

ground

EFFECT

Autumn 2020
EDITION 10

Celebrating
10
Editions of Ground Effect®

"We have a huge problem to solve and we need every tool in the toolbox."

Warrick James,
Flagpole

Cycling and protection of soil carbon

Everything you need to know about soil carbon

Fodder focus

Maximising canopy size



NORTH CANTERBURY PGP RESEARCH FARM
STONYHURST GLOWS IN THE EVENING SUN.

Welcome to the 10th edition of Ground Effect[®] from Ravensdown

We've reached our 10th edition of Ground Effect and there's no sign of a shortage of smarter farming stories!

The editorial team putting together this magazine deserves a pat on the back. The feedback we get about a publication that focuses on agri science and real farmer insights is universally positive. Indeed, the need for such a publication only seems to have increased! However, it wouldn't be a scientific publication without testing its rigour and so we'd be grateful if you could take the time to fill out our quick online survey (see the back page) to make sure we're creating valuable content for you and your business.

Perhaps it's no surprise that climate change mitigation features prominently in this edition.

Dr Harry Clark, head of the New Zealand Agricultural Greenhouse Gas Research Centre, kicks things off by looking at mitigation options being researched for farmers, including breeding low-emitting cattle, feed alternatives and inhibitors. Drs Robyn Dynes and Tony Van der Weerden and Professor Louis Schipper bring it home by talking about how soil carbon is cycled, where our GHGs come from and the climate tools we are already using.

Farmers working hard to minimise soil disturbance include: Richard Peckitt in South Canterbury, Cece and Warrick James in Mid-Canterbury and David Wordsworth in Northland.

Then we take a look at the big picture of where the future of food is heading with Dr John Penno, Agri Food scientist Frederic Leroy (recent Beef & Lamb NZ guest speaker) and social scientist Martin Cohen.

Our bread and butter is agri science and advice and there's a considerable range in our 10th edition. Topics covering such things as our Pioneering to Precision programme's progress, research farms and future plans; N-Protect as a climate tool, the efficiencies of Whole Farm Soil Testing, mitigating our phosphorus loss on farm and taking a deep dive into one of our most essential nutrients – nitrogen.

Something that is close to my heart and features prominently



here is wellbeing. We want everyone to come home from their jobs happy and healthy. We understand that this is becoming a challenge so you'll find some insights and advice from YOLO Farmer's Wayne Langford, Hummingly (Resilience) and Farmstrong.

I hope you enjoy this special 10th edition of Ground Effect. Please let us know if there's anything you'd like covered in future editions.

Best regards

Greg Campbell

Ravensdown Chief Executive

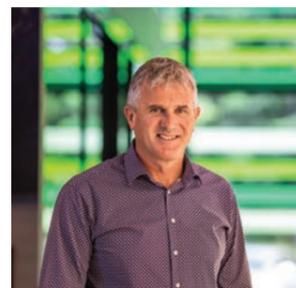
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Smart nutrients

AgResearch scientists, Laura Villamizar and David Wright are developing a new polymer coating for Ravensdown's superphosphate to better control the release of the phosphate that will compliment the trusty 'Four Rs' of good fertiliser management - placing the right amount of the right nutrient in the right place at the right time.



Practical on-farm insights

Ravensdown's Clare Buchanan splits her time as environmental consultant for the co-operative's dedicated team and demonstration manager for SIDDC at the Lincoln University Demonstration Farm. She recently presented at the October Focus Day for LUDF about the farm's pasture monitoring programme, which recently introduced LIC's SPACE satellite imagery to get pasture growth readings in addition to its weekly plate metering. They are in the process of getting the C-Dax

pasture robot up and running as well and once all three are operating they will compare the results on a weekly basis to present to the public.



Fonterra Open Gates Day

Fonterra Open Gates Day at White Gold, Kelsie Farm, owned by Dave and Carrie Irvine was attended by close to 800 people, including Ravensdown staff. Jane Garrett, Mike Manning, Gavin Palmer, Eilish Burrows, Hannah Perkin and Sonya Perkin were there showcasing the farm's whole farm soil testing map and fertiliser plan as well as the proof of placement map, and the brand new spreading truck. Hannah and Eilish spent the day helping families have a virtual Ravensdown experience with the VR goggles.



The impact of pasture cover on thistles

Variegated thistles can severely reduce pasture production and cost hundreds of thousands of dollars to control by aerial herbicide application. Research trials were a result of a collaboration between Wi Pere Trust, Ravensdown and AgResearch on an East Coast property near Gisborne to quantify how pasture height affected thistle emergence, growth, survival and seed head production.

Results showed that thistle emergence was greatest from bare ground and from pasture maintained at 3cm (up to 70% of thistle seeds sown emerged in these treatments) by early June. Emergence declined consistently with increasing pasture height.

While there will always be droughts, dry ridges, stock camps and other reasons for bare areas on East Coast hillsides, this study has demonstrated that there are large benefits from maintaining pasture to reduce the presence of thistles.





"It might be a slow journey, but some of the world's finest scientific minds are leading the way."

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Science reveals promise on the horizon

By Dr Harry Clark, Director, New Zealand Agricultural Greenhouse Gas Research Centre (NZAGRC)



DR HARRY CLARK, DIRECTOR, NEW ZEALAND AGRICULTURAL GREENHOUSE GAS RESEARCH CENTRE (NZAGRC)

NZAGRC funds and co-ordinates a wide range of scientific research aimed at identifying potential solutions and testing their efficacy. Unfortunately, due to the complexity of New Zealand's farming systems, it's a slow journey, but we're moving in the right direction. On the next page I've summarised some of our most promising research. Firstly though, I must emphasise the painstaking process of gathering evidence to assess a possible new solution's viability, which can take several years.

Challenges to finding solutions

- Will it work consistently on all farms, or all animals, under all conditions?
- How long will it take to have an effect, and will it last?
- Will the beneficial effect on emissions of one greenhouse gas be countered by a detrimental effect on another ('pollution swapping')?
- Will animal productivity and health, or the food chain, be affected?

Beyond the science, important considerations remain:

- What will it cost farmers to adopt this solution?
- Will that cost compromise their bottom line - or even the national economy?
- How does this solution weigh up, in terms of cost, efficacy and societal impact, against options to reduce emissions of other greenhouse gases by other sectors?

These are some of the difficult questions we must answer as a nation, to determine the specific actions that farmers could take to reduce emissions. Rest assured, however, that the New Zealand science community, in collaboration with industry-good organisations and farmers themselves, is stepping up to its part of the challenge.

The Government and industry have invested heavily in research targeting reductions in emissions of the two main agricultural greenhouse gases; methane (which is mostly belched out by ruminant animals) and nitrous oxide (the result of micro-organisms acting on nitrogen in the soil).

"Some farmers have already done what they can, while others are limited by their unique climate, topography, markets and infrastructure."



Promising options on the horizon

Breeding low-emitting sheep and cattle

Some individual animals emit less methane than others, and scientists have confirmed this is a genetic trait. Good progress has been made in the sheep breeding programme, and incorporation into selection indices is likely during the early 2020s. Work on breeding low-emitting cattle is just beginning.

It might also be possible to breed animals that excrete less nitrogen.

Low-emission feeds

Although the primary driver of methane emissions is the quantity of feed eaten, the chemical make-up of feeds can have an influence. Different feeds can also influence the quantity of nitrogen deposited in urine and the chemical make-up of the urine.

For example, forage rape can reduce methane emissions by up to 30%. Plantain has been shown to reduce nitrogen leaching and nitrous oxide emissions. Fodder beet has also shown promising results. The benefits and applicability of alternative fodder crops such as these depend on specific farm systems, including when the feeds are used.

Methane inhibitors

A methane inhibitor is a chemical compound fed to an animal to reduce the activity of micro-organisms in its rumen that produce methane. It's highly likely that an inhibitor will be on the market by 2023. Usually an inhibitor has to be fed daily, making it unsuitable for many of our pasture-based farm systems. However, the development of slow-release formulations could change this.

Methane vaccines

A methane vaccine would, in theory, trigger an animal's immune system to generate antibodies in saliva that reduce

methane in a similar way to an inhibitor. A vaccine would be ideal for pasture-based systems, but its successful development is extremely challenging. At present, prototype vaccines work in the laboratory, but transferring that success into animals is proving elusive.

Nitrification inhibitors

Nitrification and urease inhibitors slow down the activity of micro-organisms residing in the soil that convert nitrogen contained in fertilisers and animal excreta into nitrate and nitrous oxide. A variety of compounds are being field-tested.

"It might be a slow journey, but some of the world's finest scientific minds are leading the way."

Work in each of these areas is making it very clear that not all farms have the same potential to reduce emissions. Some farmers have already done what they can, while others are limited by their unique climate, topography, markets and infrastructure.

It might be a slow journey, but some of the world's finest scientific minds are leading the way. Consulting officers, environment specialists, extension staff and other rural professionals are gearing up to help through a programme funded by the Ministry for Primary Industries and NZAGRC, and there will be regular updates on progress. ■

Unconsciously niche

Words and images by Victoria O'Sullivan

Finding a way to reduce agricultural emissions while feeding a growing population takes innovation. Using alternatives to traditional cultivation methods, such as strip-tillage, is one way farmers can reduce their carbon footprint without compromising yields.

On farmer Richard Peckitt's arable operation in South Canterbury, soil conservation comes first. Using a combination of crop rotations and specialised machinery for minimal soil disturbance, he aims to keep organic matter levels high and environmental impacts low.

Richard farms 540ha in the Levels Valley near Pleasant Point through a combination of ownership, leasing and share-farming. To plant his crops, he uses a Mzuri strip-till, which he imported from the UK in 2017.

Strip-till is a minimum tillage method where sub-soil legs work the soil to prepare a seed row. Lead tines on the machine cultivate rows of about 20-25cms, while seed and fertiliser are deposited from a hopper at the rear.

Strip-till machines help cut fossil fuel emissions through reduced passes and limit the emissions associated with soil disturbance. On the back of this, yields are increased through improved soil structure and increased soil organic matter. The sub-soiling legs allow free movement of the roots, while the system encourages water to move up and down the soil profile. Strip-till also allows nutrients to be placed in the seed zone, improving the efficiency of resources.

Richard has used direct drilling solidly for 16 years, after he saw the damage happening to the soils following a weather bomb in 2000.

"We had 163mm of rain in 50 hours," he says. "Long story short, the cattle pugged the fence line and at harvest time I could see [the yield drop] where every fence line had been from the combine [harvester]."

"That was really what drove me into direct drilling. We had also lost soil from a worked paddock, and I thought to myself, 'we just can't farm like this'."

RAVENSDOWN TECHNICAL AGRONOMIST CHRIS LOWE ASSESSES THE RAPE SEED CROP WITH FARMER RICHARD PECKITT.



"It all comes back to your environmental footprint and only applying as needed."

Richard grows milling wheat, feed barley, peas and oilseed rape, and is trialling areas of hemp and sunflowers. Oilseed rape is the main break crop grown on contract for premium food-oil producer Pure Oil. Richard says the market for New Zealand-produced rapeseed oil is growing - this season he will grow 120ha, which will be delivered to Pure Oil's crushing plant in Rolleston.

"The oilseed rape yielded quite well last year with a 4.5t/ha average across 90ha, so that was very pleasing," Richard says. "It peaked out at nearly 6t/ha in some areas and was our best crop by far."

Richard uses yield mapping on the combine, along with gut feeling, to decide which paddocks to soil test. With the strip-till method, fertiliser is applied with the seed at sowing.

"We put DAP near the seed and nothing else till spring, rather than putting it on in autumn and watching it flood out of the paddock [over winter]," he says. "It all comes back to your environmental footprint and only applying as needed."

Deep soil N testing results coupled with crop biomass readings have helped Richard and Ravensdown Technical Agronomist Chris Lowe to better pinpoint the oilseed rape's N needs. Richard mainly uses coated urea fertiliser N-Protect for crop side-dressings, as it ensures better efficiencies for plant uptake and limits N loss to the atmosphere.

"In the past Richard would have applied over 250kg N/ha," says Chris. "Now we are applying between 150-200kg N/ha because of a better understanding of crop architecture and canopy management. This will only improve in the future with digital applications."

Sulphur (S) is also key in producing a quality oil. "Pure Oil are noticing the colour of the oil is better - you get a better quality oil if the sulphur levels are good," says Richard.

He is very conscious of potash removal and will only sell straw if he can guarantee above-replacement value.

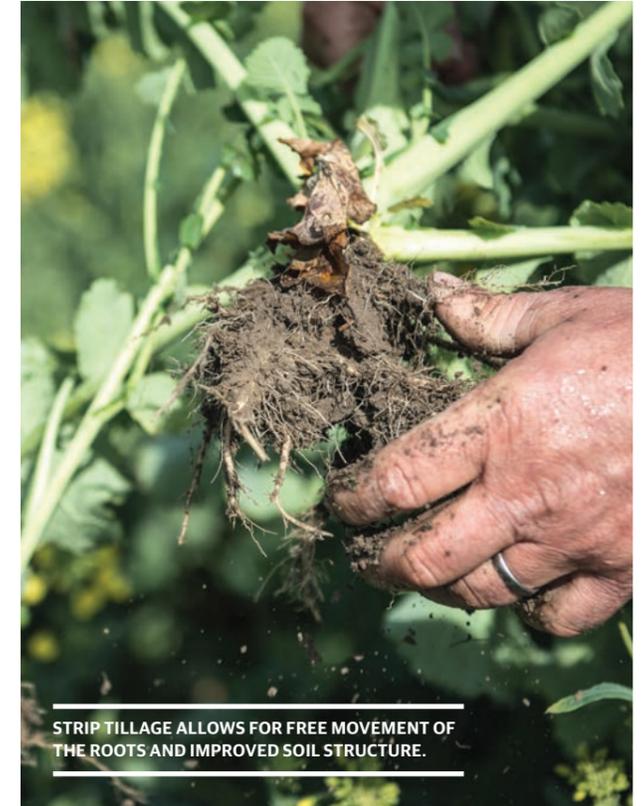
"We try not to burn, and only sell wheat straw if we can get the right money. We did end up burning some [paddocks] but long term, you don't want to rely on it."

He's also reluctant to address the challenges posed by aphids and slugs with chemicals; instead he's looking to establish a spring-sown break crop, which may then provide an opportunity to establish a cover crop such as ryegrass or crimson clover to take up N and improve soil structure.

"I had to burn a few paddocks last year and noticed less slug and aphid damage in those... but I don't want to go back to burning, which is why we'll look at break crops and change things up in a different way."

Meeting the markets

Richard says it wasn't a conscious decision to go towards producing more niche crops such as oilseed rape, but more a natural



STRIP TILLAGE ALLOWS FOR FREE MOVEMENT OF THE ROOTS AND IMPROVED SOIL STRUCTURE.

progression to answer evolving consumer demands. The change happened when he became a shareholder and supplier of milling wheat to Farmers Mill in Timaru, which manufactures and markets high-quality flour and specialty grains grown in South Canterbury.

