland offered to run some trials on his property to find out.

“For 12 years straight we looked at where we had cover crops and where we kept cover crops out. In ideal years, good growing seasons, we didn’t see a lot of difference in the yields of cash crops where we had cover crops and where we didn’t. But in stressful years there was a clear difference. Five years into that research, by the early 2000s, I was committed to cover crops. I saw the value of them.”

Steve then began researching and developing a radish variety he named the Tillage radish, which he describes as ‘a hardy plant with a huge aggressive tap root capable of penetrating the soil, pulling up some nutrients that may be down deeper than some cash crops can

reach and releasing them near the soil surface.”

There is a steady market for Tillage radish seed in South America, Europe, continental US and Alaska.

Steve says it will germinate even in cold temperatures and will begin to flower after seven or eight weeks, at which stage it needs to be controlled. “I understand wild radish is bad thing in Australia but this is a totally different species and not difficult to control.

“The conditions on my farm are quite different from those here but I’ve found out this week that even though there are a lot of differences there are some similarities I didn’t think about before.

“Your planting window in Australia is typically the same time as ours. During your summer we are also in dormancy but due to cold and snow. We have a small planting window after a harvest until we get so cold that nothing happens. Every day counts to get cover crops planted to maximise that short window of opportunity.”

It is important to treat cover crops like cash crops, he said.

“Put some thought into choosing your species and sow them carefully, starting with small areas. Like no-till, cover cropping is not an instant fix.

The problem is whether it is viable in Australia to grow something that uses up water in a dry, harsh system.

“Experienced no-tillers understand there is a transition period, maybe five to 10 years. There are some years where you’ll probably catch an extra shower of rain and you’ll see three times more cover than we see here today. You want to be ready for when that opportunity comes.”

Green bridge

Australian farmers have been hammered on the importance of controlling summer vegetation (the green bridge) to avoid pest and disease carryover. That’s an

issue Steve says is being re-evaluated in the US, where there is a shift to ‘planting green’ by spraying out the cover crop just before or just after sowing a cash crop.

Slug control is one of the factors driving adoption of this technique. With a cover crop, slugs will be active and continue feeding on the dying cover crop while the cash crop is emerging, giving it a chance to ‘jump out of the ground’ without the slug pressure exerted on fresh green seedlings germinating in a dry paddock.

Tom Robinson, who attended the Colorado No-till conference during a recent SANTFA trip to the US, asked one of the speakers, Dr Elaine Ingram, about disease carry over on the green bridge.

“Her response to me was that our soils are so degraded that the first thing that comes back is the disease and that’s why SA has a problem with rhizoctonia,” Tom said. “I know that what you are looking at here is not much of a cover crop but hopefully we are keeping the soil micro-organisms alive. We need to have more good bugs than bad bugs and hope the diversity of the species we can grow here will help achieve that.”







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