



The digital age is here

New Zealand agriculture's past is marked by several major breakthroughs that delivered substantial gains in productivity behind the farm gate. **Tony Leggett** explores where the sector's next productivity boost will come from and finds success will require a leap of faith for many.

History shows Kiwi farmers are clever at finding new ways to produce more from less. Fortunately, Kiwi ingenuity has always thrived in the agriculture sector. Think of the ubiquitous electric fence unit ticking away in the shed or the newer solar-powered unit on the back flats where a cheap form of subdivision helps improve livestock performance. Or the world-first milk meters developed to measure individual cow output, which have revolutionised the performance of our national dairy herd.

Consider the early 1950s when some brave souls started applying superphosphate on hill country from a Tiger Moth instead of by-hand from sacks or shovelled off the back of a horse-drawn dray. Follow that with subdivision and scrub clearing in the 1970s and the result was hugely increased carrying capacities, helped by cheap loans and subsidies to increase



“The real gains from digital technologies will come from the complete digital transformation of existing farm operating models.”

PAUL CLARK, WESTPAC INDUSTRY ECONOMIST

stock numbers. Think of how quad bikes and now side-by-sides have helped shift farming into top gear, shifting loads of gear and dogs around at pace with less track damage than tractors or the faithful ‘Landy’.

Indeed, productivity growth in the NZ agriculture sector has easily outperformed other sectors of the economy. However, growth has slowed in recent years, in spite of ongoing investment in mechanisation and, more recently, innovative digital technologies.

In his recent paper *Keeping ahead of the pack – pushing agriculture to new heights*, Westpac industry economist Paul Clark says mechanisation and innovation – supported by investment, research and development – has helped to lift productivity through the adoption of improved onfarm land management practices, advanced genetics for animals and better-quality pastures.

But Clark says to feed the hunger for more productivity in the future, new digital technologies and tools at farm level will deliver the innovation required.

Referred to as ‘smart farming’, farming in the future will increasingly require farmers to adopt new connected digital technologies that enable real-time monitoring, measurement and analysis of onfarm performance, plus the optimisation of farming practice.

Think of sensors above and below ground constantly collecting soil moisture and humidity data, which are connected to an irrigator to trigger the next application cycle. Or the monitoring device sitting in a water or fuel tank that

triggers alerts to a mobile phone when it falls to a pre-set level.

Other examples are drones with infrared technology flying a pre-set path over crops to determine their disease risk, or electronic ear tags to monitor the health of individual animals in the herd – all in real time. Satellite or drone imagery is also proving useful for large scale measurement of moisture, temperature and nutrient levels.

Smart farming also offers the ability to turn real-time data into actions. This requires data analytics to predict a future view, considerably more useful to farmers than the historical view that a simple spreadsheet provides. Clark notes that better forecasts lead to improved activity planning and optimised farming practices.

When artificial intelligence (AI), robotics and the Internet of Things (IoT) are used together, farming practices can be automated.

Robotic fruit picking and packing, crop planting and harvesting, milking cows or detection of heat or health issues in cows, assigning parentage in sheep flocks using facial recognition technology linked to cameras in lambing paddocks or accurate mapping the land use capability of farms from the sky above – the list is growing. AgResearch currently has more than 50 projects underway that have AI at their core.

However, this signals a major shift away from the past when farmers invested in new machinery that came with the latest clever kit already built in. Clark says future productivity gains will only be captured by farmers if they are

prepared to completely transform their existing farm operating models. “That requires the complete overhaul of how farms operate. Those who can grasp the nettle will be more competitive than those who don’t,” he says.

Adopting new digital technologies could be really challenging for many farmers. “That is especially so given that most farming operations are small and tend to be operationally focused, and rely on the tried and trusted. Digital transformation is not just costly, it can also be really disruptive,” Clark says.

When Agritech New Zealand explored barriers to adopting new technologies among farmers, just over half those surveyed said cost of implementation was the biggest factor holding back adoption. Already having a manual system in place that works was the second biggest reason, followed by a need to see proof of return on investment, and fourthly, poor internet capacity at the farm.

Clark is unsurprised that cost is a significant barrier to adoption of new technologies. “Adoption often involves significant, upfront investment, which can be prohibitive, especially when returns on that investment are uncertain or take time to materialise. Most farmers require proof of return on investment before taking the plunge and will typically follow the lead of others that have done so.”

Several companies in the tech space now offer products to farmers on a monthly or annual subscription basis to reduce the upfront cost. Many farmers



are also concerned about data sharing and privacy, leading to a reluctance to invest in new technologies.

The other challenge is building knowledge and skills to operate the new technologies so they gain the most benefit from the investment required to install them. Clark says there is a role for educators to step in and help farmers build their understanding of what technologies are able to provide greater productivity gains for them.

technologies can deliver smarter and faster operations that not only make their lives easier, but also more productive.”

Gains made in other areas like genomics, DNA sequencing and genome editing technologies are also being applied to improve performance, and build the resilience of crops and livestock to help farmers deal with the globe’s biggest impact on agriculture – climate change.