"I had always considered myself a broad-acre commodities producer," he says. "I grew up in a system in the UK where you just produced, and you had people coming through your door wanting to buy your product. Without realising it, we've gone into more niche products with a secure marketing line."

"It certainly makes it more interesting with growing what we're growing. Rather than just putting it on the truck and sending it out the gate we get feedback from the mill, and we get an insight into what they are doing and where it's going," Richard says. ■



What's good for the goose is good for the gander

Greg Ford talks to AgResearch's Dr Robyn Dynes about the mutual benefits of water quality tools for our climate.

It's the question on the tip of every dairy farmer's tongue: How can we reduce our greenhouse gas footprint?

The good news is there are already some options at farmers' disposal that've been scientifically proven to work. According to experts in the field, what many farmers don't know is that the tools are already being used extensively to improve water quality.

Farm Systems and Environment Science Impact Leader Dr Robyn Dynes says scientific evidence supports a correlation between lowering nitrate leaching and a reduction of farm methane and nitrous oxide levels.

There are exceptions to the rule, but scientists are now confident of what they've

long suspected; that running a farming operation with lower nitrate leaching results in the 'co-benefit' of lowering your greenhouse gas footprint. It's only now, after several years of data gathering and research, much of it now published in science journals, that the evidence is demonstrable.

Dr Dynes says: "Balancing your environmental footprint is good farming practice and the vast majority of farmers get that."

"The exciting thing about this co-benefit of reducing emissions and improving water quality using the same tools is that they're already widely used and really practical. It's things like reducing the application of nitrogen fertilisers, managing supplementary feed supplies and homegrown feed sources, and then adjusting the stocking rate to lower feed supply, they all reduce your emissions."

Other options include keeping your highest breeding-worth cows. Better genetics was always going to be part of farming cleaner and greener. But scientists are now also confident that reducing stocking numbers should not automatically decrease production levels. The key, Dr Dynes says, is maintaining and managing your pasture quality and quantity levels right through spring and early summer, and that when you find yourself in a feed deficit, you maintain the appetite drivers of your cows.

"That extra attention to detail pays off. It's a balancing act, as it is every year. The crucial period is that calving-to-balance-date phase, balance date being when feed grown exceeds demand from cows. There is

Existing climate tools

- Better genetics eg keep higher breeding-worth stock.
- Maintain and manage pasture quality and levels.
- Reduce nitrogen fertiliser application.
- Manage supplementary feed supplies & homegrown feed supplies.
- Adjust stocking rate to lower feed supply.

a myriad of variables, including monitoring when soil temperatures are high enough for nitrogen application. But with the right advice, farmers should be able to pull the right levers and lower their emissions."

There are, as with any business, risks. Investing in a feed pad can improve water quality, but can in some instances lead to an increase in emissions. This is known as pollution swapping. To negate this risk, farmers need to make sure their effluent disposal strategies are sound.

"We have data now that's proving farms are still able to maintain production. We simply need to keep optimising feed per hectare to farm within water quality and greenhouse gas emissions limits," Dr Dynes says. ■

"The exciting thing about this co-benefit of reducing emissions and improving water quality using the same tools is that they're already widely used and really practical."

What's happening under the hood?

By Dr Tony van der Weerden, AgResearch Science Impact Leader Climate Change



DR TONY VAN DER WEERDEN, AGRESEARCH FARM SYSTEMS AND ENVIRONMENT SENIOR SCIENTIST

Farmers considering climate mitigation strategies for their farms need to "know their number" to make an informed decision. Dr Tony van der Weerden explains the main sources of greenhouse gases from livestock farms.

Knowing the basics of what's happening on your farm and how greenhouse gases are produced need not be complicated. Probably the first and most important thing to note regarding nitrous oxide and methane gases is the ratio between them.

The two gases are quite different. Nitrous oxide lasts for more than 100 years, whereas methane is short-lived with a lower potential to warm the atmosphere. But in terms of a livestock farm's greenhouse gas footprint, methane is equally important because it represents nearly 80% of total emissions, and most of that is coming from enteric fermentation from ruminant animals.

Methanogens not methane

Pasture-fed ruminants (cows, sheep and deer) host microbes in the rumen, which is the first and largest part of the multi-chambered stomach. These microbes, when digesting feed for energy, create two waste by-products, carbon dioxide and hydrogen. Methanogens also live in the rumen, and they consume these gases as an energy source for themselves, turning them into methane, which enters the atmosphere via animal belches. In a nutshell, this is how livestock farms produce 80% of their greenhouse gases.

Small amounts of methane are also produced from dung pats and effluent ponds, but it's methanogens, rather than the animals, that are the culprit. It's one of the biggest misconceptions out there.

Nitrous oxide

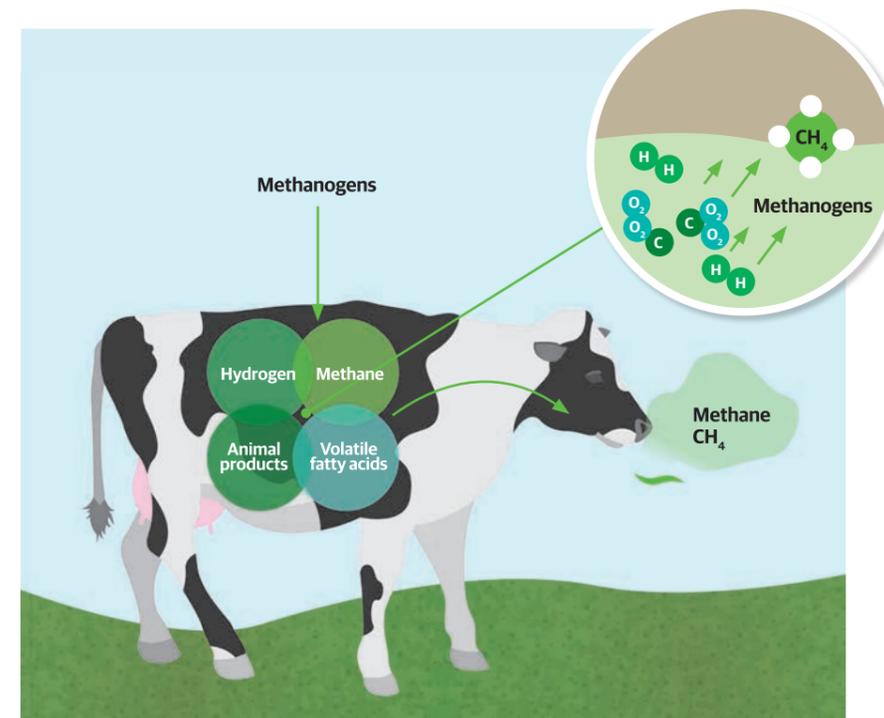
Nitrous oxide accounts for the remaining 20% of farm emissions, predominantly coming from soils that have been affected by livestock urine, with nitrogen fertilisers coming in second.

Livestock excrete too much nitrogen in urine for pasture to utilise, so the soil microbes convert some of it into nitrous oxide. Additionally, nitrogen can volatilise from the soil surface as ammonia, or, when soils drain, can leach through the soil as a nitrate, with some of that also being converted to nitrous oxide.

Simple right? While scientific terms can be a turn off, methane and nitrous oxide are now part of the climate change lexicon, as is

the term "carbon dioxide equivalents", designed to standardise emissions targets. Carbon dioxide equivalents, or t CO₂e, convert all gases into a baseline number to give everyone a point of reference for comparison. Ironically, direct emissions of carbon dioxide from agriculture are relatively small when compared to methane and nitrous oxide. An average dairy farm produces 10t CO₂e per hectare every year and can range between 3-20 tonnes depending on farm intensification. Sheep and beef farms emit an average of 3t CO₂e per hectare, while cropping farms range between 0.5 to 2t CO₂e per hectare depending on how much fertiliser is used.

To ensure you're picking the right mitigation option for your farm you need to understand where the emissions come from. A good place to start is to work with your farm advisor to model scenarios and, where possible, consider multiple mitigation strategies to really make a difference. ■



FAO REDUCING ENTERIC METHANE FOR IMPROVING FOOD SECURITY AND LIVELIHOODS!

(1) see Source Code page 56



Carbon farming provides diversity

"There is a lot of criticism of pines, but we have a huge problem to solve and we need every tool in the toolbox."

Carbon farming is providing options for the James family, alongside their sheep and beef operation in Canterbury.

It was 2007 when Warrick and Cece James became disillusioned with the returns coming out of the sheep, beef and deer industry and decided they needed a fresh start. Selling their family farm in Springfield, they took time to investigate their options and two years later purchased Flagpole, which borders the Selwyn Gorge. Flagpole had the diversity they were looking for in the 1,300 hectare beef and sheep operation, which they were still passionate about, and a forestry block.

Flagpole's nine-year-old trees had been planted post 1989, qualifying to be sold for carbon credits, which helped the James family buy the farm before the market collapsed due to a flux of cheaper carbon credits available overseas.

The block of radiata pine and Douglas fir are registered in the Permanent Forestry Sink Initiative.

"There is a lot of criticism of pines, but we have a huge problem to solve and we need every tool in the toolbox," Warrick says. "The trees aren't the total answer, but they serve as a sticking plaster in the short term, offsetting our carbon liability until we get a reduction in carbon emissions. The bonus is that it's probably our most profitable enterprise and it's being produced off the most marginal part of the farm.

"I must emphasise that you must only put trees on marginal land. You don't know what's coming with regards to the future of farming, but once trees are planted on hill country there is no going back."



CECE, PHOEBE AND WARRICK JAMES AT FLAGPOLE, WHICH BORDERS THE SELWYN GORGE.



"That's why we use companies like Ravensdown who help us with solutions and advice."

How carbon farming works

First you must choose what system you will use – permanent or harvest? Warrick was advised to go permanent because the block hadn't had any thinning or silviculture done and the location was too difficult to get the trees out. Warrick adds that permanent also gets a premium, because its social licence is better due to its lighter touch on the environment.

To make carbon farming beneficial it's best to be over 100 hectares as MPI doesn't measure anything below that.

"Anything under 100 hectares is calculated off Lookup tables. With our exotic forest we're sequestering nearly twice the amount of carbon than what the tables were saying, so it's worth being at a scale that warrants physical measuring."

Pick your weapon: exotic or native?

Warrick and Cece grow exotic trees such as radiata pine, Douglas fir and Eucalyptus because they sequester more carbon, due to their ability to grow faster.

In a recent interview, Julie Collins, head of Te Rakau/Forestry New Zealand, compared the merits of native vs exotic, where native will store more carbon long term if left unharvested – compared with a typical pine (exotic) forest harvested every 28 years. However, because exotic forests generally grow faster than native forests, they sequester carbon at a higher rate, helping most in the short to medium term.

"Flagpole's annual rate of sequestration is about 41 tonnes per hectare per year for radiata pine, which is 2,065 tonnes over a 50-year period and 1,060 tonnes for Douglas firs. By comparison, a native forest at Flagpole would be sequestering six tonnes per

hectare per year which attributes to 300 tonnes over 50 years," Warrick says.

Right tree, right spot

Douglas fir – "They grow better in the shade; they can go higher in altitude. They like rainfall but not hot winds as their needles are quite fragile."

Radiata pine – "They are the hardiest, they are resilient to hot, dry conditions yet grow fast – sequestering a lot of carbon."

Eucalyptus – "They handle the dry well, a general all-rounder though they don't like the wind so much. They sequester as much carbon as the pine."

Managing risk

Fire and liability are the big ones, Warrick says. "If your trees burn, are chopped or fall, you incur a liability, which means you must pay all the earned carbon credits back. We've insured against that, but the rules are changing in the next two years, making it less onerous, in that you'll only have to replant and get it back to the same age before you can claim credits again."

"For non-permanent forests, liability works differently. The new rules of 'averaging' mean you can collect carbon for the first 18 years, then harvest after a 4-5-year stand-down period. If you replant you won't be liable. It works well in that you can claim an income all the way through the first rotation from carbon and then timber at felling."

To spread the risk, Warrick has planted on different properties and at different stages to give him a more sustainable income and a succession programme for his family.

Top three tips

1. Get good advice – Get a good consultant and good planters.
2. Marginal land – Only plant what doesn't earn or is uneconomic for other land use.
3. Don't skip steps – Develop the land properly. Don't skip or skimp on spraying, nursery care and good planting practices. Keep good fencing and pest management until the trees can hold their own.

What about 50 shades of green?

The concern is that the incentives to plant are going to drive mass planting of productive pastoral land, which will have long lasting consequences for provincial New Zealand.

"They've got a point," Warrick says. "Whole property planting is not the answer, but you can't stop people doing what they want to do on freehold land. When they launched the Billion Trees Programme in our woolshed last year, Ministers O'Connor and Jones were adamant they didn't want productive pastoral land used for trees."

Farming in a fishbowl

The James family's passion for farming and the lifestyle it offers is what keeps them going in the face of all the criticism farmers get around environmental issues.

"You've just got to do the best you can. There are a lot of uninformed people out there who want change overnight. While there's merit in what they're saying, sometimes they're a bit extreme and we need them to give us a break because we will get there. That's why we use companies like Ravensdown who help us with solutions and advice. Our daughter Phoebe is our agri manager and is never too far away to get some advice. She has done our Farm Environment Plan and has organised our baseline, so we're ready when the council requires it." ■



Warrick's toolbox

FARM

Flagpole

520ha – 624,000 radiata pine and Douglas fir (18 years) trees

Flagpole farm stats

- 1,300 hectares
- 1,900 Perendale ewes
- 700 hoggets
- 40 rams
- 130 Limousin cows
- 25 R2 heifers
- 25 R2 bulls
- 125 MS calves

FARM

Russell's flat

90 hectares grazing – Eucalyptus, Douglas fir and radiata (1-2-year-old)

Cycling and protection of soil carbon

By Professor Louis Schipper, University of Waikato



"These approaches not only act as a guardian against further contribution to greenhouse gases to the atmosphere but also support a healthy soil."

PROFESSOR LOUIS SCHIPPER, UNIVERSITY OF WAIKATO

Globally, soils contain more carbon than all terrestrial plants, animals, micro-organisms and carbon dioxide in the atmosphere combined. Therefore small changes in soil carbon stocks can increase or decrease atmospheric carbon dioxide, contributing to global warming.

Some soils, but not all, can gain carbon with a change in land use or management. In some parts of the world, such as New Zealand, holding onto soil carbon through careful land management is equally important. Maintaining (and possibly increasing) soil carbon is one of many production and environmental goals that New Zealand farmers have for carefully managing their land and making changes to their systems.

