ravensdown

INSIGHT AND ACTION FOR AGRICULTURAL SUCCESS

ground EFFECT

AUTUMN 2017
EDITION 4

Scientific Round Table

Five science leaders tackling the big issues

Get the best out of your kale

Tips to grow a successful winter forage

WELCOME TO THE FOURTH EDITION OF GROUND EFFECT® FROM RAVENSDOWN

The team has assembled some great insights and tips that can ultimately help NZ Inc through boosting the performance of our agri-sector.

John Hellström, the Retiring Chair of the National Animal Welfare Advisory Committee kicks off this edition by defining what is meant by a social licence to operate. It's an important term for the agri-sector today and will only become more so into the future.

A great example of the practical implication of this can be found on page 26 where sheep farmers Matt and Lynley Wyeth keep their lambs' welfare in the forefront of their minds.

We don't know what the winter will hold, but we can be sure that soil compaction will be an issue in some areas. Our very own Dr Ants Roberts explores what can be done about this issue. Winter is also the time of potential phosphorus loss and Professor Rich McDowell of AgResearch tackles that thorny topic.

We also assembled a panel discussing the most important research issues of the next ten years where our own agri-science leaders were joined by Dr Jacqueline Rowarth, who at the time was Professor of Agribusiness at the University of Waikato, Dr Keith Cameron, Professor of Soil Science at Lincoln University and Dr Ian Yule, Professor of Precision Agriculture at Massey University.

The discussion was robust with our own Mike Manning doing the moderating. A video summary and the full discussion can be found on our website **(www.ravensdown.co.nz/scientific-round-table).**

Readers of Ground Effect don't just want to listen to leaders in agri-science. They also want to learn from real farmer examples and there's a bumper crop in this edition.

For example, Tautane station, which has historical significance to Ngáti Kahungunu is using IntelliSpread™ to prevent fertiliser from landing where it's not supposed to and being applied where it has the most benefit.

Readers can also learn from the experiences of the Lincoln University Dairy Demonstration Farm on page 22 and winners of the Ravensdown Pasture Performance Award at last year's New Zealand Dairy Industry Awards on page 23 and the smart irrigation of Craige McKenzie on page 28.

We also hear from Athol New who is the current FMG Young Farmer of the Year. One of the best things about being a sponsor of this competition is seeing the new leaders coming through and hearing their perspectives on where they see the sector's challenges.

I trust you will enjoy this edition and as usual we welcome your feedback.

Best Regards
Greg Campbell
Ravensdown Chief Executive

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BEHIND THE SCENES

Ravensdown is collaborating for a sustainable future

Future leader joins Ravensdown

Johanna Smith, who is looking forward to starting the graduate programme in February, has been awarded one of only five ANZ Future Leader scholarships.

She is a former winner of the Ravensdown Hugh Williams Memorial Scholarship and has this advice for anyone thinking of joining Ravensdown: "If you know what you want to do and which company you want to work with, don't wait!"

Soil, a balancing act downunder

Dr Ants Roberts (Dr Dirt), Ravensdown Chief Scientific Officer, and Dr Hendrik Venter,Technical Director ARL, presenting their research on cadmium and Al analysis of NZ soils at the Australian and New Zealand Society of Soil Science Conference in Queenstown last December.

Agricultural Leaders' Health and Safety Action Group

Ravensdown is part of a group of 24 agricultural industry leaders, established to try to make farming safer. The idea is to learn from members' experiences to make businesses healthier and safer and to provide tools and support for the wider industry. Ravensdown CEO, Greg Campbell has been asked to be a part of the advisory group. The plan is to use regional networks to involve farmers in improving health and safety, starting with regional workshops in the first quarter of 2017.

Thought Leader

SOCIAL LICENCE FOR PASTORAL FARMING SYSTEMS - does it really matter?

John Hellström ONZM, Retiring Chair, National Animal Welfare Advisory Committee

Since the 1940's animal production systems have evolved to optimise productivity while improving human health and safety, biosecurity, food safety and environmental protection, though at times at a cost of compromised animal welfare. During this time, pastoral farming, particularly dairying, has become dramatically concentrated into large-scale farming systems targeted by animal rights and environmental activists. As a result, these intensive systems are being viewed with increasing suspicion by society at large.

Effectively, there is a struggle underway to gain society's support for or against these intensive animal production systems. The fact that this debate is now shaped in terms of being for or against "factory farming" indicates that the animal rights activists are so far winning. The New Zealand animal rights organisation Save Animals From Exploitation (SAFE) has generated widespread public concern about the adoption of low-welfare technologies such as battery layer cages, gestation stalls for sows, dry feedlot mega-dairies and caged-fish farms. Intensive farming industries have largely ignored these challenges or argued that because animal health and productivity are optimised then welfare must be OK. In general they have been resistant to change and in particular to welfare arguments based on reduced ability for intensively farmed animals to display normal patterns of behaviour.

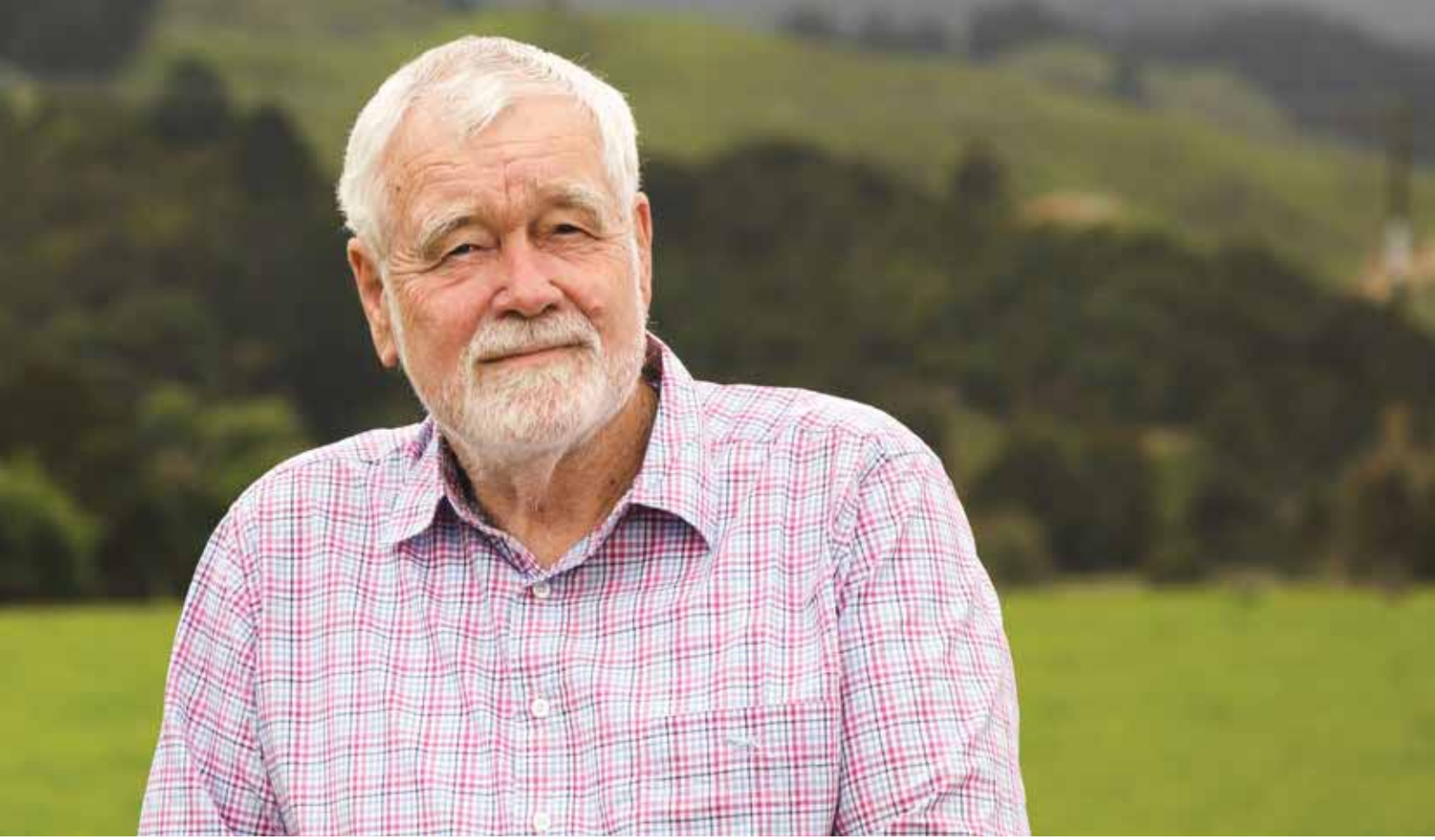
The concept of a "Social Licence to Operate"* is relevant to consideration of this matter. Social licence was first identified as a requirement by North American mining and forestry industries. In order to gain community acceptance to go about their businesses, which were blocked by activism, regulatory approvals were not enough. The industries also needed the informal acceptance or approval by communities and stakeholders of the importance and legitimacy of what they wanted to do. Social licence may range from acceptance to whole-hearted approval from the community. Politicians look for evidence of social licence to support their decision-making: a lack of social licence puts them at risk of offending voters. It is therefore advisable for sector or industry leaders to work to gain social licence to support their business objectives.

