



Richard Heath

Executive Director
Australian Farm Institute

Conservation agriculture is the dominant cropping system in Australia, yet many conservation agriculture practices are under threat. Accelerated evolution of farming systems is necessary to ensure that Australian farmers can continue to farm in a profitable, productive and sustainable fashion. This Autumn 2020 edition of the *Farm Policy Journal* explores some of the drivers for change to current systems and forecasts what future systems may look like.

There is no doubt that conservation agriculture has delivered substantial environmental benefits, particularly compared to previous widely implemented European style farming systems. However, farming landscapes are often still degraded and further improvements to cropping systems are required to restore agriculture's stores of natural capital. Community pressure for demonstrable sustainability outcomes is one of the drivers for the continually evolving improvement of conservation agriculture systems, along with the rapid development of chemically resistant weeds and disruptive regulatory pressure on the use of the agrochemicals which are vital to conservation cropping techniques.

The authors of the first article in this Journal, Maartje Sevenster and John Kirkegaard (CSIRO Agriculture and Food) and Sue

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Ogilvy (Australian National University), present two frameworks for quantifying the sustainability metrics delivered by conservation agriculture. They contend that the accounting principles contained within the two frameworks will be required to provide the incentivisation and market signals for practice evolution that delivers mutual benefits to farmers and the community.

The article notes that both life-cycle assessment (LCA) and natural capital accounting (NCA) are needed in a complementary approach to demonstrate sustainability outcomes. LCA can account for the whole-of-supply chain environmental *effects* of the use of agricultural natural capital, while NCA informs the *development of practices* which provide long-term sustainable management of agricultural assets.

Increasingly, one of the natural capital assets pinpointed as a potential opportunity for conservation agriculture is soil carbon. For

example, the Carbon Farming Initiative has been promoted as an opportunity for conservation agriculture systems to extract additional value from building soil carbon.

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systems, glyphosate is still a key component of most Australian conservation agriculture systems – and is likely to remain so for some time. The fourth paper in this edition

However, in the Journal's second article, Robert White and Brian Davidson from the University of Melbourne contend that the opportunity for sequestering soil carbon has been over-hyped. The authors argue that building soil carbon in existing conservation agricultural systems is actually quite difficult, and that measurement systems to efficiently determine the amount of carbon sequestered do not exist. For these reasons, to advance the continuing development of conservation agriculture they recommend rethinking government policy which encourages the perception that soil carbon is an 'easy win'.

explores the possibility of Australian cropping systems continuing without the availability of glyphosate.

As well as the environmental and community factors driving the evolution of conservation agriculture, there are multiple practical and scientific constraints and drivers on the need to replace existing practice. In the third article Richard Dickmann, Head of Public and Government affairs at Bayer Australia, outlines the plant science industry's involvement in the development of conservation agriculture practices and forecasts how such companies are likely to evolve.

Hugh Beckie, Ken Flower and Michael Ashworth from the Australian Herbicide Resistance Initiative model the impact that farming without glyphosate would have on the Australian agri-food sector. They conclude that profitable farming without glyphosate, using non-herbicidal weed management practices combined with effective pre-emergent herbicides, is possible; however, significant practice change would be required and maintaining low weed seed banks would be a challenge.

The plant science industry has been crucial in the development of chemically-reliant conservation agriculture through the development of safe, broad-spectrum herbicides and herbicide-tolerant crops. However, the development of wide-scale chemically-resistant weeds is a fundamental challenge to this system.

In the final paper of this Journal, Michael Walsh from the University of Sydney further explores the possibilities for farming systems to evolve without glyphosate. Michael details new technologies which allow site-specific control of weeds both chemically and non-chemically. Physical weed control technologies targeted to individual weeds (both in crop and in fallow) will allow substantial reductions in weed control costs without reliance on herbicides.

The author contends that the future role of the plant science industry in conservation agriculture will be focused on more integrated, biological and regenerative systems than it has been in the past, as learnings from practices that led to weed resistance development are incorporated in new strategies.

While farming systems have always evolved, and will continue to evolve, there is a heightened sense of urgency amongst practitioners of conservation agriculture on the need for new, profitable, productive and sustainable methods of cropping. Environmental, societal and practical challenges to current practice are driving this clear need for change. The scientific community is actively engaged in this discussion and is working to provide Australian farmers with new facts and practices to ensure that Australian agriculture continues to thrive.

While research is underway on more integrated, less chemically-reliant farming