How is carbon cycled?

Plants continuously convert carbon dioxide to organic carbon compounds (like simple sugars) through photosynthesis to capture energy from the sun and create biomass (growth). A large proportion of this captured carbon is rapidly returned to the atmosphere as carbon dioxide by plant respiration.

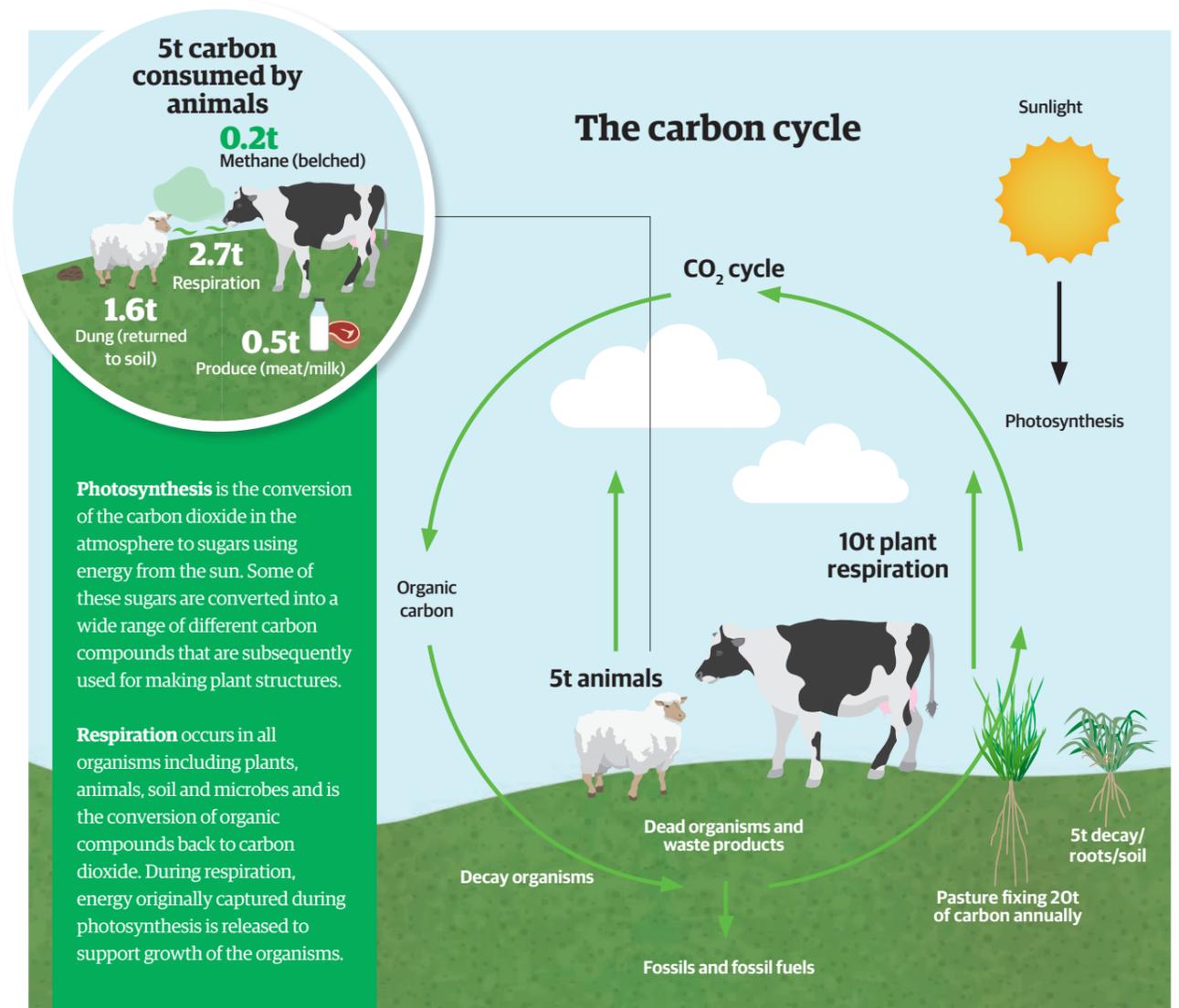
As plants grow, they store carbon in above-ground biomass and their roots. Growing roots release some of the captured carbon into the soil. Like leaves, roots also die, depositing dead cells below ground, which contributes to organic matter.

All this released carbon is a welcome food source (organic matter) for soil microbes which process the organic matter and rapidly respire it back to carbon dioxide. A small proportion of this below-ground

carbon can be stabilised as soil organic carbon but will slowly decompose with time and return to the atmosphere.

Further losses of captured carbon occur when above-ground biomass (pasture and crops, etc) is grazed and respired by animals or exported in products such as milk.

Whether carbon accumulates in the soil depends on a small difference between photosynthesis and all these different forms of respiration. Slightly more photosynthesis than respiration results in an increase in carbon, either in the plant biomass or in the soil. Alternatively, increased respiration relative to photosynthesis results in carbon losses. Forests can gain a lot of carbon in their biomass, but pastures don't, due to constant grazing by animals.



Land management matters

When land use is changed or new management practices are deployed, this balance can be upset with changes occurring to either or both carbon inputs and outputs^{1,2}. For example, imported feed can result in a small gain of soil carbon, despite most of the feed being consumed and respired by animals, as there is additional dung, containing carbon, deposited on soil that can become stabilised. Some changes are not intuitive; for example, increased pasture production following irrigation does not increase soil carbon in New Zealand, presumably because much of the extra growth is eaten, then converted to product or respired. Additionally, decomposition of soil carbon also increases as microbes are stimulated by water.

Soil carbon accumulation plateaus when land use and management are at a relatively steady state. The level of accumulation depends on the ability of different soils to 'protect' the carbon from microbial degradation.

Measuring changes in soil carbon stocks

Pragmatically, it is possible to measure change in carbon stocks through careful soil sampling, but it is important to remember that small changes would be considered important. A change of 2-3% of total carbon stocks in the top 0.6m would be equivalent to 2.4-3.6 t/ha of carbon in an average New Zealand soil. Consequently, any small sampling errors of variable soils could lead to farmers being misled by apparent gains or losses of soil carbon. It would also be critical to capture changes in the different soils found in any individual farm.

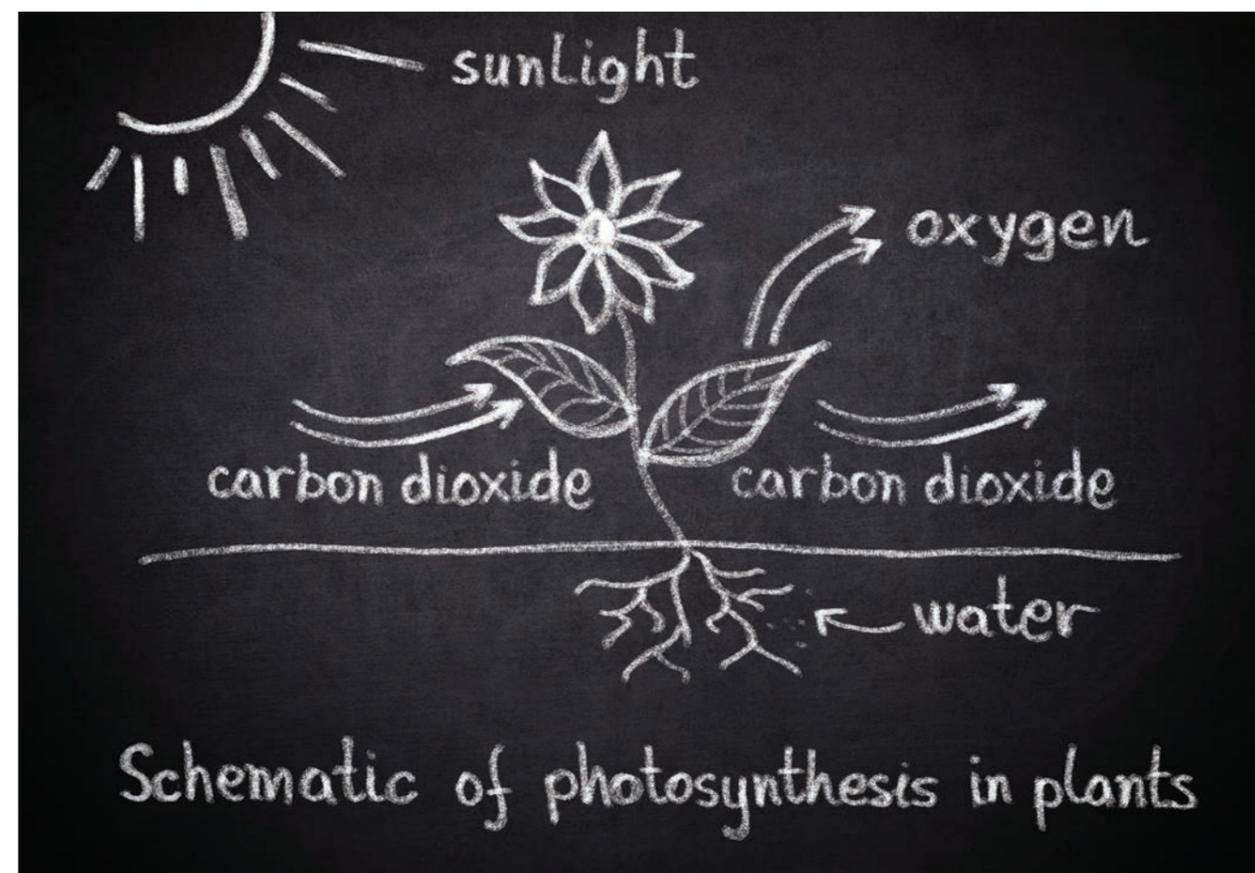
Manaaki Whenua - Landcare Research and the University of Waikato have designed sampling approaches that will allow detection of soil change at national and farm scales^{2,3}.

Another active research area is exploring management practices that increase soil carbon in pastures and protect existing stocks. These approaches not only act as a guardian against further contribution to greenhouse gases to the atmosphere but also support a healthy soil^{4,5}. ■

Soil carbon facts

- New Zealand pasture soils have relatively high carbon stocks, on average 120 t/ha in the top 0.3m.
- By comparison an ungrazed pasture sward contains about 1.3t of carbon per hectare and three cows contain about 0.25t of carbon.
- New Zealand pasture soils are less disturbed than many other parts of the world where there has been extensive cropping, and so have not lost carbon in the past.

"Some, but not all, soils can gain carbon with a change in land use or management."



(1,2,3,4,5) see Source Code page 56



NORTHLAND FARMER DAVID WORDSWORTH'S NO TILLAGE APPROACH

Farewell furrows: the benefits of no-till

For millennia, farming has meant cultivating the soil, digging up the earth in order to plant seeds. But these days, no-till systems are starting to catch on and nowhere more than in Northland. We talk to Dargaville's David Wordsworth about direct drilling.

"I've a bad case of iron disease," confesses David Wordsworth who farms 155ha just outside Dargaville. David is proudly showing his tow-behind direct-drilling equipment that has benefitted from seven years of tinkering. The impressive machine mixes just the right amount of fertiliser to place with the seed and can apply slug bait all in one pass.

Leaving the plough in the shed and avoiding turning the soil over each season offers huge benefits, but there are some trade-offs according to David who has operated as a successful contractor for 25 years.

Soil science and technology have moved on since the first plough. With today's precision equipment, seed, fertiliser quality and agrichemicals it's possible to drill the seed directly into the ground rather than cultivate and create rows and rows of bare earth.

As well as reducing the amount of carbon released (see pg 12-13 Ground Effect Spring 2017), avoiding cultivation means less labour, fuel and nutrient loss.

"Where soil erosion and P run-off are risks, it also makes sense. In Northland we have coastal effects with wind and water impacts on relatively sandy soils," David says.

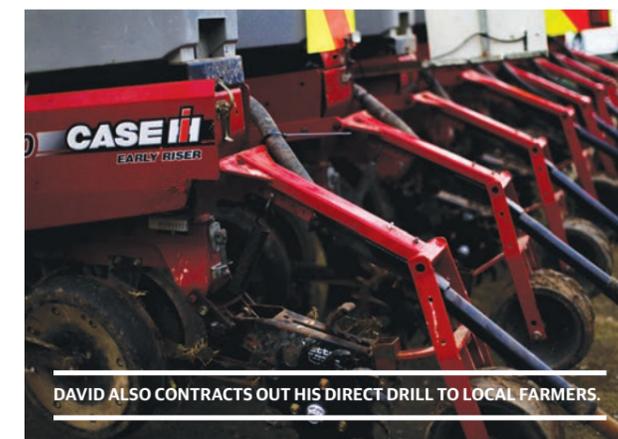
He grows 35ha of maize, 20ha of barley and runs 300 livestock for beef. When we visited, the barley crop was thriving from a soil bed covered with the remnants of the maize crop. The coverage of the old crop suppresses weeds, recycles nutrients and helps retain moisture. The catch crop acts as a feed when conditions are right.

"The goal is to always have something growing on that soil. This helps with organisms like worms, which can thrive rather than get turned into bird food. This in turn helps with the soil structure and of course, fertiliser use while sowing means less machinery rolling across and compacting soils."

Adjusting the fertiliser means just the right amount can be applied. There are no side dressings that risk burning the plant.

"It's certainly more precise than a side dressing or a helicopter job," David says. "The nutrient is right where the plant needs it, so there's no risk of it heading into a waterway and there's less risk of leaching because it's not being scattered at too high a rate."

Ravensdown Senior Agri Manager Carolyn Green explains that using a delayed-release product like N-Control 75 accommodates the changing needs of the plant for nitrogen uptake during its growth cycle.



DAVID ALSO CONTRACTS OUT HIS DIRECT DRILL TO LOCAL FARMERS.



“No-till may not be right for everyone. It may be enough to reduce tilling practices. Any step to minimise disturbance and reduce damage to the soil is a smarter step worth exploring.”

“There are several different forms of N such as sulphate of ammonia and N-Protect, which is proving popular if you’re expecting a dry patch - and up here that’s quite often!”

David will sometimes use a mix of DAP and Select along with N-Control 75, emphasising that fertiliser quality has got to be really good for this kind of task.

“Carolyn keeps us organised. I’ve known her from way back and she does a great job with soil tests, fertiliser plans and sorting orders, because you need to sort the seed, fertiliser and often slug bait like Endure at the same time. Together, we’ve had a pretty good run over the years.”

Glyphosate is used to spray out so the soil doesn’t need to be turned over and this year they’re trying granulated Glyphosate 680 Dry because there are fewer drums and it’s easier to handle.

The direct drill/no-till system is catching on. About two thirds of the planting jobs David works on are now no-till.