Unfortunately this task is often seen as an exercise in public relations rather than a genuine and permanent change in the ways in which the enterprise or sector

"The social licence to operate takes the responsibility to defend a practice off the politicians and puts it onto the practitioner."

In brief

A social licence is informal, earned not bought or taken, largely values based, driven by trust and therefore hard to get and easy to lose. Confusion and lack of transparency erode it and it can be damaged by others out of your direct control: activists, regulators, competitors and politicians chasing personal agendas.



"The generation of social licence involves trust above all else."

interacts with the public. Gaining social licence requires more than good communication; it results from an iterative two-way process with a lot of genuine listening.

The generation of social licence involves trust above all else. While those for or against an activity strive to convince society of 'the truth', communities will consider this in the light of the trust they have in the various messengers. There is a well-developed body of work on risk communication theory** that provides many relevant insights to meeting this challenge. Those with a need for social licence would be well-advised to consider and apply the insights from risk communication to their own particular set of credibility problems.

Traditionally, pastoral farming systems have had strong social licence. The urban concept has largely been one of contented ruminants happily browsing on clover under a sunny sky with snow-capped mountains at a comfortable distance. Climatic disasters have been seen as bad luck and largely a cause for sympathy. Partly as a result of activism, but more so from a series of industry accusations, this concept has largely been replaced with one of suspicion and concern. Pastoral farming is no longer trusted by society at large and is increasingly seen as an activity that causes considerable harm to the environment and animal welfare.

Politics steered by public perception

In a thoughtful addition to the debate Federated Farmers President Dr William Rolleston noted the need to consider pastoral farming's social licence and warned of the challenges this creates and the risks of failing to engage intelligently to confront the misinformation and fear that are at the roots of societal concerns.*** Passive management of this concern, based on a view that society will accept that farms must continue to supply abundant, cheap and safe food, is likely to fail. Debating the scientific accuracy or legitimacy of those concerns before trust is established is also doomed to fail. A more effective way forward based on engagement, transparency and constructive measures to address animal welfare and environmental concerns is required.

However, there are strongly held views and divided opinions about social licence. Many of those challenged by communities see social licence as a concept to derail property rights and argue that effective regulators should disregard the noise generated by protestors and NGOs. Politicians are generally more sanguine – social licence is frequently discussed in the Beehive and our public service. The lack of social licence translates into unpopular decision-making and the risk of losing voter support, so from the regulators' point of view it is far better to persuade resource users to sell their story to the public and build their own social licence. The social licence to operate takes the responsibility to defend a practice off the politicians and puts it onto the practitioner. In the animal welfare area it is unlikely that politicians are going to try and defy gravity by resisting growing calls for better treatment of animals. ■

(*, **, ***) see Source Code on page 42

PUTTING P IN ITS PLACE

By Professor Rich McDowell, Chief Scientist, National Science Challenge: Our Land and Water

Phosphorus (P) loss is nothing new, but the nutrient's ability to elude us and waste our money remains a challenge. Professor Rich McDowell explains the nutrient's characteristics and how to mitigate the loss risks.

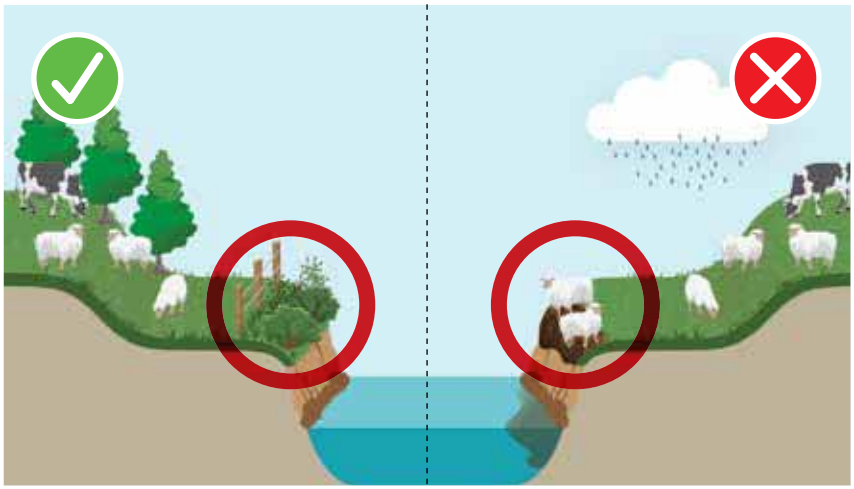
Farmers will be well aware that P contained in soil, fertiliser and dairy shed effluent can be lost to surface waters via transport mechanisms such as runoff and leaching - including via artificial drainage networks. However, some factors are out of farmers' control, such as the soil's ability to retain P, measured as Anion Storage Capacity (ASC) that Ravensdown tests for at ARL, or slope, which increases the potential for runoff. Nevertheless, how farmers manage their farms can greatly decrease losses.