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BRENDAN O’CONNELL, AGRITECH NEW ZEALAND

He suggests creating innovation ‘ecosystems’ that facilitate knowledge transfer between farmers and the wider agricultural sector, including farm consultants, research institutes and universities. “Education is also becoming increasingly important as farmers seek to bridge their lack of understanding of how digital

Given the contribution of agriculture to the country’s greenhouse gas profile, a game changer for livestock farmers will be the release of products that reduce methane output. Several private sector and government-funded programmes are underway in New Zealand, some in collaboration with developers in other countries.

THE INTERFACE BETWEEN TECHNOLOGY AND FARMERS

At the centre of the conversation on new technology developments in the sector is Agritech New Zealand chief executive Brendan O’Connell, who understands the need to keep new products simple to apply at farm level.

Before setting up as a technology consultant, Ireland-born O’Connell trained as a mechanical engineer and worked for Tru-Test on a range of clever products for farming after emigrating to NZ more than 20 years ago.

“Everyone’s heard the old adage used by many companies, which is you can’t manage what you don’t measure. So, by being able to measure things in a new way means you can definitely decide to behave differently,” he says.

An example is animal identification and traceability, initially developed for biosecurity purposes. “But now we can attach other more explicit measurements for growth, health, and movement, which ultimately leads to more productivity per animal,” he says.

O’Connell says the technologies are there to provide greater control by processing data, collected automatically, into a more useable form so farmers can make better decisions. However, he does suggest that as a sector, companies often focus more on the technology and not enough on its application. Unlocking greater uptake of new technologies is

LEFT Drones are just one example of technology farmers can implement onfarm.

challenging. “I’m always fascinated by the use of the word adoption in this area. Adoption is different to a (purchase) transaction; adoption is an ongoing relationship.”

He learned from his time at Tru-Test that farming is a game of limiting factors. Farmers know what is constraining their business and will seek tools and solutions to overcome those constraints. This means forming a relationship with suppliers to solve those onfarm problems. “Adoption is all about process and behaviour change. Compared to other countries, NZ farmers actually have good levels of adoption of new technologies.”

A recent survey of growers and farmers showed about 12% fit into a ‘trail blazer’ group who are attracted to new technology and willing to test it out. Behind that group, is a much larger mass of farmers and growers who O’Connell says are extremely pragmatic about how they apply new technologies behind the gate.

They are still open to finding new things, but they set the bar high when they consider ‘will this deliver a benefit to my property?’

Not surprisingly, O’Connell believes there is a huge opportunity for farmers and growers to adopt new technology that uses AI. “People talk about AI having more impact on humanity than electricity has, so it’s exciting and scary at the same time. I am an optimist, I see the power of AI being determined by the direction we take with it and the quality of the questions we ask of it.”

The agri-technology sector is growing. Agritech New Zealand says there are between 700 and 900 firms operating in the agri-tech sector and they generate revenue of between \$2 billion and \$3b per year. Most are concentrated in data analytics, post-harvest management, and animal and crop health. Many are startups too. 

NEW SOLUTIONS NEEDED NOW FOR UNDER-PRESSURE SECTOR

Drystock farmers can’t afford to wait for farm gate prices to recover to restore profitability, says Wairarapa farm consultant Ed Harrison (pictured), of BakerAg. They need new technologies and systems that will deliver solutions they can apply immediately. “The reality is that even if sheepmeat prices returned to the longer-term average, the terms of trading in farming will not go back to where they were because operational costs and interest rate costs have reset at a higher level.”

Harrison says it is no longer enough to be a ‘good farmer’ because even the best performers are battling to break even, especially if there is debt on the balance sheet.

He sees a strong need for adaptation and innovation to achieve more productivity. “Our previous generations set the benchmark for creating transformational change. Breakthroughs back in the 50s or 60s like flying on superphosphate and subdivision brought a step-change in productivity.

“Following the removal of subsidies in the 80s, the work done in animal breeding and the farm system space saw onfarm efficiency and reproduction go through the roof.”

Harrison feels the energy to innovate, test new systems and approach problems differently has been stifled in the past five years, diverted into dealing with the “avalanche” of compliance demand on farm businesses.

“Fortunately, the new government has created some breathing space in the regulatory environment but our industry has to use that time to take stock of the new terms of trade that we now face and develop new technologies and strategies to cope with that environment.”

He wants the focus to be on finding innovative ways to gain better efficiency from staff, apply fertiliser more efficiently; combat the rising animal health challenges like drench resistance, determine which genetics will deliver what our markets want and which stock policies will perform best in the lower input, more climatically challenging times ahead.

The fundamentals of productive farm infrastructure (soil fertility, subdivision and water) and the input key productive inputs (people, cropping and animal health) remain unchanged. “We just need to take these to the next level.”

His suggestions for technologies that could deliver another step change in productivity include ‘fenceless’ farm technologies like the dairy solution provided by Halter; a phone application decision tool which shows ‘hot-spots’ of worm larval challenge by paddock to help farmers plan stock movements, and development of products to give greater precision and concentration when applying soil nutrients.

“Superphosphate has been around for decades, and it’s been a fantastic product, but I’m concerned that we have seen very little enhancement since it was first introduced. It costs a lot to buy, truck and apply, so I’m asking the question ‘is there something else that would deliver the required nutrients in a more effective way?’”

Earlier this year, BakerAg called for the establishment of an apolitical, independent ‘innovation think-tank’ to help farmers capture new efficiencies from their land and resources. Harrison says the concept drew some support from the farming community and agribusinesses, but lacked the momentum to progress it further.