“There are definitely more farmers interested now because they have seen improved yields. But it’s fair to say there is still a little reluctance. This can come from having money tied up in cultivation equipment or being unwilling to take the leap and try something new.

“No-till may not be right for everyone. It may be enough to reduce tilling practices. Any step to minimise disturbance and reduce damage to the soil is a smarter step worth exploring,” David says. ■

Benefits of no-till systems:

- 1. Protect against soil erosion
- 2. Improve yields
- 3. Increase carbon in soils boosting micro-organisms
- 4. Reduce N and P leaching and run-off and avoid excessive nutrients
- 5. Better weed suppression



DECOMPOSING MAIZE STUBBLE MAKES IDEAL WORM FOOD AND WORKS WELL AS A WEED MAT.

Problem

A maize silage crop removes upwards of 200kg N/ha from soil. It is impractical to load this much N up front, because it may leach during heavy rainfall periods, it has the potential to burn the seed and a side-dress application may scorch the crop, damaging the plants.

Solution

N-Control 75 polymer coating limits N losses through leaching in wet conditions by slowing down the transmission of nitrogen from the granule into the soil solution (see pg 18-19 in Ground Effect Spring 2016).



"If done well, plant and animal agriculture can be sustainable, regenerating the world's soils while providing the global population with quality nutrition."

The future of food

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Dr John Penno

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Professor Frederic Leroy and Dr Martin Cohen

Turning alternative proteins into opportunity

Dr John Penno has set up an alternative protein company, Leaft Foods, which works with the farming system to provide alternative income opportunities. He shares the concept with Ravensdown and his thoughts on the future of food production.

One of the greatest challenges facing the world today is being able to ensure the growing population has access to enough nutritious food that's produced in a sustainable way. Right now, we're seeing that the global food system is under increasing pressure to meet this challenge.

New Zealand's innovative farmers and business people have used Aotearoa New Zealand's natural advantages of climate and environment to create world-leading business models, especially in the production, manufacture and export of dairy, beef, lamb and wool commodities. Today, this strength is also our weakness. We're seeing an over-concentration of resources and capability in a few areas, which has the potential to cause major negative environmental impacts, especially in relation to our gas emissions on the climate and nitrogen loss on fresh water.

Environmental, ethical and health concerns are driving consumers to change their purchasing habits. Until very recently, meat was meat - from an animal. Now, with advanced technology that was previously reserved for use in pharmaceutical production, we're beginning to see proteins such as casein being produced from advanced fermentation processes - instead of from a cow. The demand for plant-based products is driving a significant shift

towards a more sustainable food production model.

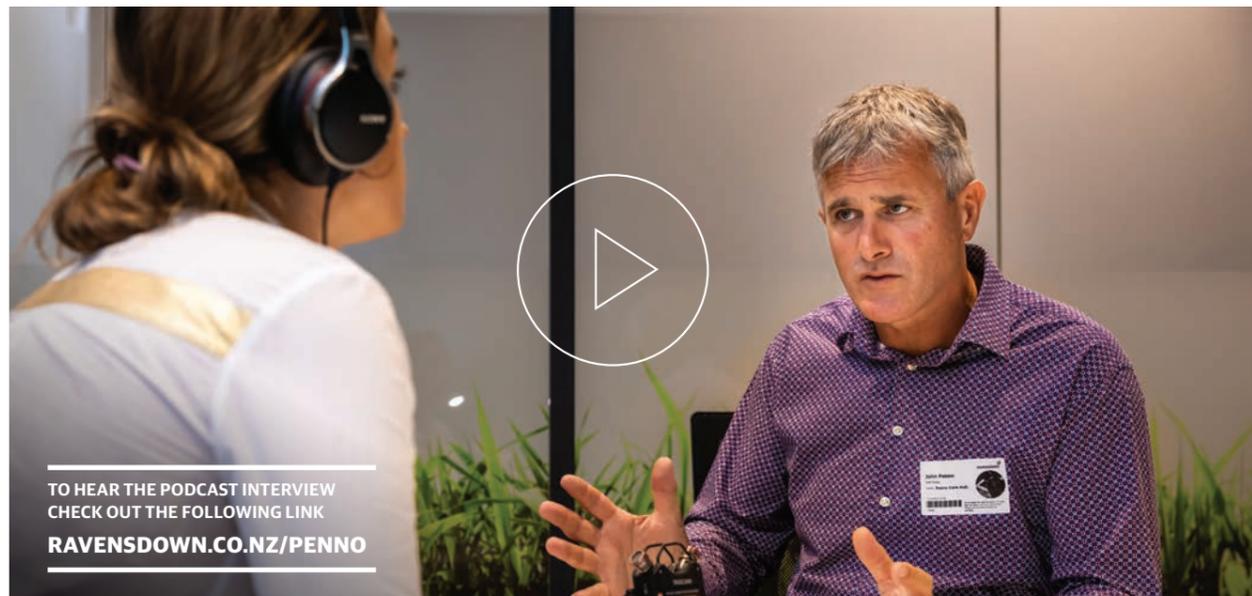
The future of New Zealand's food production has the potential to be quite different from what it is today, with a wider range of high-value products from multiple sources. There is a significant opportunity for New Zealand to harness advances in technology and innovation to transform the protein sector in a fundamental way.

My wife Maury and I founded Leaft Foods to do exactly that, be transformative. Rather than competing with traditional animal industries, we are looking to complement and enhance them.

We started experimenting in our own kitchen with the concept of a plant-based protein and decided that this idea was worth pursuing. Leaf protein has great nutritional value and excellent functional properties and is abundantly grown in crops familiar to Canterbury farmers. Investing in this new venture has been exciting, to be involved with new food-processing equipment and innovative technology, which has made it feasible for protein to be released from the cells and extracted in a readily digestible form.

The by-product is available to be fed to livestock with some of the protein removed - lessening the nitrogen that might otherwise be lost to the environment.

Our on-farm solution ensures that we are working with those who care for the land and practice sustainable farming. Right now, we are growing a highly innovative team to figure out the process for extracting these proteins and what new food products they can integrate into. We're looking for the best and brightest people to help us get there. ■

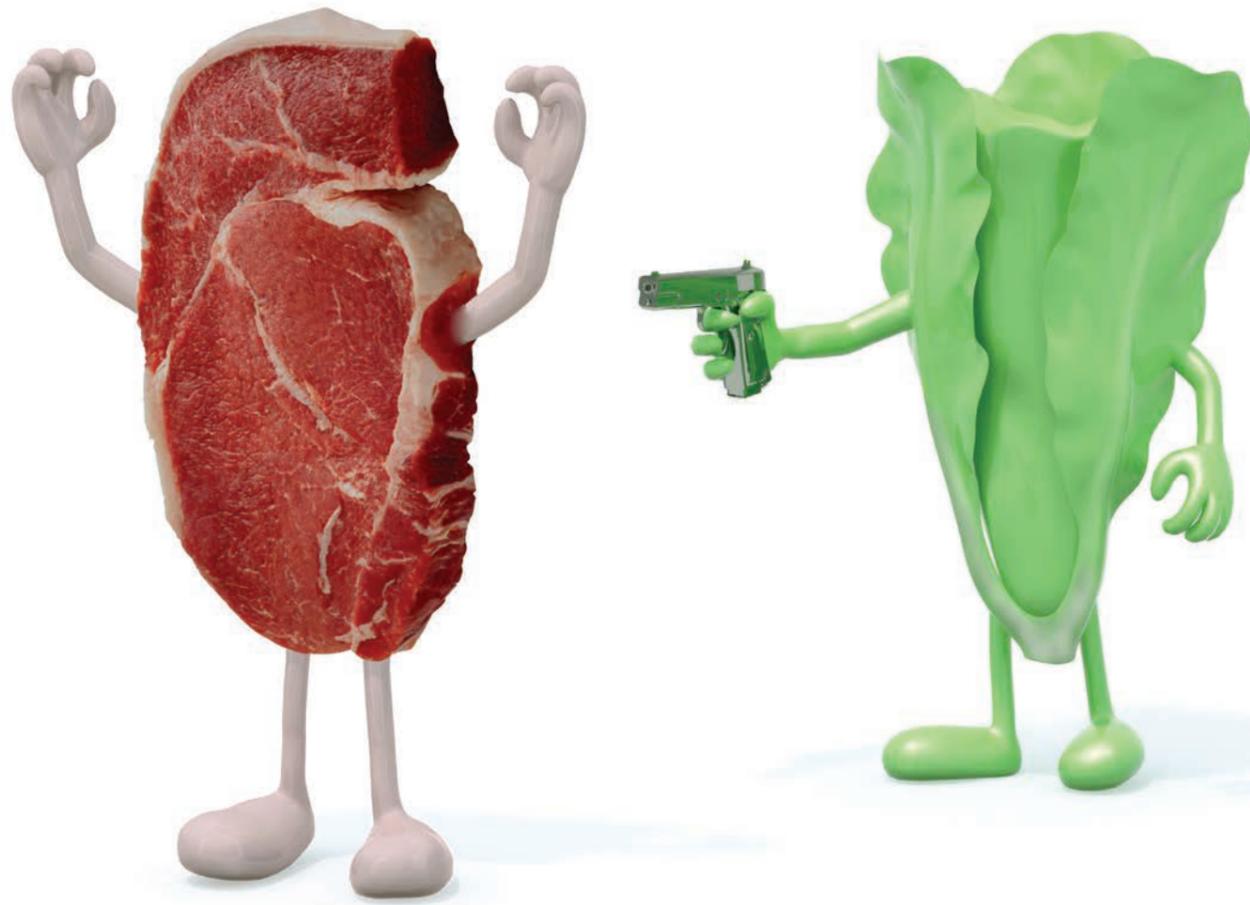


TO HEAR THE PODCAST INTERVIEW
CHECK OUT THE FOLLOWING LINK
[RAVENSDOWN.CO.NZ/PENNO](https://ravensdown.co.nz/penno)

JOHN PENNO OF ALTERNATIVE PROTEIN
COMPANY LEAFT FOODS



"The future of New Zealand's food production has the potential to be quite different from what it is today, with a wider range of high-value products from multiple sources."



We're told to panic

By Professor Frederic Leroy and Dr Martin Cohen

The animal vs plant debate heats up as a meat-free diet is pitched as a key climate solution. We get the perspectives of two European food and social scientists, Frederic Leroy (Belgium) and Martin Cohen (UK).

The 'narrative' of the animal versus plant debate has grown so strong that those still questioning the principle risk being labeled 'climate deniers', conspiracy theorists, and egoists - all on the wrong side of history.

While our enemy (CO₂) is out there terrorising the atmosphere, it resides within

each of us. Because every single one of our activities generates the dreaded gas, every breath we take adds to the problem.

So, let us prepare for a new age of carbon-neutral. On the way, there will be many temptations: building a house (and heating it), driving a car, buying clothes and washing them, using a smart phone, keeping pets, and - horror! - having children. For many, it may seem too much to give up.

And perhaps it's as well then, for an anxious world, that a scapegoat appears... **LIVESTOCK!** An excellent choice, as this has

not only been its historical role, it is also a very convenient option. Not sugar, nor refined starches and seed oils, far fewer doughnuts or nuggets, but animals have been chosen as the chief sacrifice of the Great Food Transformation. Regardless of the fact that animal foods were part of our evolutionary diets or the shaky nutritional science behind their demonisation, the flocks and fowls are now said to cause chronic disease and are destroying the planet. Haven't you heard that cows are worse than cars? Has not an Oxford academic said that eating a vegan diet is the

"single biggest way" to reduce our environmental impact? Hasn't a learned Harvard professor calculated that up to a third of early deaths could be prevented by everyone giving up meat?

Indeed, as a 'leading member' of the so-called EAT-Lancet 'Commission', this same professor has also designated a Planetary Health Diet that stipulates a daily ration of red meat ranging from a maximum of 14 grams to a virtuous ideal of zero.

Impossible? Unrealistic? Yet haven't the venerable universities of Cambridge and Coimbra banned red meat from their menus? Haven't the United Nations awarded "Champions of the Earth" status to two companies that not only produce vegan burgers but have adopted a mission to eliminate the need for livestock. Truly, animal foods must be evil, if ultra-processed foods like these are to be preferred.

To the point then

With so much authority behind this push to plant-based eating, the expected benefit must be huge, mustn't it? Yet, if a Westerner did decide to become vegetarian, his or her footprint would only decrease by 2-4%¹. That's something, but not much. Moreover, even this shift comes with trade-offs, it will include consequences that could potentially be troublesome on a nutritional level. Put another way, if the entire United States went livestock-free, and if the complex changes in land use really did work out as speculated, that would decrease emissions by 2.6%², while also causing a deficiency in essential nutrients. Is the price worth it?

Added to which, all this detracts from the critical issue of burning fossil fuels. Let's be clear: yes, we do have a global responsibility to provide sustainable diets to future generations. Yes, we are facing a planetary crisis. And, no, not all is well with animal agriculture in its present form. But the same can be said about plant agriculture. For example, trendy avocados that drain the water supplies of villages in Chile and cashew nuts that leave Indian women with acid burns. Think of palm oil and almonds, or the greenhouse apocalypse in Almeria.

"If done well, plant and animal agriculture can be sustainable, regenerating the world's soils while providing the global population with quality nutrition."

Think of soil-depleting, biodiversity-compromising, chemically boosted monocultures.

If done well, plant and animal agriculture can be sustainable, regenerating the world's soils while providing the global population with quality nutrition. But this is not about enough food quantity or about calories, or even protein, but about essential amino acids, vitamins and minerals. All too often, environmental comparisons are calculated per gram or per kilocalorie instead of per unit of true nutrition.

Giving up on livestock would deprive us of a range of exceptionally nutrient-dense foods and undermine our hopes for sustainable crop production³. Not to mention livestock's many other benefits. As the UN Food and Agriculture Organisation has pointed out, animal agriculture is perfectly compatible with sustainable development. Animals provide livelihoods, ecosystem services, manure, traction, use marginal land where crops can't thrive, and build topsoil. They may today be identified as the problem by think tanks and elites but, as Ethiopia's Minister of Agriculture wrote recently, they should be part of the solution instead.

Yes, there is work to be done to make animal agriculture truly sustainable, but it needs to be done through sound reform rather than the hubris of radical revolution. What is needed is a reconnection to traditional, holistic views on food systems updated with the best of science. What we don't need is media-spun quick fixes and high-tech fantasy. Systemic change is required, but a breakthrough will never be achieved by placing the guilt and shame on the shoulders of individuals. Nor, indeed, on the weary shoulders of our animal companions for that matter. ■



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MARTIN COHEN (UK) IS A SOCIAL SCIENTIST AND WRITER ON FOOD ISSUES. HIS MOST RECENT BOOK IS 'I THINK THEREFORE I EAT' (TURNER 2019) - TWITTER: @DCMARTINCOHEN

"Yet, if a Westerner did decide to become vegetarian, his or her carbon footprint would only decrease by 2-4%¹."