P LOSS MANAGEMENT STRATEGIES

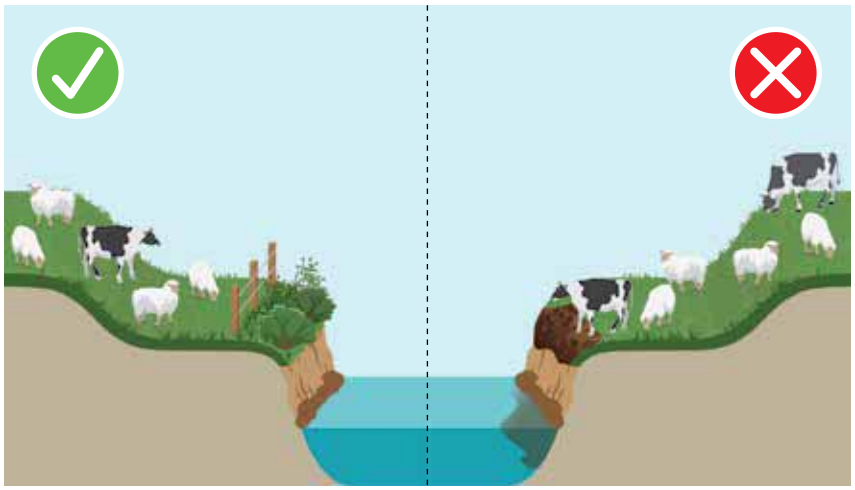
The interaction of the P source with transport mechanisms ultimately dictates how much P is lost e.g. rainfall or irrigation causing soil drainage or overland flow (runoff). We call areas where there is a moderate or high likelihood of a P source coinciding with a transport mechanism Critical Source Areas (CSA).

There are around 22 strategies, to decrease P loss, so there are always options to suit your farm (**). Here are some of them.

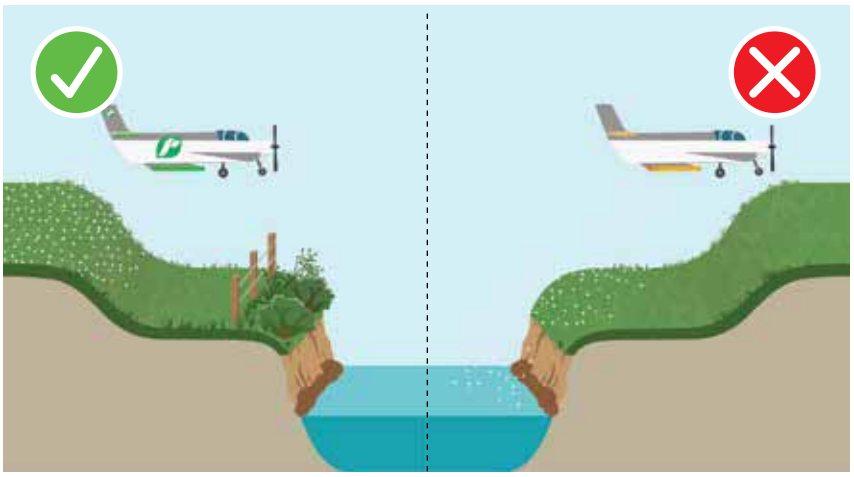
1. Focus your efforts. While critical source areas dominate P losses across a property they usually represent a small proportion of your farm and can be easily predicted with a little help. Knowing where they are increases the cost-effectiveness of strategies to mitigate loss several fold, compared to applying strategies farm-wide (*).



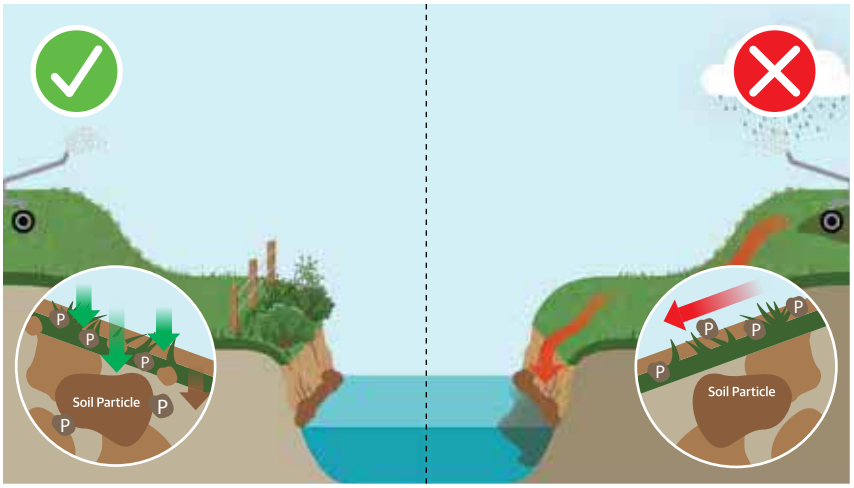
2a. Where farms or paddocks are intersected by waterways or gullies, fencing them out prevents direct deposition of dung and urine by grazing animals. If they need to be grazed, leave near-stream areas till last and when the likelihood of runoff is low.



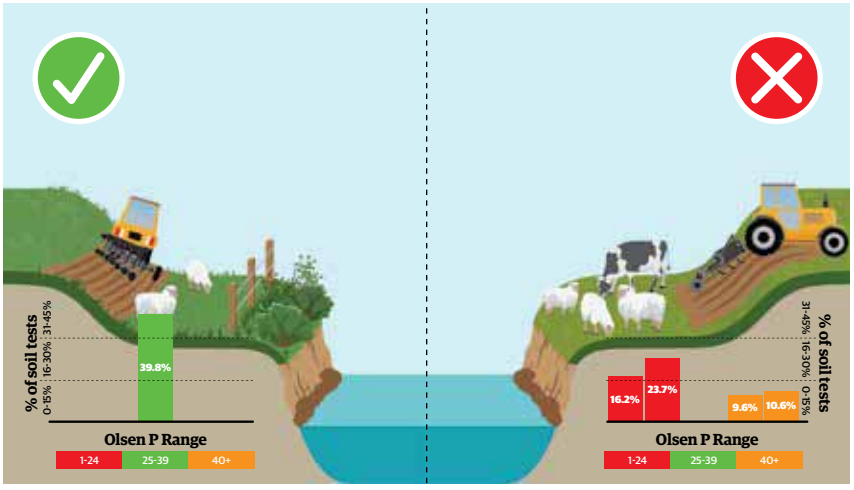
2b. Avoid applying fertilisers in water bodies or CSA by using technology enabled spreaders such as Ravensdown's spread to file maps (Intellispread).



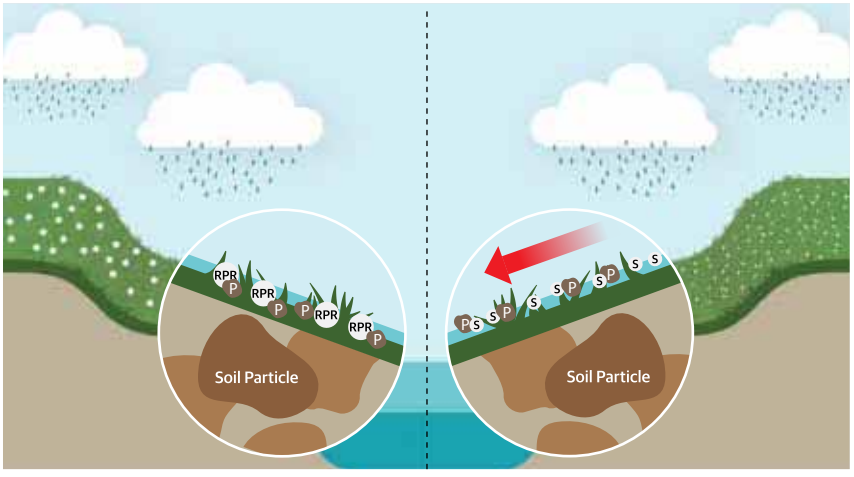
3. Apply dairy-shed effluent at low rates and only when the soil is dry enough to hold it e.g. < 4mm/hr allows effluent to infiltrate the soil, minimising the likelihood of ponding and maximising the chance of P being retained by the soil (**).



