



Carbon sequestration in broadacre agriculture

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Womboota Irrigator & Nuffield Scholar 2010

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- After travelling around the world visiting research centres and farmers involved in carbon trading, Alastair Starritt believes Australian broadacre agriculture is well placed to actively participate in future carbon trade schemes.

With ever growing debate over carbon levels in the atmosphere and increasing speculation over future participation in a carbon related trade scheme, Alastair Starritt used his Nuffield Farming scholarship to seek clarity and direction in this area.

"After a run of drier than average seasons on the east coast of Australia, I was continually re-evaluating my business. I am a family partner in a mixed livestock and cropping operation at Womboota, north west of Moama, in the NSW Riverina," Alastair said.

"We have assessed every variable possible from seeding technology to rotations, varieties, nutrition and micro water harvesting. The constant in the system was soil – in terms of it being a stable component in what seemed an increasingly volatile business case.

Our cropping program includes wheat, barley, canola, field pea and lucerne, complemented by periodic irrigation depending on water availability. Livestock involves a self-replacing Merino ewe flock for wool production, first-cross ewe flock for prime lamb and wool production, and a Border Leicester stud with an annual on-property ram sale.



A focus on soil health and carbon capture led Nuffield Scholar Alastair Starritt to investigate on-farm options for carbon sequestration.

A future capturing carbon

My focus on soil health became the catalyst for an interest in soil carbon, sequestration and the role broadacre agriculture may play in future carbon capture and storage.

With predictions of unprecedented global demand for food and fibre by a more environmentally sensitive population, the pressures placed on agricultural production systems in the future could very well change the face of farming as we know it. Debate over carbon and its impact on the environment seems to ramp up and decline as time moves on, either way the issue is not likely to retreat all together.

Experts say carbon capture, is not likely to become an instant income source for agriculture, unfortunately, yet a price on carbon for a majority of input and a potential tax on emissions may well become a new hidden cost.

As the largest group of land managers on the face of the earth it would make sense to inform and encourage farmers to at least consider the potential benefits of sequestering carbon into agricultural soils. Both for a global environmental benefit as well as on-ground productivity gain. Soils with higher carbon content are able to hold more water and nutrient and produce more per



Boone Roark, Kansas, inspects a crop of dryland summer bean, which has potential for carbon sequestration in cropping systems.

input unit – the very fundamentals that agricultural production is based on.

Through plant photosynthesis carbon is drawn from the atmosphere and installed into the soil profile as a naturally occurring process. The challenge as I see it is to adopt a co-ordinated approach to this type of sequestration and provide base measurement and feedback on increasing or decreasing soil carbon content, not to dictate land use but encourage and reward agriculture for increasing soil carbon content.

A simple rule of thumb: healthy soils are able to capture and store greater amounts of carbon. Introduce me to a farmer who doesn't want healthy soils!

These simple points place agriculture in a unique position to enhance a naturally occurring process to increase soil carbon content. Nearly all forms of farming involve some process of plant growth in many and varied production systems. An understanding of the value of healthy soils in terms of productivity per input cost and the added benefit of sequestering atmospheric carbon could very well propel agriculture forward for generations to come. Future research may be directed toward plant breeding technology that selects plant traits with higher sequestration ability.

Develop systems to practise theory

After being awarded the scholarship in 2010, with sponsorship from GRDC, I travelled to Europe, Canada, the United States and New Zealand.

Research has found there are several plant species that show greater amounts of carbon sequestering ability. Plant researchers at Abberestwyth in North Wales (United Kingdom) are undertaking early trials on ryegrass varieties and their sequestration ability in pasture based systems. Generally speaking the greater the plant surface area and vigour, the greater the sequestering ability. Both corn and sugar cane are excellent for development in this area.

There is a direct correlation between humus soil health and carbon content. But to increase carbon in soil is not as simple as "surface residue equals carbon". An understanding of trace element balance micronutrients and soil biological life are all essential to paving the way to increasing carbon content in soils.



Canadian farmer Grant Miller and Alastair Starritt talking seeding equipment and the role of zero-till cultivation in increasing carbon capture in farmed soil.

A diverse range of land uses and plant cultivars helps to spread production risk as well as complement soil health.

Zero till broadacre crop production with minimal soil compaction is a positive step towards increasing carbon in soils. Although broadacre agriculture is on the right track it's hard to imagine how or why many farmers would take the next step (to become carbon sequesters) by committing to a yet to be proven ideal. Who would risk business security on a whim by radically changing a production system to what may be perceived as a best management scenario for future land use without some form of financial security?

Canadian farmers have attempted a voluntary carbon sequestration best practice program based on soil disturbance and residue retention and although highly adopted, the value of fifteen dollars per tonne (set by parliament) for estimated carbon held in soil profile is considered low. Income has not reflected effort and many Canadian farmers see maintaining a profit margin as a higher priority.

Possibly the next great hurdle to overcome is base measurement of carbon content currently in soils and the micro increments of change over time. Carbon content in soil varies immensely from not only soil type but also in profile depth. With so many variables in accuracy of measurement progress is slow on establishing a best management scenario for soil carbon capture. It seems the greatest restriction to accurate measurement of soil carbon content lies within testing equipment.

Researchers at New Zealand's Massey University are working on more accurate soil carbon content testing equipment. Carbon is considered captured if returned to a stable form. Future carbon capture policy needs to consider the huge variability in agricultural production systems and allow for flexibility in land use. For example, zero-till agriculture will enhance soil moisture content and assist greatly in improving soil health through less compaction by reducing tillage. However, heavy reliance on chemical herbicides to control weeds can create problems with weed resistance. Sometimes other measures such as grazing cultivation or even burning may have to be considered as part of the production process. However, at this point such practices may be frowned upon.

Nothing would fall from favour faster than a perceived best management practice policy that does not consider the balance between seasonal variability and production pressures that farmers have to accommodate.

Let them know!

Australian broadacre agriculture is arguably well placed to actively participate in future carbon trade schemes. Basic principles have already been widely adopted in Australian broadacre farming systems, such as zero-till, rotational crops, minimising soil compaction, yield mapping, and understanding the need to tune nutritional requirements to a given crop, season or soil type.

So how does agriculture get recognition for the silent revolution? Communication! There are some really positive things going on in agriculture at the moment and it's high time the benefits of farmers and their efforts are recognised. If policy makers neglect input from agriculture a huge opportunity may be lost. Agriculture needs to be viewed as part of the solution rather than all of the problem."