(1,2,3) see Source Code page 56



"There are higher demands on our natural resources, and we are set with the task of ensuring they are there for generations to come."

Smarter farming

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Effective collaboration for environmental gains

By Rebecca Hyde, Ravensdown Technical Discipline Lead and 2017 Nuffield Scholar

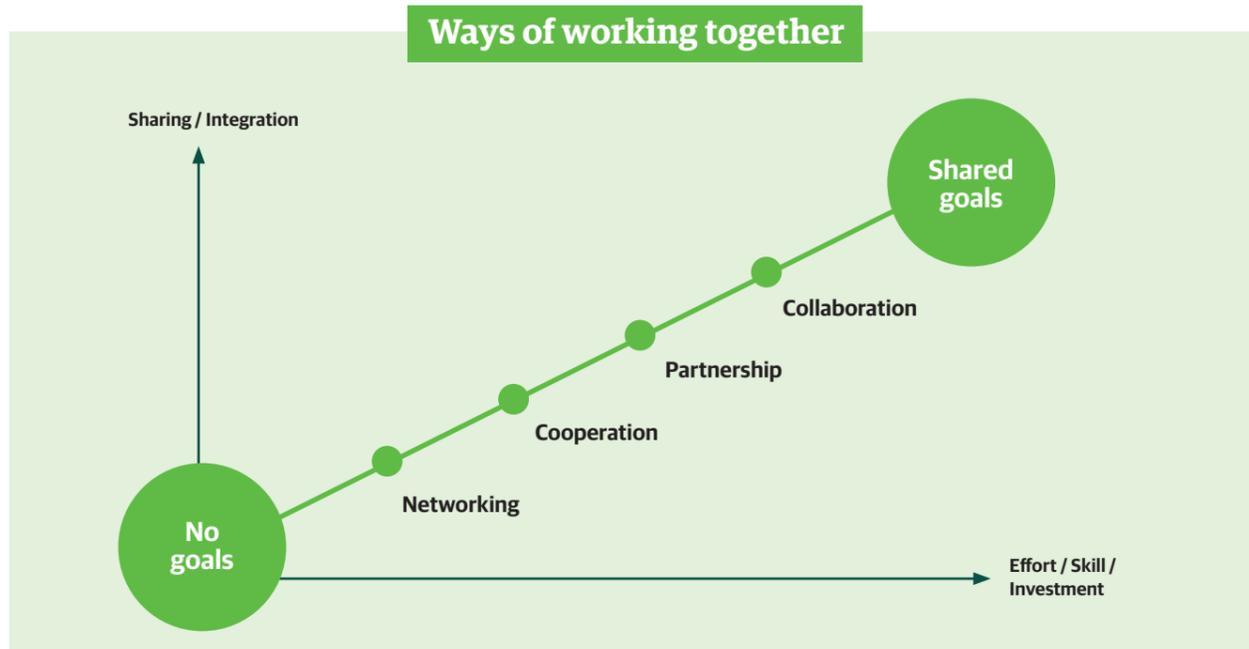


FIGURE 1: LEVEL OF COMMITMENT AND MUTUAL UNDERSTANDING BETWEEN EACH WAY OF WORKING TOGETHER.



REBECCA HYDE, RAVENSDOWN TECHNICAL DISCIPLINE LEAD AND 2017 NUFFIELD SCHOLAR

Collaboration brings previously separate organisations into a new structure with full commitment to a common mission. Partnerships is a formal relationship with an understanding of the common mission, but authority/accountability still rests with an individual organisation. Cooperation is an informal relationship where groups work alongside each other to achieve a common goal.

During my research and travels I met with collaborative practitioners, academics, community groups, national bodies and farmers to understand what effective collaboration looks like. Common themes began to appear; having a united voice, ensuring the right type of people are involved, determining if collaboration is required and having strong facilitation during the collaborative process.

United voice

The leaders of our primary industry need to set clear goals together and have a joint vision on what we want to achieve for our environmental management.

These relationships require comprehensive planning and well-defined communication channels operating on many levels. Authority is determined by the collaborative structure. Risk is much greater because each member of the collaboration contributes their own resources and reputation.

My Nuffield research looked to better understand what effective collaboration is and why we always talk about it in relation to environmental management. If collaboration is done correctly, a more durable and effective relationship is established.

What is collaboration?

There are key differences about the level of commitment and mutual understanding between collaboration, partnerships and cooperation.



"The leaders of our primary industry need to set clear goals together and have a joint vision on what we want to achieve for our environmental management."

Right type of people

Having the right type of person involved in the collaborative process is vital. The right type of person is someone who can create a movement, can understand where others involved are coming from and has the respect and mana of the people they represent. There is no room for egos in the collaborative process. There are five essential skills an individual involved in the collaborative process should have.

Strong facilitation

It is important to first establish the best way to work together. Facilitators can manage the difference in the group, yet move the group forward to make decisions. These facilitators need to be independent of the organisations involved in the regulatory process.

There is no doubt the world we live in today is constantly changing and increasing in complexity. There are higher demands on our natural resources, and we are set with the task of ensuring they are there for generations to come.

Farming and the environment will always go hand in hand. It is up to our primary sector to ensure we continue to learn and improve our farming practices to protect the environment we all live in. Effective collaboration is one of the tools that will enable us to achieve the outcomes we desire. ■

Five collaborative skills

Collaboration is not always necessary but if collaboration is the best option, the process needs to be committed to. It takes time and energy to build the required trust and respect, that is social capital, amongst the parties involved. If the foundation is not set and the time allowed to build trust, the goal will never be achieved.



FIGURE 2: FIVE ESSENTIAL SKILLS REQUIRED BY PEOPLE INVOLVED IN THE COLLABORATIVE PROCESS.

The Primary Sector Council's vision 'Fit for a better world'

Launched in December, the vision is intended to foster collaboration across the sector, government, communities and industry to take the Food and Fibre sector beyond compliance to world leading sustainable food producers who will be the benchmark of how we measure success.

You can find out more at fitforabetterworld.org.nz



Mitigating P-loss on sensitive areas

In New Zealand's soils, phosphorus does a great job at growing plants but unfortunately it does the same thing if it makes it into our water. Research aims to help farmers choose the right fertiliser for their type of land and apply it strategically, so it stays on the farm and out of waterways.

New Zealand farmers can keep up to 70% more phosphorus in their soil by understanding how nutrients move from land to water on their type of land, and where their Critical Source Areas (CSAs) are located. This knowledge can give farmers the confidence to choose the right fertiliser for their land type and apply it at the right rate, at the right time, and in the right place, so it stays on the farm and out of waterways.

That's a lot of 'rights' for one sentence – four in fact, known as the 4Rs of nutrient management.

In 2014, scientists from the International Plant Nutrition Institute – whose membership is made up of fertiliser companies – published the 4R Nutrient Stewardship guidelines for best

management practices for fertiliser use worldwide.¹

"Managing fertiliser well isn't expensive," says Professor Richard McDowell, Chief Scientist for Our Land and Water, one of 11 National Science Challenges that fund research into the biggest issues facing New Zealand.

"Farmers can halve the amount of phosphorus leaving their farm with minimal impact on farm profitability."

In New Zealand, the adverse consequences of inappropriate fertiliser use are increasing, making it even more important to follow the 4R guidelines.

"Here, intensive pastoral agriculture has expanded into areas at high risk of losing phosphorus," says Professor McDowell. "These high-risk areas include land with a moderate to high slope, regular and frequent rainfall, or with soil that has a low capacity to absorb phosphorus."

Professor McDowell is a phosphorus expert and prolific author of phosphorus research. He is co-author of a new paper² that provides a scientific basis for New Zealand and Australian farmers to choose the right fertiliser for their type of land and

apply it strategically, so it stays on the farm rather than draining away as pollution.

The research found that when fertiliser is managed badly, it's responsible for 30% to 80% of the phosphorus that drains away from a farm. When it's managed well, that can decrease to less than 10%.

The paper backs up and adds scientific credibility to the 4R concept for Australasian farmers.

"The research found that when fertiliser is managed badly, it's responsible for 30% to 80% of the phosphorus that drains away from a farm."

"When farmers understand how phosphorus moves from land to water on their type of land, they can be more confident in choosing the right type of fertiliser and optimising the application rate, timing and location," says Professor McDowell.

In 2014, Professor McDowell investigated the use of phosphorus mitigation strategies in 14 New Zealand catchments, and estimated that phosphorus loss could be halved for less than 2% of farm earnings before interest and tax.³

For the most efficient and cost-effective reductions in nutrient loss, he recommends farmers understand where the CSAs are on their farm and target mitigation strategies to those areas.

Research from Our Land and Water has shown that targeting mitigation actions to CSAs is six to seven times more cost-effective than an untargeted approach⁴, and that on-farm mitigations are working to decrease concentrations of phosphorus in streams and rivers.⁵

"Focusing on critical-source-area management within farm environment plans is helping to reduce phosphorus losses from land to water nationally," says Professor McDowell. Having a farm environment plan that is measurable and linked to catchment objectives is crucial, he says, so that landowners have the information they need, to know when and where to apply mitigations and make informed decisions about suitable land use.

The 4Rs

-  Apply the Right source of nutrients,
-  at the Right rate,
-  at the Right time,
-  and in the Right place.

(3,4,5,6) see Source Code page 56

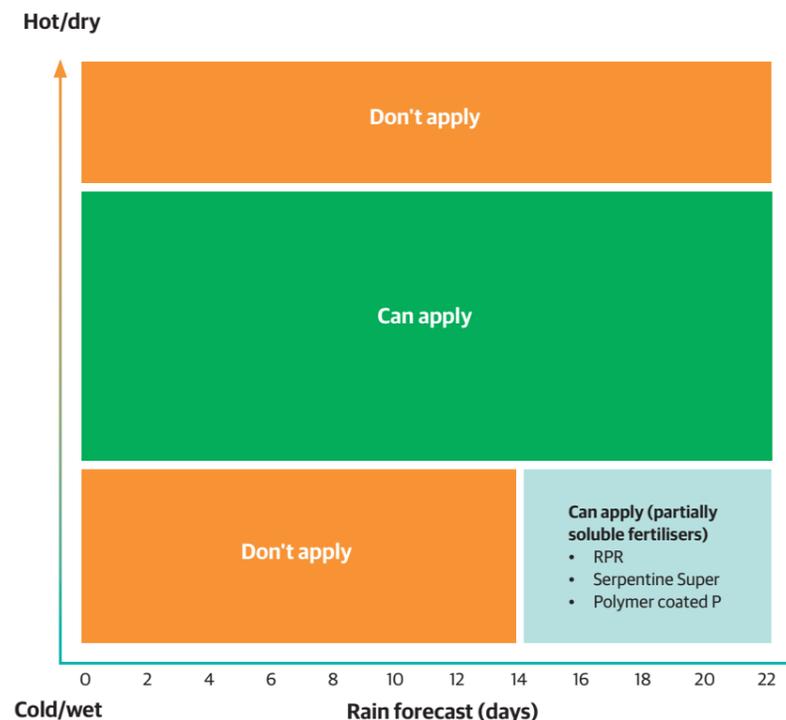


FIGURE 1: WHEN TO APPLY SUPERPHOSPHATE

Science-backed advice for application

When and where to apply?

- Apply annual fertilisers when the probability of surface run-off or leaching is lowest.
- Always avoid applying phosphorus-based fertiliser when rain is forecast within the next 14 days.
- Run-off can also occur in dry times of year when soils are hydrophobic. Soil water repellence is common during mid-summer to autumn on north slopes in the eastern regions of both islands, and in the central plateau.

What to apply?

- When run-off or leaching is unavoidable (for example, where rainfall is frequent or heavy enough to produce run off or leaching events year-round) consider applying a partially water-soluble phosphorus fertiliser, such as reactive phosphate rock (RPR), Serpentine Super or products coated with a polymer to control the rate of P release.
- Data shows that at a catchment scale, RPR can potentially decrease

phosphorus in streams by up to 58% compared with superphosphate.⁶ Other products, such as Serpentine Super, can also decrease losses by about 20–30% compared to superphosphate.

- A cautionary note: data shows that products such as RPR only produce the same amount of pasture as superphosphate when soil pH is <6 and rainfall is >800mm.
- In ideal conditions transitioning to RPR from superphosphate, replace a third of the superphosphate with RPR each year: 33% in year one, 66% in year two, and 100% in year three. ■

"When it's (fertiliser) managed well, that can decrease to less than 10%."

Thought Leader: Will Foley

NPS: creating a win-win-win

By Will Foley, Farmer and Hawke's Bay Regional Councillor



WILL FOLEY, FARMER AND HAWKE'S BAY REGIONAL COUNCILLOR

Hawke's Bay farmer Will Foley has had a bit of experience with environmental regulation. Recently elected to the Hawke's Bay Regional Council and a past Federated Farmers provincial president for Hawke's Bay, he talks about how the National Policy Statement (NPS) for Freshwater Management consultation document has been received in his neck of the woods.

Since the end of 2015, farmers in Central Hawke's Bay have had Tukituki Plan Change 6 in operation, with various regulations rolling out over the years, including stock exclusion, nutrient leaching caps and minimum river flows, amongst others.

Farmers in my region have had time to get their heads around these regulations, produce their Farm Environment Plans (FEP) and plan around their changes and the capital investment required.

Regardless of our FEP outcomes, farmers are now being tasked with reducing the in-stream nitrogen levels on a catchment by catchment basis, even if we're well within our limits on farm. This is very much the topical issue amongst farmers in our region, as some thought they had fulfilled their requirements and were happy they were doing their part.

With such a strong push on nitrogen (which I disagree is the sole

contributor), no one seems to be asking why the nutrient is being lost from our systems so easily. Riparian planting is great to capture the nutrient movement before it gets to the waterway, but why not keep it at the root zone in the first place?

Nitrogen has been given a large amount of airtime with Hawke's Bay's target of 0.8mg of N/L being lower than the current government proposal. As FEPs were completed, the factors causing nitrogen to be an issue, such as higher rainfall areas, lighter soil types and higher cattle ratios, didn't really relate to the in-stream limit.

The fact we haven't had a drought or summer dry since 2013 helps with the minimum flow limit not being too much of an issue, but since the demise of the Ruataniwha dam there is no 'plan B' in place for when drought comes.

No one disputes the environmental gains to be had by keeping cattle on flat ground and off steeper slopes, but Hawke's Bay is still very much a large sheep-farming area. It seems crazy to see sheep appearing in stock exclusion plans around the country as sheep generally avoid water like the plague and aren't an issue in this situation.

With nutrients being an expensive but necessary farm expense during the year, why are we not looking more into keeping them on farm in the first place? We would certainly be more profitable and reduce our environmental footprint.