4. The risk of P loss increases the higher your soil Olsen P levels are, especially in low Anion Storage Capacity (ASC) soils, so try to keep Olsen P no greater than the agronomic optimum (25-39) maintaining good pasture covers, ploughing with the contour and not over grazing, all help prevent P loss by soil erosion (***).



5. Potential losses of soluble sources of P from superphosphate are greatest in the first 30 days. If there is a significant likelihood of runoff or leaching in that time then consider applying a lower water-soluble product (****).



See Ground Effect edition 2, page 29, for more on Ravensdown's ongoing development of the P loss tool LUCI which identifies Critical Source Areas and management strategies.

(*, **, ***, ****) see Source Code on page 42

TICKING ALL THE BOXES – when culture, science and education align

On the east coast of the North Island sits an iconic station, Tautane. The 3374 hectare hill country station was recently purchased by its original owners Ngáti Kahungunu. The station is leased by Taratahi, the agricultural training centre, and has recently joined Ravensdown's research farm network throughout New Zealand for the co-operative's Primary Growth Partnership (PGP) Pioneering to Precision programme.

"We're for progress and Ravensdown's PGP programme is putting Māori back into the forefront of farming and innovation."

HAYDEN HAPE AND MATT SMITH CATCHING UP AT TAUTANE.

Tautane station, which has historical significance to Ngáti Kahungunu, is their first foray into purchasing land. The iwi's mandate from their people had previously been to stick with fisheries, in which they are a global trader. However, now they have their first land acquisition they have signed, in partnership with Taratahi, on to Ravensdown's PGP research programme, which is developing aerial soil testing technology and increasing aerial spreading precision with GPS-driven automated variable rate spreading.

Ngáti Kahungunu leader Ngáhiwi Toamona says there are some cultural values that align with Ravensdown's science.

"Our ancestor Kahungunu was an innovator and forward thinker and so that's where we want to be. We want to be sustainable and trade in the new world with sustainable practices. We're for progress and Ravensdown's PGP programme is putting Māori back into the forefront of farming and innovation."

Iwi liaison Hayden Hape works with Taratahi Farm Managers Matt and Claire Smith who both say that having cutting-edge technology on the farm has been great for educating the next generation.

"We want everyone to be educated on our farm, international people included. Matt and Claire are doing a fantastic job out there teaching the students life skills as well as farming skills. Marrying the science, education and culture together is what we want for our future generations," Hayden says.

Matt and Claire say they are in the unique position of being a part of training the future generations while doing something they love.

"There's a lot of talk between Ngáti Kahungunu and Taratahi," says Claire. "It's a great partnership where we share the same vision about training future New Zealand farmers. It's quite a privilege to think that one day someone we've trained could be managing the farm for Ngáti Kahungunu.

"We've been on the back foot for the past 40 to 60 years trying to defend our land and language and love of our culture but now we have to get out of that mode."

"We try and keep the students up to date with the latest technologies because when they get to manager level or become farm owners, this technology (Ravensdown PGP) could be the new norm, so it's about getting them used to the tech as much as possible."

Getting results

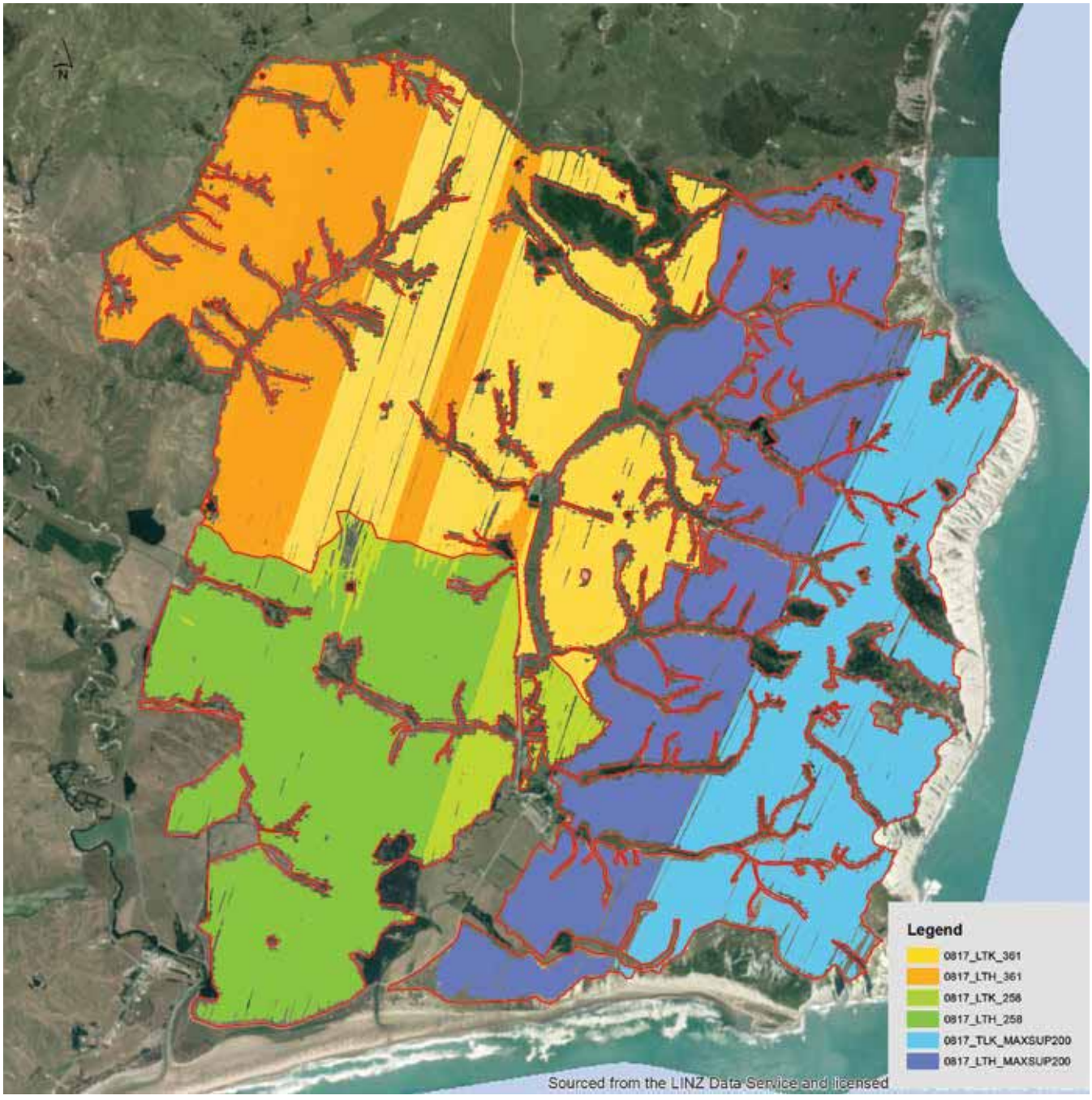
A recent field trial of Ravensdown's PGP programme at Tautane produced a very promising proof of release map and has all those involved excited about the possibilities.

The spreading map sent wirelessly to the plane, specified areas and blocks where no fertiliser should be applied and the computer-controlled hopper doors automatically cut the fertiliser flow when over those areas.

"I think it's going to have huge, huge benefits for hill country farming," says Matt. "Our first application using the technology allowed us to take out about 347 hectares of sensitive areas and waterways and reallocate that fertiliser to other parts of the farm. It was a super nitrogen mix, and you could see it definitely was going where it was supposed to go, which is going to have a huge beneficial impact on environmental sustainability.

"We showed the students the map of how we used to do it with the blanket spread and the new variable-rate proof of release map – they were pretty excited and can see the benefits of it. The students that were here when the spreading was happening were quite intrigued by all of it. For them to see what's happening here, rather than in a classroom, is pretty powerful stuff."

Hayden adds, "We say a good environment is good business. It's about combining western science with our science. We have our



MICHAEL WHITE, RAVENSDOWN'S TECHNICAL DEVELOPMENT MANAGER, SHARES INSIGHTS ABOUT PGP AND THE INTELLISPREAD™ SERVICE.

"This is absolutely transformational, a world-first so far as we know, and represents the biggest advancement since topdressing began in the 1950s."

own view of the world, which is pretty special, and we want to make sure those applications are up with current practice. If we can find current situations where western science supports our science and vice-versa then that's where we want to be and we feel that Ravensdown's research aligns with that. We're not afraid of it and know how we're going to move forward."

"We've been on the back foot for the past 40 to 60 years trying to defend our land and language and love of our culture but now we have to get out of that mode and get into development mode and back to being leaders. So PGP, yeah we're right in!" Ngahiwi said.

What next for the unique trio?

So what lays ahead for the farm and the research? Ravensdown's PGP Project Manager Michael White says the aim is to couple Ravensdown's remote sensing technology, that assesses soil fertility from the air, with the computer-controlled variable rate spreading and placement technology.

"It has simply not been seen before," Michael says. "This is absolutely transformational, a world-first so far as we know, and represents the biggest advancement since topdressing began in the 1950's. When we speak to farmers about this, the most common sentiment so far has been 'can you go faster with this project?' Such is the opportunity for enhancing the performance of our hill country farms and farmers' desire to leverage technology to improve."

Matt says what will transform hill country farming is the sensor's ability to aerial soil test down to the square metre and variable rate spread to 60 square metres with placement verification.

"It would have a massive impact on productivity and sustainability. We'll be better able to avoid having fertiliser landing on sensitive areas or waterways, with proof. It may cost a little bit more due to additional flying, but I think the savings you're going to make and the ability to provide proof of release is huge, especially being able to provide consumers with a guarantee that we, as farmers, are moving forward protecting the environment as well as being economically more efficient."

Ngáhiwi says his iwi wants this technology to become commonplace right across all their whenua.

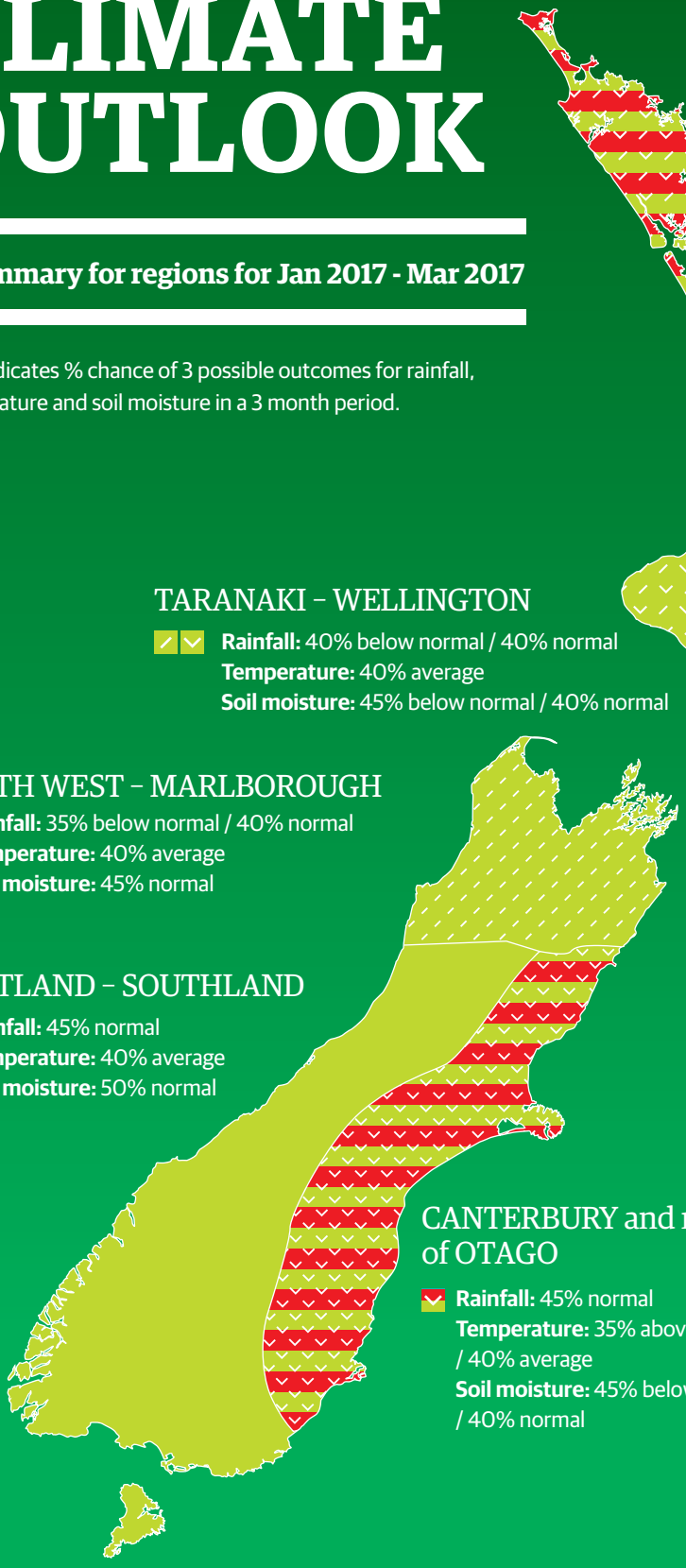
"Ravensdown's PGP programme is part of our ambition to take over all our land and show we can farm profitably and sustainably for future generations, whilst putting our cultural spin on modern-day farming." ■

ENSO (El Niño – Southern Oscillation) conditions are easing to neutral so expect typical summer conditions, with high pressure systems crossing the North Island and prevailing westerly winds over the South Island.

SEASONAL CLIMATE OUTLOOK

A summary for regions for Jan 2017 - Mar 2017

Map indicates % chance of 3 possible outcomes for rainfall, temperature and soil moisture in a 3 month period.