That's why I have decided to take up that challenge on my own farm and test different methods myself. I don't have any answers yet, but we need to try to do things differently, such as increasing fertiliser efficiency, perhaps by buying less and more often, grazing differently to allow higher covers through the year to increase plant growth stage and take up more nutrients at the time.

Communities and consumers are calling for change so we will need to respond. It's just a matter of trying to strike the right balance so it's a win-win-win: Improving the environment while creating jobs and a prosperous economy. ■

"Communities and consumers are calling for change so we will need to respond. It's just a matter of trying to strike the right balance."

TO HEAR THE PODCAST INTERVIEW
CHECK OUT THE FOLLOWING LINK

[RAVENSDOWN.CO.NZ/
NPROTECT](https://ravensdown.co.nz/nprotect)



Foot on the gas: N-Protect®

By Greg Costello and Dr Ants Roberts



GREG COSTELLO, RAVENSDOWN FERTILISER
PRODUCT MANAGER



DR ANTS ROBERTS, RAVENSDOWN CHIEF
SCIENTIFIC OFFICER

Did you know that every time you apply urea fertiliser to your pastures there's a risk that some of the nitrogen (N) in the fertiliser can be lost to the air? This process is called volatilisation.

When you apply urea to your pasture, an enzyme called urease, produced by at least 20 different types of soil bacteria, splits the urea molecule in two (hydrolysis). As further chemical changes occur during this

hydrolysis, ammonium ions are produced and the pH of the solution around the fertiliser granule can be as high as pH 9. This causes some of the ammonium ions to be converted to ammonia gas, which can be lost to the air.

How bad is the risk?

During the months of spring through to autumn, research shows the average ammonia loss could be 18%, with an average 8% loss over the winter months. In the extreme, losses of 33% have been measured in hot, dry conditions with little pasture cover. Volatilisation risk is greatest when the following conditions occur:

- High rates of N in a single application (ie, 50-100+kg N/ha)
- Lack of rain/irrigation - requiring 10mm within eight hours of application
- No or minimal plant cover/bare soil
- High wind
- High temperature.

No one can tell you what the volatilisation loss will be on the day of application and research has proven that you need at least 10mm of rainfall or irrigation within eight hours of a urea application to minimise volatilisation losses. If you can guarantee 10mm within eight hours across all your paddocks where N is applied, then go for it. Having moist soil is not good enough and in fact may make volatilisation worse.

N-Protect: The smart choice

To reduce the risk of ammonia gas loss, Ravensdown has coated urea with a urease

inhibitor. This slows down the activity of the enzyme and reduces the rise in pH around the dissolving granule.

Trials on N-Protect application to pastures in New Zealand have shown that on average the use of N-Protect reduces volatilisation losses by 50%. At an average loss of 18%, this would reduce ammonia loss to 9%.

It is true that N-Protect costs more than standard urea, but you can reduce the rate of N applied and spend the same amount as you would if you bought standard urea, without a loss in production. Alternatively, you could apply the same rate of product and enjoy a small increase in response to the saved N.

Greenhouse gases

One other important point. Some of the ammonia gas comes back down onto soil in rainfall. Some of this ammonia is at risk of being converted to nitrous oxide by soil bacteria. Nitrous oxide is a potent greenhouse gas and using N-Protect will reduce this effect. Lincoln University Professors Cameron and Di calculated that if all urea applied annually in New Zealand was urease inhibited, this would:

1. Reduce indirect N fertiliser losses of N₂O by 6-7%
2. Reduce total agricultural N₂O emissions by 1%
3. Save about \$970,000 in national GHG liabilities (assuming 500,000t of urea sold annually is coated with 250ppm NBPT at application and a carbon price of \$20 a tonne). ■



The rise of soil testing

By Will Bodeker, ARL Manager

The increasing requirement for improved nutrient management in soils has seen an 81% increase in soil tests ordered by farmers. Whether motivated by economics or environmental efficiencies, ARL's soil sample numbers present a significant uptake in precision agriculture and farmer nutrient know-how.

We know economic and production considerations have gained more importance over time, as market and regulatory pressures required the best use

of resources to ensure profitability and sustainability. The increase over the 14-year period illustrates the desire by primary producers to meet environmental and economic demands. From 2011 there was a marked increase in sample numbers that coincided with the introduction of Whole Farm Soil Testing (WFST), where every paddock is tested instead of only a small number of monitor paddocks. Over the page, you will see this increased soil sampling has contributed to improved nutrient management and inevitably, environmental sustainability. ■



WILL BODEKER, ARL MANAGER

Sum of standard soil test

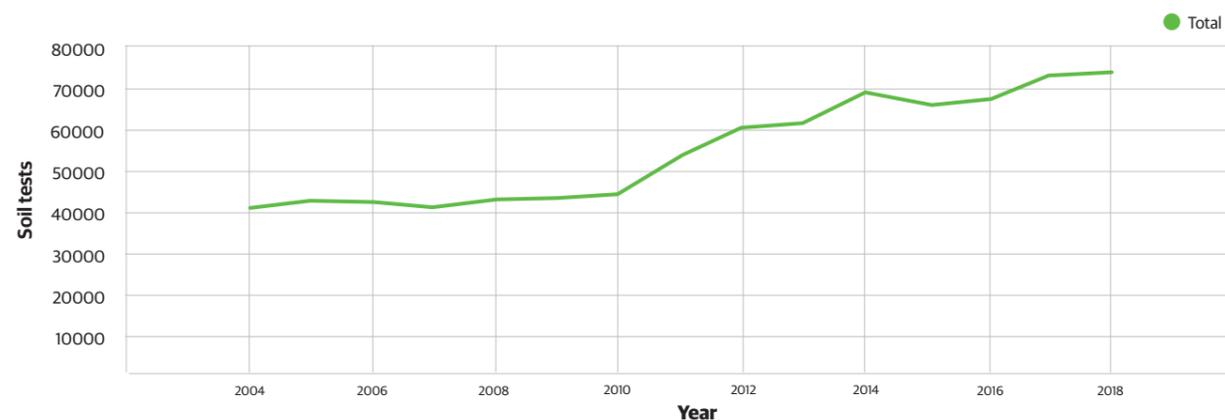


FIGURE 1: ARL SOIL TEST DATA: THE NUMBER OF SOIL TESTS PROCESSED SINCE 2004.

The proof is in the pudding: WFST

By Dr Hendrik Venter, ARL Technical Director



DR HENDRIK VENTER, ARL TECHNICAL DIRECTOR

The alternative practice of Whole Farm Soil Testing (WFST) is a responsible approach to nutrient management. ARL's analysis of accumulated laboratory data has shown that it improves nutrient management by reducing nutrient variation between paddocks.

Since 2011 Ravensdown has promoted the alternative soil sampling approach of WFST where paddocks are sampled individually, along GPS transects, to provide detailed information on soil nutrient status. Coupled with the ability to develop nutrient management plans, integrated with proof of placement technology, the aim is to help farmers reduce variability of nutrient levels between paddocks - improving nutrient efficiency and ultimately soil fertility.

By comparison, the conventional approach to soil sampling is to divide the farm into blocks that represent areas of different soil types, slope, land use and fertiliser history. A representative paddock from each block is then selected to be used as a monitor paddock from which soil samples are collected for analysis. Fertiliser applications for each block would then be based on soil test results obtained for the monitor paddocks that may cover less than 10% of the farm.

Results

Reducing high soil nutrient levels and increasing sub optimal levels over time has positive economic and environmental consequences. From ARL's sample numbers of 160 farms over an 11-year period (2004-2017) the figures show an encouraging trend for all parameters from an environmental and economic perspective. Figures 1, 2 and 3 all show trends of shifting towards the optimum range as a result of Whole Farm Soil Testing. ■

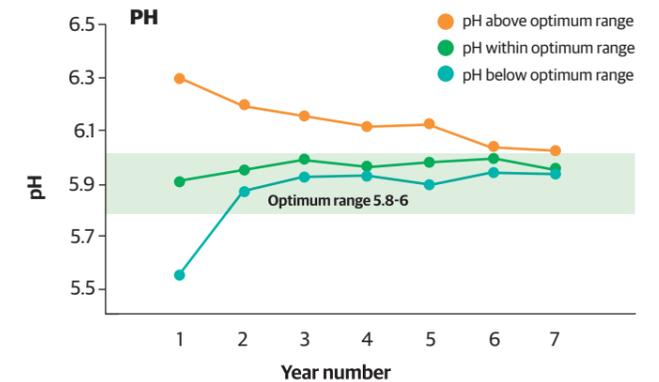


FIGURE 1: ANNUAL CHANGE IN MEAN PH VALUE FOR PADDOCKS WITH PH VALUES EITHER BELOW, WITHIN OR ABOVE THE OPTIMUM RANGE.

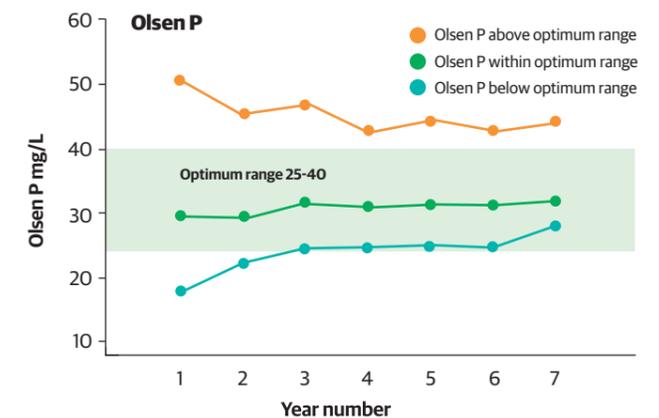


FIGURE 2: ANNUAL CHANGE IN MEAN OLSEN P VALUES WITH OLSEN P VALUES EITHER BELOW, WITHIN OR ABOVE THE OPTIMUM RANGE.

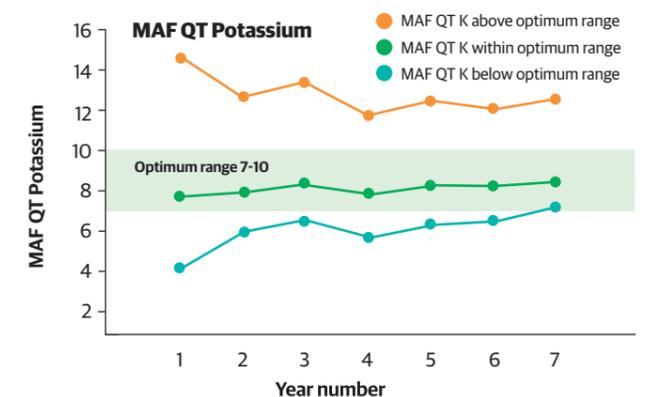


FIGURE 3: ANNUAL CHANGE IN MEAN MAF QT POTASSIUM VALUES WITH MAF QT K VALUES EITHER BELOW, WITHIN OR ABOVE THE OPTIMUM RANGE.

Soil testing from the sky closer to reality

By Mike White, Ravensdown Technical Development Manager



MIKE WHITE, RAVENSDOWN TECHNICAL DEVELOPMENT MANAGER

Hill country farms cover a wide range of varying land slopes, aspects, soil properties and altitudes, all of which influence the potential productivity of pastures. Even within a single paddock, significant differences in soil fertility occur, translating to variability in fertiliser responsiveness. Capturing soil fertility through remote sensing on a scale previously unthinkable offers the opportunity to transform nutrient use and productivity for hill country farms.

AirScan™ is the result of Ravensdown's Pioneering to Precision Primary Growth Partnership with the Ministry for Primary Industries. Its objective? To transform precision nutrient application: the right nutrient, at the right rate, in the right place, at the right time. Entering its final year of a seven year programme, the aim of maximising the return on every fertiliser dollar spent is within our grasp.

We are now confident that there is a relationship between the remote sensing imagery and the plant nutrients nitrogen (N), phosphorus (P) and soil Olsen P. Additional nutrients are still being investigated but some challenges remain, with it being critical that pastures are in rapid growth and a vegetative state to obtain

a good correlation between plant chemistry and soil fertility. However, Ravensdown is now concentrating on ensuring that the technology is suitable to be offered as a commercial service.

The high-end sensor involved is extraordinary in its ability to conduct the equivalent of 10,000 soil tests per hectare, when flown at a 600m altitude. It does this by measuring light signatures on the ground to a resolution of 1m². When you extend this to its ability to cover large areas in a short space of time, with a survey rate of 1,000 ha an hour, this becomes the equivalent of conducting 10 million soil tests an hour. At this scale fertiliser plans are no longer restricted to paddocks as fence lines become irrelevant.

Crucially, Ravensdown has also developed tools to integrate the high-resolution soil fertility information with a

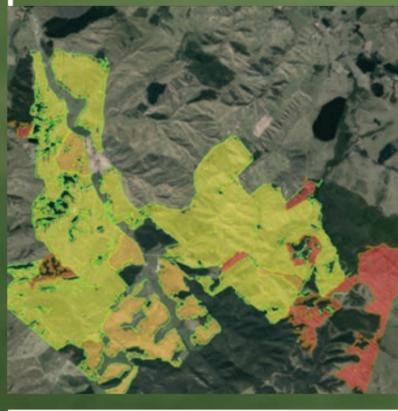
farm's physical information to estimate current and potential pasture production. This allows a comprehensive cost-benefit analysis to determine the financial benefits of maintaining or increasing soil fertility, or withholding fertiliser spatially across the farm.

The last piece of the puzzle is Ravensdown's continued development in improving capability in precision aerial applications. In the last six years, automated flow control (Intellispread™) has been introduced into four of our commercially operated topdressing aircraft.

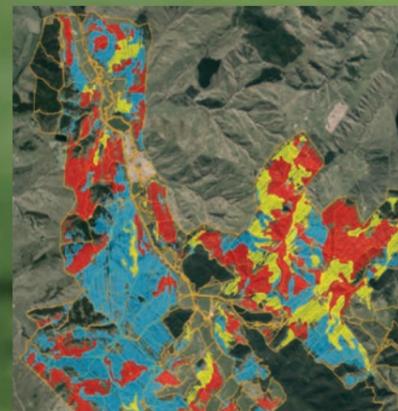
Soil testing from the sky is a lot closer to reality, and when coupled with automated flow control in topdressing aircraft it is a game-changer for increasing the precision of variable rate fertiliser strategies - thereby maximising the return on every fertiliser dollar spent. ■

Examples of a variable fertiliser programme applied on the same farm by Ravensdown's variable-rate-capable control system (Intellispread™).

- Superphosphate - 200kg p/ha
- Superphosphate - 250kg p/ha
- Superphosphate - 300kg p/ha
- Superphosphate - 600kg p/ha
- Superphosphate - 400kg p/ha
- Superphosphate - 150kg p/ha



USING EXISTING TECHNOLOGY (10-20 SOIL TRANSECTS AND BLOCKS DEFINED BY BOUNDARIES).