NORTHLAND – TAUPO

Rainfall: 45% below normal / 40% normal
Temperature: 40% above average / 40% average
Soil moisture: 50% below normal

TARANAKI – WELLINGTON

Rainfall: 40% below normal / 40% normal
Temperature: 40% average
Soil moisture: 45% below normal / 40% normal

NORTH WEST – MARLBOROUGH

Rainfall: 35% below normal / 40% normal
Temperature: 40% average
Soil moisture: 45% normal

WESTLAND – SOUTHLAND

Rainfall: 45% normal
Temperature: 40% average
Soil moisture: 50% normal

CANTERBURY and most of OTAGO

Rainfall: 45% normal
Temperature: 35% above average / 40% average
Soil moisture: 45% below normal / 40% normal

Most of the EAST COAST

Rainfall: 40% below normal / 40% normal
Temperature: 45% above average / 40% average
Soil moisture: 45% below normal / 40% normal

KEY

- Rainfall above normal
- Rainfall normal
- Rainfall below normal
- Temperature above average
- Temperature average
- Temperature below average
- Soil moisture above normal
- Soil moisture normal
- Soil moisure below normal

NIWA seasonal climate outlook infographic for Jan 2017- Mar 2017 | niwa.co.nz

NIWAWeather

NIWA Taihoro Nukurangi

Where is your slime coming from?

By Dr Hendrik Venter and Dr Julie Wagner

DR HENDRIK VENTER, RAVENSDOWN TECHNICAL DIRECTOR AT ARL (ANALYTICAL RESEARCH LABORATORY)

DR JULIE WAGNER, VETERINARIAN AND RAVENSDOWN ANIMAL HEALTH PRODUCT MANAGER

Mineral supplementation of dairy cows via drinking water is a common practice across New Zealand. Failure of the dispensing mechanism (dosatron) can lead to an inadequate supply of minerals and subsequently poor animal health outcomes.

One of the main causes of dosatron failure is the build-up of a slimy material in the pipes, which subsequently prevents the flow of water and minerals through the dosatron and piping. Magnesium chloride is frequently, but unfairly, blamed as the cause of the blockage. In this article we discuss the reasons for the formation of the slimy material and how this can be managed.

The slimy material removed from blocked dosatrons is biofilm, produced by the bacteria present in water that sticks to the pipes. Given the opportunity, the biofilm builds up until it causes the pipes and dosing mechanism to become blocked. The presence of mineral scale, like that sometimes seen in the bottom of a kettle where water contains high levels of lime and other minerals, as well as incompatible compounds that cause precipitates to form, provides a rough surface for the bacteria to attach to and encourages biofilm growth.

What's the culprit?

It is not proven that magnesium chloride is causing the issue. It is used across the country with only a handful of complaints about blocked dispensing equipment, so it is reasonable to conclude that other factors are probably involved here. We have explored this using mineral analysis from our IANZ-accredited laboratory ARL.

While clean drinking water contains a wide range of dissolved compounds in equilibrium that typically remain soluble with other compounds, our analysis of biofilm samples and water from affected farms has shown in the worst affected cases there was, besides magnesium chloride, a mixture of other compounds added. This created a hydroponic culture solution containing nutrients stimulating biofilm growth.

Water mineral composition

Simply put, the quality of the water consumed by livestock can impact performance. Farms with naturally high mineral levels in water may have a higher stock intake of trace minerals and macro minerals than estimated. This can also be compounded by mineral feed and supplements in the mix. While typically not a concern, in some cases, high mineral intakes can be problematic and may lead to animal health issues. Water high in minerals can also encourage and support the growth of bacteria and algae, which may reduce your stock's water intake and in some cases negatively impact animal health.

Regular monitoring of dispensing equipment for the build-up of minerals and biofilm can help prevent inadequate supply of minerals to stock water and the associated health problems. Monitoring of minerals and bacterial quality of water on-farm helps identify possible challenges from excessive mineral intake or mineral interactions that can lead to secondary deficiencies. ■

BY TESTING YOUR WATER YOU WILL FIND WHICH MINERALS ARE CAUSING YOUR BLOCKED DOSATRON AND YOU'LL BE ABLE TO FIX ACCORDINGLY.

Table 1. Solubility: Anion and cation compatibility chart

	Anions								
	Phosphate	Molybdate	Borate	Sulphate	Iodate	Chloride	Selenate	Nitrate	
Ammonium									Cations
Calcium	■	■	■	■			■		
Magnesium	■	■	■						
Potassium									
Sodium									
Iron	■	■	■						
Manganese	■	■	■						
Copper	■	■	■						
Zinc	■	■	■						
Cobalt	■	■	■						

■ = insoluble compounds

Get the best out of your kale

HUW MURRAY, RAVENSDOWN TECHNICAL MANAGER AGRONOMY

REBECCA JOHNSTONE, RAVENSDOWN AGRI MANAGER

Growing winter crops is an integral part of most farms and is important both for supplying winter feed and your regrassing programme. It's important to grow a successful winter forage crop to both reduce wintering costs and give your new grasses the best possible chance of success - that's why we suggest you start planning now.

Paddock selection and pre-planning

As part of your regrassing programme, addressing any weed issues and nutrient deficiencies prior to establishing the winter crop is important. Selecting paddocks for regrassing should be based on paddock Dry Matter (DM) performance, which may be the oldest paddocks, where native grass species are taking over and clover is thinning out. Choosing the poorest paddocks on-farm will have the biggest gains in production, provided we address the performance issues.

You should soil test at least the autumn before and, based on those results, apply necessary capital lime or fertiliser to ensure the paddock fertility is where it needs to be. Lime in particular takes time to exert the effect, so if pH levels are low you need to be applying lime 6-9 months before the crop goes in.

Cultivar selection

Select an appropriate cultivar for the stock type to graze the kale.

- Sheep = short variety
- Cattle = medium leafy variety.

Before putting crop in, check for weeds, it will need a pre-emergence spray if weeds are prevalent.

Getting the seed bed right

The two methods of paddock preparation are cultivation or direct drilling, each of which has its own pros and cons.
Starter fertiliser will be based on the paddocks' fertility and the size of the crop you're aiming for. Ideally, we would have taken care of the base fertility already (based on our autumn soil testing). If not, we will need to apply capital fertiliser at this stage. If fertility is below optimum, direct-drilled crops will benefit from receiving some fertiliser down the spout to ensure nutrients are near the emerging seed. Using DAP is often the most cost effective way to supply nitrogen and phosphate into the crop, which is also useful in direct-drilled situations as there isn't the same breakdown of organic matter that releases nitrogen for the plants to use.

Gaining a strike of 80 plants per m^2

Kale should be sown when soil temperatures are at 10-12°C and rising (usually around November). But we also don't want to leave the paddock too late before sowing as we risk the crop not receiving enough 'thermal time' to reach its potential. If the crop isn't able to go in early enough, e.g. can't get it in until after Christmas, winter rape may be a better option.

Kale is usually sown at 4-5kg/ha, however 5kg/ha will give you a greater yield in certain cultivars (*) as well as promoting finer stems and more leaf. Use treated seed to protect the germinating kale from insects some coatings (e.g. Ultra Strike, Super Strike, Agricote and Gaucho) also include a fungicide.

Post emergence

Once the crop is up and growing, the main job is monitoring for weeds and insects and treating accordingly. Herbage testing at this time can also be beneficial while crops are actively growing.

Look at applying one or two side dressings of urea, depending on the crop yield potential as well as the soil nitrogen reserves. For example a 12.5 tonne crop takes up approximately 200kg/ha of nitrogen. Much of this may be provided by the soil reserves. Sprayed-out paddocks with low clover levels or heavily cropped paddocks are likely to have less soil N reserves than paddocks coming out of good quality pasture.