BY REMOTE SENSING AT A RESOLUTION OF 1M², MAKING FENCE LINES IRRELEVANT.



Hitting the sweet spot

Sixth generation Stonyhurst farmer Charles Douglas-Clifford is a big fan of data, gathering as much of it as he can to enable the farm to perform sustainably. In Stonyhurst's second year as a research farm for Ravensdown's Pioneering to Precision PGP research programme, Charles is keen to see the technology help him improve the balance between environmental sustainability and financial viability on his breeding and finishing farm.

“Soil nutrient knowledge is huge. We're interested in getting a really good picture of where our farm is at overall as well as being able to variable rate spread, which is why we wanted to be involved,” Charles says.

The research programme gathers soil nutrient data by plane with a hyperspectral sensor that is then calibrated by physical soil tests analysed at Ravensdown's soil testing laboratory ARL. That is then used to create nutrient recommendations that can be applied at variable rates by plane, as well as excluding waterways and any other areas as necessary.

“It [PGP] seemed like a good fit with all the other data we collect, to be able to further apply it and try to get some sense out of it. The likes of proof of placement and variable rate spreading will benefit us in not over-allocating or spreading where we don't want to. For us to be able to sit down and accurately reallocate fertiliser to restore an equilibrium to our land will put us in a good position going forward.”

Farming values

Getting the balance right - the sweet spot - has been a long-standing value of the Douglas-Cliffords since they settled at Stonyhurst seven generations ago.

“We all live and farm with the philosophy to be sustainable so we can leave the farm in a good state for the next person to come on. We are just custodians and caretakers of this land,” Charles says.

soil testing regularly for 40 years has afforded Charles with enough data to have him office-bound for a solid year to be able to utilise its full potential.

“We've got a lot of knowledge and information now to make educated guesses, but at the end of the day they are guesses. What we want to get an understanding of is the property as a whole. The ability to soil test the whole property to the square metre and aggregate that into clumps that you can spread at the varied rate required, as well as excluding areas, is important to us. Being able to take out portions of the paddock such as gullies, stock camps or sunny faces means we are empowered to hit that sweet spot of economic sustainability.”

“We all live and farm with the philosophy to be sustainable so we can leave the farm in a good state for the next person to come on. We are just custodians and caretakers of this land.”



ON-FARM TOUR: CHARLES SHOWS GROUND EFFECT'S EDITOR PENNY CLARK-HALL THE CALVES HE'S FATTENING.

With almost 170 years of those values being followed, Stonyhurst has benefited from some significant caretaking and seen some impressive improvements. The winning recipe is ensuring the farm is economically viable so they can continue to invest in environmental and sustainability practices. Charles and his family have always taken a long-term view here, which is focused on a partnership with the land where both can coexist with mutual and sustainable gains.

“What's important to me is that it's got to be profitable to be sustainable. The two go hand in hand. There's no point in being environmentally perfect and bankrupt, but at the same time there's no point making squillions and burning your land for the next person. We've got to find an equilibrium.”

That's where the efficacy of data comes in. Collecting data on every single stock unit for the past 15 years with electronic tags and



Charles's toolbox

FARM

Stonyhurst

Farm stats

- Nutrient know-how by aerial hyperspectral scanning of soil
- **2,500ha** effective
- Breeding Values - EID tags on every animal
- **10,000** ewes and lambing 12-13000/yr
- **500** calving cattle
- **400** calving deer
- **400** rams
- Environmental - Intellispread (proof of placement and variable rate spreading)
- **250ha** of native bush
- Capital lime and annual sulphur with strategic compound fertilisers on cropping paddocks

The challenge is to be able to use data in a practical way. Charles explains how he extracts meaning from the EID tags in their collective ram breeding programme.

The data opportunities are constant, but the more you have the more time consuming it is to interpret and find the trends. We've started applying a lot of the information to the breeding values of our ram breeding programme, but it's a lot to take the raw data to a point where you are integrating values to find genetic traits within certain lines. The benefit is that if we know certain traits are proven from breeding values we can, within reason, replicate a lot of that commercially.”

Stonyhurst is in partnership with five other farms of a similar nature and they pool resources to achieve their breeding objectives of quality micron wool and meat production, whilst targeting foot rot resistance as well.

“It's had its challenges but we're starting to make headway now.

We challenge intensely (culling) to enable us to find the base animals to breed from, which has led to us reducing our micron (24-25 micron) while not surrendering anything in fertility or production. Our wool, which is sold to Smart Wool, now makes up 35-40% of our sheep income.”

The ultimate for Charles would be to integrate all his data into one big picture where he can track what mobs have been on what paddocks, confine grazing rotations, break the farm up by stock and nutrient capacities and what inputs and outputs are required.

“If we can get a detailed nutrient profile of the farm, we know we can get the land to an equilibrium point of macro- and micro-nutrients.

“We've got to keep constantly pushing the boundaries and moving forward to make progress to our bottom line and environment.” ■

“We've got to keep constantly pushing the boundaries and moving forward to make progress to our bottom line and environment.”

"Despite our best efforts, soil fertility on dairy farms, whilst generally flat in topography, will also vary."



AirScan expands to new horizons

By Mike White, Ravensdown Technical Development Manager



MIKE WHITE, RAVENSDOWN TECHNICAL DEVELOPMENT MANAGER

geographic areas in a short space of time (1,000ha an hour - conducting the equivalent of 10,000 soils tests per hectare) which means that multiple dairy farms will be able to be surveyed in a single day.

"If the technology proves effective for predicting soil fertility across extensive and intensively managed pastures, then it offers huge potential for enabling variable-rate fertiliser strategies."

An emphasis of pasture first in respect to dairy farms is underpinned by legume pastures being a high quality and cheap form of feed for cows. So it's no surprise that with a focus on pasture there is an accompanying focus on soil fertility to ensure pastures are given the very best opportunity to perform.

Despite our best efforts, soil fertility on dairy farms, whilst generally flat in topography, will also vary due to different soils, effluent applications, forage cropping, animal transfer through dung and urine, supplementary feed and fertiliser spreading.

Currently Whole Farm Soil Testing (WFST) provides the most detailed picture of this soil fertility variability by soil testing each paddock (or parts of paddocks) individually. Ravensdown has been offering WFST since 2011. Once you have identified which paddocks will benefit from maintaining/increasing soil fertility or withholding fertiliser across the farm, then variable-rate spreading technology can be

used to ensure the farm is at its optimum soil fertility giving the opportunity for pastures to thrive. This benefit is not only about maximising the return on fertiliser spend but also about reducing excessive soil phosphorus (P) levels, which increases the risk of P loss to waterways. Managing soil fertility levels is important for farmers to manage this risk by withholding P fertiliser from high fertility areas. This can be significantly enhanced if they can be spatially defined accurately.

Building on the promise that AirScan™ technology is showing on hill country farms within the 'Pioneering to Precision' Primary Growth Partnership, Ravensdown has begun research to establish if similar benefits can be developed on dairy pastures between remote sensing imagery, plant nutrients and soil fertility. With a focus on soil phosphorous (Olsen P), the high resolution that the remote sensing imagery can achieve of 1m² provides dairy farms with the potential to obtain soil fertility maps to a level of precision beyond what WFST can achieve. This has exciting implications when you extend this to the technology's ability to cover large

The research programme for dairy pastures is into its second year, calibrating its collection of remote sensing imagery. Soil and plant samples from farms in Waikato, Taranaki, Manawatu, Canterbury and Southland make up a large dataset, encompassing the variation found within dairy pastures. This is critical to validating the robust relationships between remote sensing and soil fertility.

If the technology proves effective for predicting soil fertility across extensive and intensively managed pastures, then it offers huge potential for enabling variable-rate fertiliser strategies that will not only maximise the return on every fertiliser dollar spent but will equally improve our environmental footprint. ■

Fodder focus

By Chris Lowe, Ravensdown Technical Manager Agronomy

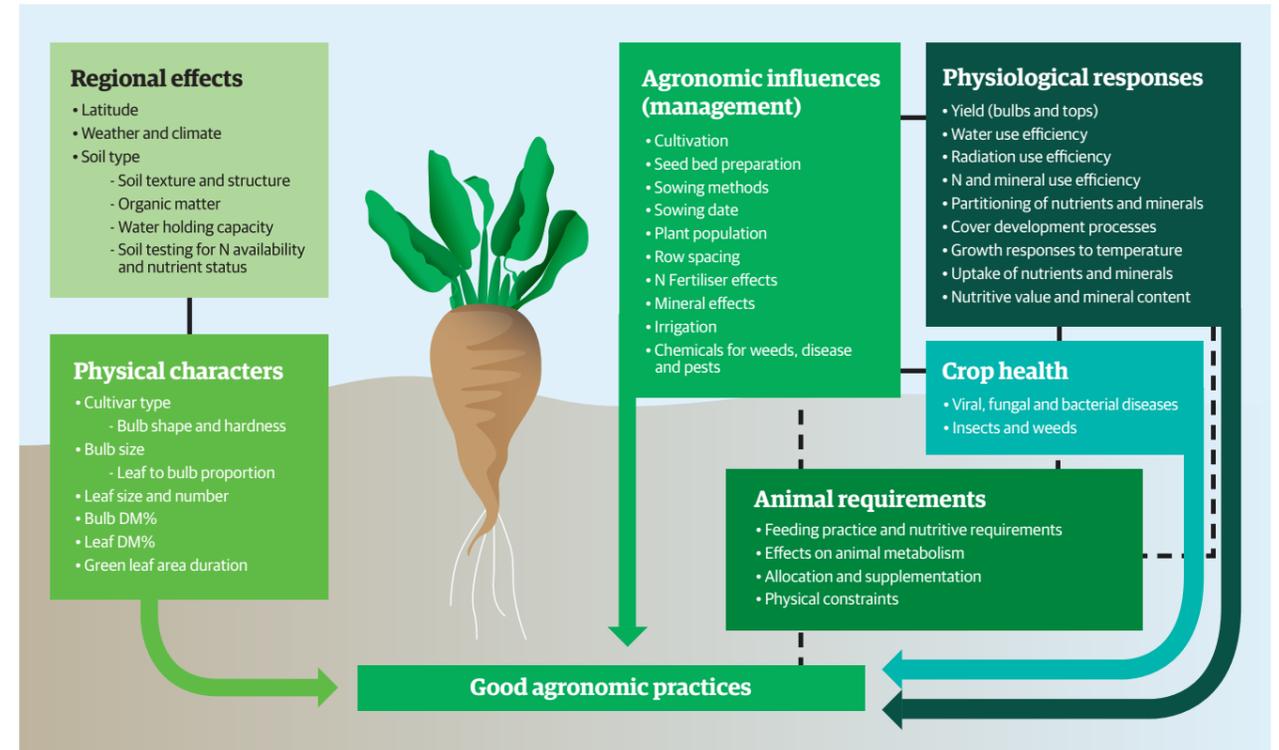


FIGURE 1: IMPORTANT FACTORS AND INTER-RELATIONSHIPS CONTRIBUTING TO FODDER BEET MANAGEMENT AND PERFORMANCE. ARROWS INDICATE THE PATHWAY TOWARD IMPROVED AGRONOMIC OPTIONS FOR IMPROVED PRODUCTION.

Steps to get the best canopy size

Sowing date - Ideally aim for end of September/October drilling. Sowing too early can put plants under stress and cause them to bolt. Fodder beet needs a base temperature of 3°C but generally we advise 5°C and rising. Sowing too late (after mid-November) reduces a plant's ability to take in solar radiation because it won't reach canopy closure until January.

Plant population - Keeping the seed rates between 90,000 and 100,000 is critical because once a fodder beet crop drops below seven plants per m², the yield will drop dramatically. Seed bed preparation will greatly aid establishment. Keep it fine and firm and sow at a depth 15-20mm.

Because beet is slow to establish and has a low plant density, good weed control is very important to minimise weed and pest competition.

Rate of canopy expansion - Early nitrogen applications (prior to sowing) are important to drive canopy expansion but only if required. Recent trial work undertaken by Plant and Food Research¹ as part of the Sustainable Farming Fund has demonstrated that N applications in excess of 100kg N/ha are uneconomical. Over-applying nitrogen is also environmentally unacceptable and a waste of resources.

Recommendation - I suggest 40-50kg N/ha in a base mix, or drilling with a product like Nitrophoska Select. Then following up with no more than 150kg N-Protect/ha 4-5 weeks post drilling, which gives you the best of both worlds in cost and environmental responsibilities, but make sure you do an N test first.

Canopy protection - Maintaining a healthy canopy through careful and accurate disease control will greatly enhance yield. Remember that fungicides are a preventative rather than a cure. ■

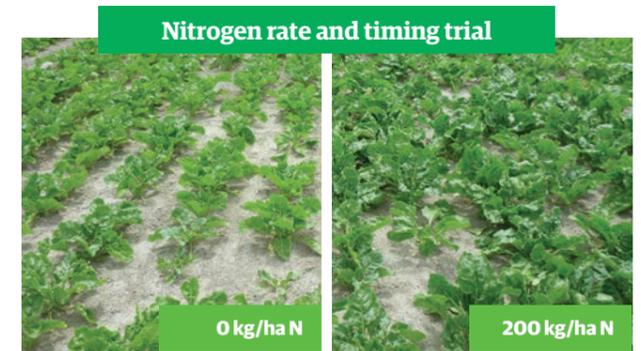


FIGURE 2: FODDER BEET AGRONOMIST SOLUTIONS (FBAS)



FIGURE 3: FODDER BEET AGRONOMIST SOLUTIONS (FBAS)

Three common mistakes for fodder beet

1. Poor plant populations
2. Poor seed beds
3. Too late putting N on to drive canopy

We sit down with Ravensdown Agronomist Chris Lowe to get the breakdown on what it takes to get the best out of your fodder beet crop.

There are three things you need to get right if you want to give yourself the best shot for a great fodder beet crop, according to Chris and they are:

- 1. pH balance** - It is critical to select your paddocks well in advance and get them soil tested to correct your pH to a 6.0 to 6.2 minimum.
- 2. Paddock prep** - Don't underestimate the importance of seed bed preparation. You need good seed to soil contact and a drilling depth of around 20mm. Many people still use full soil inversion which is fine although more harmful to soil structure and soil organic matter. Strip tillage crops have had some success as it still allows sub soiling to reasonable depth without turning over the entire paddock. Another trend is to sow at narrower widths (37.5cm rows) and whilst the yield benefit is still undetermined it certainly aids the crop to achieve row closure quicker.
- 3. Cultivar choice** - Choose a variety that suits your end use. Grazing sheep or young stock are better on lower dry matter varieties, whereas cows will be fine on medium varieties 16-18%, such as Geronimo. If you're lifting, look for varieties above 20% DM. Ensure your seed is treated with fungicide and insecticide as this will give it early protection against pests and diseases.