(*) see Source Code on page 42

Maximising your fertiliser spend with a Whole Farm Soil Testing programme

By Dan Copland and Julie Roberts, Ravensdown Senior Agri Managers

DAN COPLAND, RAVENSDOWN SENIOR AGRI MANAGER

JULIE ROBERTS, RAVENSDOWN SENIOR AGRI MANAGER

Fertiliser costs are often one of the largest spends on-farm, therefore it is important to establish a robust soil testing and nutrient input programme to make sure you are maximising your fertiliser investment.

In our opinion the whole farm soil testing (WFST) programme is one of the most precise and cost-effective nutrient management strategies a farmer could adopt. By using WFST and creating a customised nutrient input plan you will be able to cost effectively apply the correct nutrients at the optimal rates to maximise pasture production on your farm.

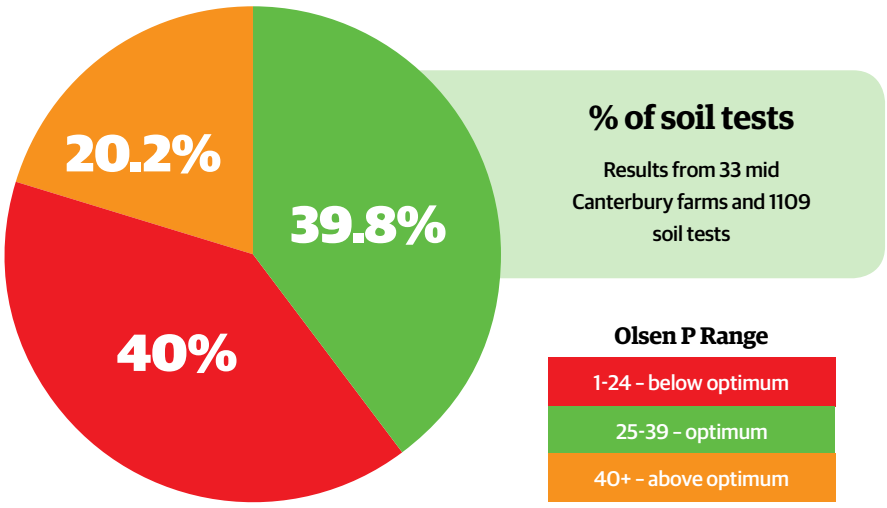
Ravensdown's WFST programme is a repeatable process that can be tailored to meet your farms' specific soil fertility and budget requirements. The use of Ravensdown technology, such as GPS transects and Smart Maps, means the whole process can be captured and progress can be more accurately monitored.

What is Whole Farm Soil Testing?

As the name suggests, whole farm soil testing (WFST) tests every paddock on the farm, gathering much more information than other soil testing strategies. Our training and experience means we can correctly interpret the soil test information for each paddock and make confident and precise decisions around nutrient input for each paddock.

For example, when it comes to maintenance fertilisers on a dollar per kg nutrient basis, phosphate (P) is one of the most expensive nutrients you will apply annually. Therefore it is imperative to get phosphate applications right. Under the WFST programme we can create a phosphate input plan that targets low Olsen P areas with capital P, lifting paddocks into the optimum range. We can then apply maintenance P (based on Overseer) to paddocks that are already in the optimum range and sub-maintenance or no phosphate to areas that have above optimal Olsen P levels; essentially mining the phosphate from these areas without detrimentally impacting pasture production.

2016 WFST Olsen P



Whole Farm Soil Testing finds surprising variations

Analysis of 1109 soil test results taken from WFST programmes in mid-Canterbury, has shown that a staggering 40 percent of the paddocks tested have Olsen P levels below the optimum range. Applying capital P to these paddocks/areas and getting them into the optimum range could potentially see an increase in pasture production of about 2-8 percent.

We also found that close to 20 percent of paddocks tested had an Olsen P level above optimum. With the majority of these programmes we have been able to cut back or withhold phosphate from groups of paddocks, cutting $2000-$15,000 out of the farmer's fertiliser budget.

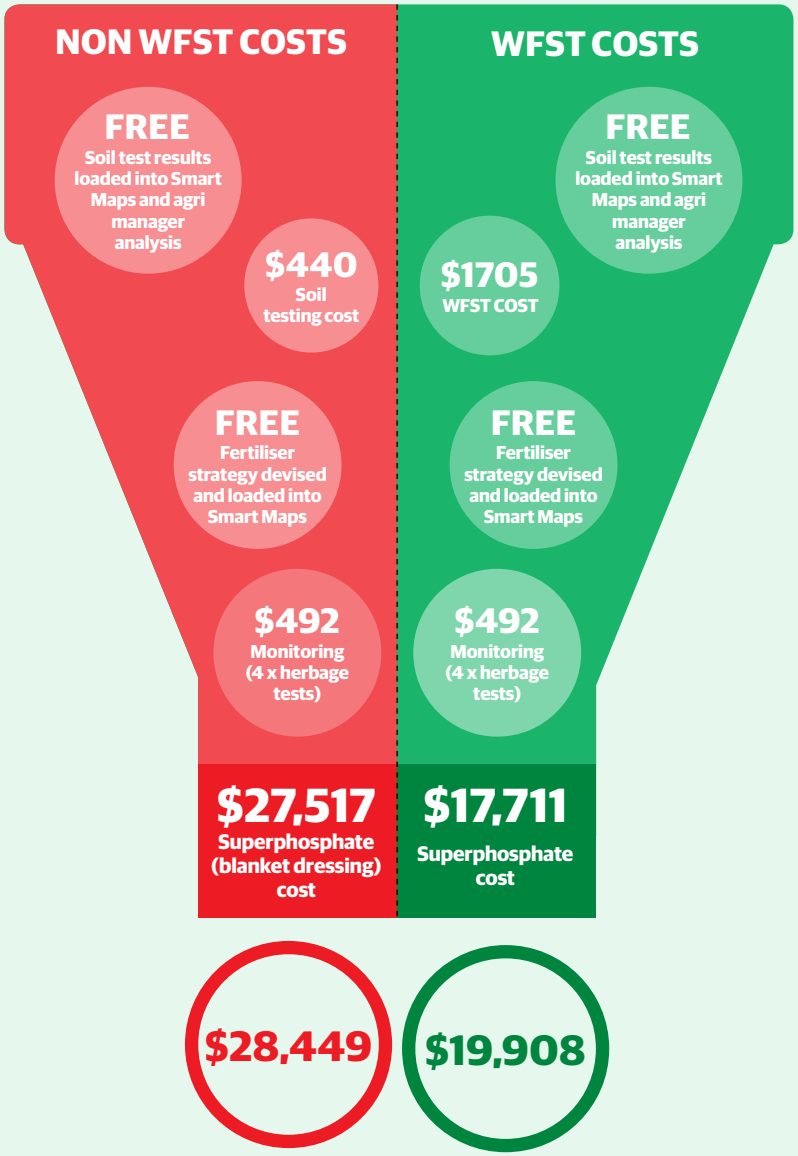
Westpac Taranaki Agricultural Research Station (WTARS) recently adopted the WFST method and got some surprising results. The farm is on Egmont volcanic ash soil and has been fertilised similarly for many years so WTARS weren't expecting to find too much variability within these tests, however the results revealed some big inconsistencies in their nutrient levels.