"Maintaining a healthy canopy through careful and accurate disease control will greatly enhance yield."

(1) see Source Code page 56



"If you are out there thinking you're alone in this, you're not! If you think you're never going to be able to come back, you're wrong."

Wellbeing

- 51 Five ways to wellbeing**
Farmstrong
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Wayne Langford (YOLO Farmer)
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Hummingly



Take a break

Wellbeing feature ahead

Five ways to wellbeing

Over the last four years, 15,000 farmers have reported an improvement in their wellbeing after participating in the Farmstrong programme. We catch up with the team at Farmstrong to find out how the nationwide rural wellbeing initiative helps farmers and their families cope with the ups and downs of farming.

It's all about sharing the things farmers can do to look after themselves and the people in their business, so they perform well, live well and farm well.

Farmstrong offers practical tools and resources through its website, workshops and events inviting farmers to find out what works for them and 'lock it in'.

Your 'Wellbeing Bank Account'

Farmstrong Ambassador Sam Whitelock says, "I know from having grown up on a farm that farmers are great at looking after their stock and pasture but sometimes not so good at looking after themselves.

"A good way to think about building your resilience is to imagine it's a bank account. What you 'invest' now will benefit you later. If you invest in your wellbeing account when times are good, you'll be

able to make the 'withdrawals' you need when times are tough.

"You can build up your account and stay well by learning a few simple habits. I call them the 'Big 5'. They are very practical things. If you do them regularly, they'll become habits that help you to keep things in perspective when the going gets tough."

1. Stay connected with mates
2. Keep active
3. Take notice of the small things in life
4. Be curious and learn new things on or off the farm
5. Give back to the community

"Whether you're a rugby player or a farmer there are always going to be things you can't control. In rugby it might be the ref, in farming it's the weather and prices. That's why investing in your wellbeing on a regular basis is so important. I can personally vouch that the five ways to wellbeing make a huge difference."

To find out what else could work for you, check out our farmer-to-farmer videos, stories and tips at www.farmstrong.co.nz.



SAM WHITELOCK,
FARMSTRONG AMBASSADOR

"Whether you're a rugby player or a farmer there are always going to be things you can't control... That's why investing in your wellbeing on a regular basis is so important."

FIVE WAYS TO WELLBEING



TALK & LISTEN,
BE THERE,
FEEL CONNECTED



Your time,
your words,
your presence



REMEMBER
THE SIMPLE
THINGS THAT
GIVE YOU JOY



EMBRACE NEW
EXPERIENCES,
SEE OPPORTUNITIES,
SURPRISE YOURSELF



DO WHAT YOU CAN,
ENJOY WHAT YOU DO,
MOVE YOUR MOOD

INTRODUCE THESE SIMPLE STRATEGIES INTO YOUR LIFE AND YOU WILL FEEL THE BENEFITS.
WWW.FARMSTRONG.CO.NZ



The foundation of life

On his 34th birthday, Sunday afternoon, dairy farmer Wayne Langford was bed ridden. Something that had become quite a common theme in his life. Wayne, now famously known as YOLO (You Only Live Once) Farmer, via his social media movement to live every day as if it's his last, has generously shared his story about how he overcomes the black dog that is depression.

They say it takes 21 days to create a habit, 90 days to create a lifestyle. A few years ago, my habits had got me to a dark place. We were milking once a day and I'd start a little later than most, milk the cows, breakfast/lunch, then off to bed to dodge the world around me. Simple on-farm decisions weren't getting made, such as where the cows were going or ordering supplementary feed.

Without my knowledge, my wife (Tyler) had taken over all the finances, something I had previously been well in control of. If I had asked the kids (aged 11, 9 and 8) what they remembered of that time, it was that dad was tired, grumpy and just no fun anymore. That's the one that hurts the most. I had slowly changed and adjusted my life, created numerous bad habits, which after not too long had now become our lifestyle. I thought I was just lazy and not motivated. The truth was I felt like my gumboots were stuck in the mud. I had depression.

My story

We were a young farming couple who had bought our first farm (93ha in 2015) after having worked in the family farming business for 12 years. I'd met my wife at Lincoln University, bringing some new bloodlines back to Golden Bay. Not long after, three beautiful children arrived, three under three at one stage; we worked out how that was happening and stopped that!! I had taken on a number of governance positions off farm, completed the Fonterra Governance Programme, Kellogg's Rural Leadership Programme and numerous dairy courses. I had also taken on a dairy chair role with Federated Farmers, which saw me move quickly up the ranks onto the National Dairy Executive. Life was good, life was great. I was ready to take over the world.

I distinctly remember that day lying in bed, as if I was looking down on myself from above. I had to choose to do something different with my lifestyle, create some new habits, or life was about to go south quickly. That day, I jumped up, grabbed the kids, threw everyone in the car and just got the "hell outta there".

We headed to the beach, swam, laughed, played in the sand. We got ice-creams, and in the car as we drove home I said to the family, "We are going to do something every day for the next 365 days to say that we've lived for that day!" One of the kids yelled out YOLO (You Only Live Once) and that's when the YOLO Farmer was born, a

journey that has changed our lives.

Now over 1000 days into this incredible adventure, I have begun sharing the story much more. I've been overwhelmed with the support and following on social media, over the phone and in person. If you are out there thinking you're alone in this, you're not! If you think you're never going to be able to come back, you're wrong.

I liken it to a tractor. Every now and then you overheat your tractor. Sometimes it's when they're new, sometimes when they're older, more often than not it's when you're really busy and numerous jobs depend on that one tractor. My point being, if you overheat your tractor and keep driving it, you'll damage it even more. If you slow down, stop and let it cool down, it will recover. This is no different to your mind. I "cooked" mine, I could've done real damage, but I slowed down, stopped, changed my habits, changed my lifestyle and now I'm back better than ever.

"If you are out there thinking you're alone in this, you're not! If you think you're never going to be able to come back, you're wrong."

Looking after your mental health has five key pillars

1. Gratitude
2. Connection
3. Learning
4. Giving
5. Being active



When people contact me and ask for help, I often ask them to keep track of which pillars they have associated with over a short time. It's helpful to even write these down. If you notice my social media posts, I do this every day to keep aware.

Another pillar I like to talk about is being proud. Find things in your life that you are proud of, not just your farm and family, but smaller things that you can relate to in everyday life. What on your farm are you proud of? What are you not so proud of and how can you work on those for the better? Doing this gives you hope, a key ingredient in life. It also lets your mind love what you are doing and

share it with others. That love is infectious.

I would be remiss if I didn't use one soil analogy in a Ravensdown publication.

If you're the soil, do a soil test and find out which of the five macro nutrients (Gratitude, Connection, Learning, Giving, Being Active) you need. Fill the gaps with what you're missing, then have a look at the micro nutrients (love, hope, faith, compassion, freedom). Start filling all those gaps and imagine what can be achieved. It'll take time, but as farmers we're used to that. Our topsoil is the rich foundation of life and that soil you create can grow, produce and do amazing things. ■



The nuts and bolts of change

Hummingly, internationally recognised resilience and wellbeing trainers, recently deployed their unique “Resilience Genie” tool with Ravensdown staff. They share their set of methods that empower people to deal with stress, uncertainty and pressure.

Through the generations, farming has always involved change and evolution. But today’s farmers are facing change at a pace and with pressure that can be tough to get your head around. Change brings the s-word - stress. We’ve been working with people in the agriculture sector, helping them understand how to meet the demands of a changing world and a large part of the picture is learning about stress - the good, the bad, and how to manage it well. Essentially, it’s about how to work and be well when facing change - for you, your work on the farm and your family.

We’ve lost count of how many times we’ve had blokes tell us, “Yeah well, I don’t get stressed”, only to have someone from their team or their family cock an eyebrow, telling us otherwise. Stress, not managed well, messes with your work, your body, your

relationships, your decisions and your outlook. It’s something we need to take as seriously as other safety issues on the farm because the consequences can be just as severe. Everyone experiences stress. But stress isn’t always a bad thing.

Why is change stressful?

It all goes back to our human biology. And it’s about survival. Our body will go on high alert and pump us with stress hormones when it comes across things in our world that are NUTS - that is anything:

- N** **New** - if we haven’t faced it before, we’re unsure of our chances of a good outcome and that makes our body edgy.
- U** **Uncertain** - anything uncertain signals potential danger because we don’t know which way things will go.
- T** **Threat** - our body goes on high alert when we feel a threat to how we’re seen by others, to the way things have always been done, to our identity.
- S** **Sense of control** - when things feel outside our control, our body lets us know there’s potential for danger.

When we think about the changes in the agricultural sector, we hit many of the NUTS stress factors. This means there are good reasons why we, or others around us, might be feeling the pressure.



Tips to work and be well

Stress and performance are linked - both on the farm and how things go for us in our lives at home. Psychologists have run experiments to demonstrate this link.

When stress is too low we tend to perform poorly - we need to care enough and have something at stake to help us focus and perform. So, a bit of stress is a good thing, as we can see in the green area at the top of the graph (see below) where some stress leads us to perform. With the right amount of stress we step up to the plate, get stuff done, learn new things, tackle a challenge, stretch ourselves and feel a sense of pride and accomplishment. Many of the challenges we are now facing in farming can take us into this space - forcing us to innovate, to problem solve, to learn and to grow.

But what happens when the stress levels get too high or the pressure is on for too long? That’s when our performance takes a dive, both with our work on the farm and in our life in general. We begin to forget things, we struggle to solve problems that we’d usually sort easily, we make poor decisions, we lose perspective, we lose sleep, we’re more prone to accidents, our health suffers, we get short with those we work with and those we care about. Stress at these levels, especially when it goes on for a long time and doesn’t let up, has serious impacts and consequences.

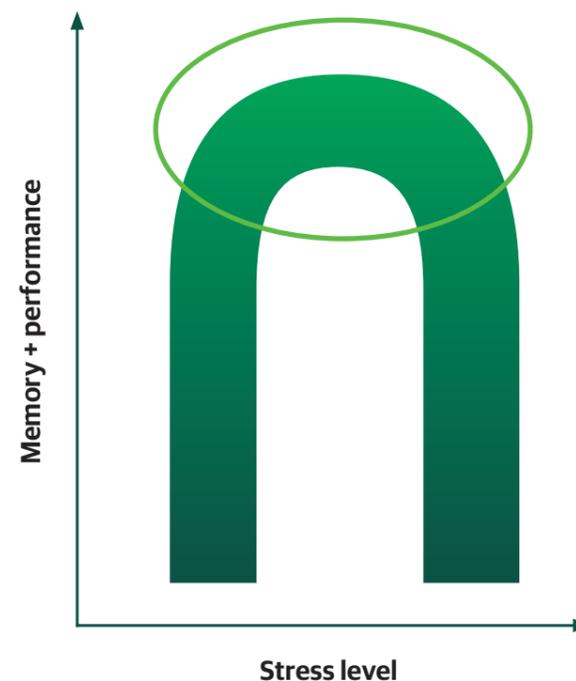


FIGURE 1: THE IMPACT OF STRESS ON MEMORY AND PERFORMANCE

*If you are concerned about yourself or someone else contact your doctor, the Rural Support Trust (0800 787 254) or the ‘Need to Talk’ helpline on 1737 (text or phone 24/7).

5 tips to cope through change

1. Get curious and start to pay attention

It’s amazing how far we can get through life without knowing our own stress profile. Get curious about what you look and feel like when stress is helping you to perform well - when you’re in the green zone. And get to know what you look and feel like when stress is getting too much. Remember we all get stressed - this just makes us human. Do you know your own signs for when stress is getting too much (for example: headaches, making mistakes, snappiness)? Stress will show up in different ways for different people. If you’re part of a team, do you know what positive and negative stress looks like in each other?

2. Take note when other people point it out

When stress is getting too much or has gone on too long, we are often blind to it in ourselves. We find it easier to recognise in others - we see that someone really needs to take a break before things really ‘go south’, but there’s just no telling them. It’s the same for most people. Next time someone shows concern for you and your natural tendency is to fob them off, really think twice because they may be seeing something that stress hormones have made you blind to in that moment.

3. Find ways to wind down

Some stress (of the right amount) isn’t a bad thing, but we’re not designed to operate this way for long periods. Recovery time is important - just as the All Blacks would tell us as part of their strategy for performing under pressure. When stress is high our body feels under threat and is amped up. It’s important to find ways to slow your body down. Can you carve out some down time between peak times? Do you have somewhere quiet you can head even for half an hour? Can you find moments to take some deep breaths to still your body? One of the most important things you can do is keep up or get back to the things you enjoy. Make some wind-down time part of each day.

4. Stay connected

When the going gets tough, research shows that it’s our friends, work mates and family who are our best sources of support. But when the pressure is on, we often pull away from those around us - because we are too busy, too tired, don’t have the energy or patience, or for a million other reasons. When the pressure is on, this is the time we most need to stay connected to our mates and our family. Do your bit to stay connected.

5. The big five

1. Connect
2. Give
3. Take notice
4. Keep learning
5. Be active

Find out more at www.hummingly.co.nz ■



SUN SETTING AFTER A FANTASTIC DAY AT STONYHURST

In case you would like to learn more, we have collated this list of sources cited in our articles. Most of these are available online. If you'd like more information, or you'd like to discuss an article written in Ground Effect® by any Ravensdown specialist, please give the Customer Centre a call on 0800 100 123 to arrange a chat.

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The Last Word

We hope you enjoyed the 10th edition of Ravensdown's Ground Effect®, which is all about enabling smarter farming for a better New Zealand.

Got an idea? This publication is only as valuable as the value you get from it so if you want to see more or less of particular topics or issues please do get in touch via the details below.

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On behalf of Ravensdown, we'd like to thank you for your contribution to New Zealand and our food and fibre industry. We continue to invest in and develop our agri-science, technology and innovations for the good of your business and the country. Keep up the good work of smarter farming for a better New Zealand.

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Penny Clark-Hall
Editor

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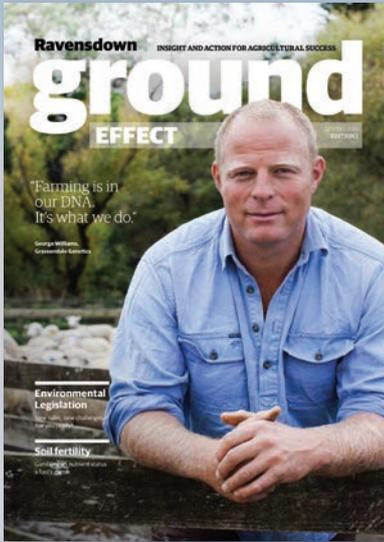
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Celebrating 10 editions of Ground Effect®