Soil pH levels on this farm ranged from 5.2-6.3, Olsen P levels 15–108, QTK 4–19 and Organic S 10–20, with clear areas where their fertility levels could be improved and other areas mined. We are now working with the station to apply capital fertiliser to the paddocks where it is required and withholding it from the high fertility paddocks, likely resulting in more pasture grown at the same, or potentially lower, cost of fertiliser applied. The current use of the research station's slurry wagon to apply effluent will also be considered when they look at reaching optimum fertility levels.

By testing every paddock it has enabled the WTARS farm management team to spend their fertiliser dollar more strategically by ensuring that the nutrients are applied where most needed. A prime example being a plan for the paddocks with high potassium levels to be used for growing maize and harvesting silage in the future. ■

Cost Analysis of WFST and superphosphate input

219ha irrigated mid-Canterbury dairy farm, 31 paddocks tested



Whole farm soil testing benefits:

- More precise information
- Increased pasture production
- Saving on fertiliser costs
- Can be customised to suit any farming situation
- Monitored in Smart Maps
- Ongoing repeatable programme.

LEVERAGING SCALE – a new take on the corporate dairy world

Trying to operate 13 dairy farms with 13,500 cows as one, with three other operations managers, keeps Athol New pretty busy these days. The reigning FMG Young Farmer of the Year is part of a wider team at Purata Farms managing four dairy farms and one dry stock farm in mid-Canterbury. The business philosophy? To leverage their scale as one big operation but with little hubs – a better outcome for the staff, the cows and the owners.

Athol is one of three operations managers, looking after 4000 cows over 1300 hectares. His journey here is something of a long story, but what he's been doing lately is challenging the status quo. With a solid footing in being titled the best young farmer under the age of 31 in New Zealand, Athol plans to leverage his own scale and skill-set whilst giving back to the contest that opened so many doors for him.

Q: What has been the biggest benefit from entering the FMG Young Farmer Contest?

"It was a great networking opportunity where I learnt new skills and tested myself against my peers. There's a good brand behind Young Farmers which made it easy to phone people up and leverage the access you get to the incredibly intelligent people in the industry. It opens your mind and broadens your horizons, providing opportunities that other people don't necessarily have.

In the build-up, where I was researching other farm operations, the doors were flung far and wide with a lot of incredibly successful farm owners more than happy to open up their farms to me to come and learn, and the information I was given was far deeper and more detailed than they give other people. When I phoned Craige McKenzie, he was in hospital getting an operation and was like 'yeah come on over', and he saw me while he was on crutches! The stuff he taught me was at a much higher level than the things he presents normally.

It's also the technical business knowledge you gain, which is usually where most young farmers struggle. It was really good for me personally, looking at how I can build my equity."

Q: What are your biggest challenges at the moment?

"My new role at Purata (going from managing two farms to five farms) is challenging in the fact that I'm now trying

to achieve through people rather than myself. When I started out in the industry growing and developing people was my worst skill-set and now it's one of my strongest thanks to the mentoring I received from Juliet McClean (previous Managing Director of Purata Farms).

Having a foot in both camps, making strategic business decisions and being a part of the day-to-day development of my team can be challenging but it's where I'm happiest having the balance.

Because my skill-set is now running a $40 million asset, my personal challenge is how I leverage that to start my own dairy business, which won't be at the same scale."

Q: How have you challenged the status quo?

"We changed our system a couple of years ago to calve all of our heifers (1200) together, where most farms usually do 20% of their herd. As part of that I developed a teat seal application trailer with our vet at the time, Dave Campbell, which is essentially a mobile herring bone cow shed that holds five cows at a time.

We use it to apply a sealant for the teat canal which prevents mastitis for the heifers who haven't calved before. Because they don't come into the dairy shed and are out grazing, it means we can apply the teat seal out in the cattle yards where they are raised to a height on the trailer, so it's easier to apply and they're more relaxed being together.

Because of this we've been able to reduce heifer mastitis from 20% to 3% across the whole Purata farming business. Having all the heifers calving together and treated for mastitis has also allowed the cows to start in the milking shed producing very high quality milk. We now use teat seal on all our cows when they're dried off because of the success rate we've had, which allows us to use fewer antibiotics on the cows.
It's now being used across the country and in Australia."

Q: Where do you see the future of farming?

"It's going to be all about utilising data. Data is the future. There's a lot of data available now that we just don't know how best to use. We're currently using cow-to-bale identification, automated milk metering and heat detection, which produces so much data in one of our sheds that it requires three computers to run it.

Precision agriculture and data go hand in hand and it will get right down to cow level where the individualisation of cows in large-scale businesses will become common place so farmers don't have to be so hands on.

The future for dairy farming is going to be particularly challenging with the nutrient management side of things coming faster than the science can keep up with, which is likely to affect land values. We've got to make sure the regulations are sound and backed by science rather than anecdotal evidence.

The nutrient management regulations are particularly challenging for Canterbury going into the future. There are likely to be more farms investing in mitigations especially during those higher risk, nutrient loss periods."

Head to the 2017 Grand Final in Feilding from the 7th to 8th of July to see who the next Ravensdown Agri Challenger and FMG Young Farmer of the Year will be!

ATHOL NEW WITH ONE OF HIS TEAM, ASSISTANT HERD MANAGER BASIL HEWAGE.

Pasture First Approach

RON PELLOW AT THE LINCOLN UNIVERSITY DAIRY FARM

EVERYTHING'S NEGOTIABLE WHEN IT COMES TO CHANGE

Dealing with change is a constant in most businesses. The New Zealand ag sector expects uncertainty in the weather and in the market place. Increasingly, it now also has to include the impact of changing environmental regulation on future farm profitability.

The Lincoln University Dairy Farm (LUDF), a commercial demonstration farm, run by the South Island Dairying Development Centre* (SIDDC) of which Ravensdown is a partner, has tackled the low milk prices and future environmental regulations to meet its objective of maximising sustainable profit.

The 160 hectare, fully irrigated, pasture-focussed Canterbury dairy farm voluntarily chose to limit its estimated nitrogen (N) leaching back in 2011-12, while seeking to maintain profitability amongst the top 5%.

"With a low milk payout and constrained nutrient losses, we've had to push efficiency to levels we previously thought were unattainable," says Ron Pellow, Executive Director of SIDDC.

Average performance for the past two seasons, running a similar farm system, has resulted in 510 KgMS/cow, and 1777 KgMS/ha. Farm working expenses averaged $3.67 per KgMS resulting in an average operating profit of $1140/ha/year.

Modelling with Overseer® estimates nitrate leaching losses in these two seasons was more than 25% lower than the 2009-2013 baseline period.

"LUDF has largely achieved this with an exceptional focus on pasture management and by operating with a better match of feed supply (pasture) and stocking rates."

Feed that previously was required for maintenance of a larger number of cows, is now available for milk production. This lifts farm efficiency, helping to improve performance, profitability, and reducing nutrient loss.

When it came to further reducing costs to match the lower payout, we considered everything is negotiable, but zero was not always an option.

While it's easy to cut costs, and in some cases this is the only option, LUDF had little room for savings without eroding long-term productivity ," says Ron.

Instead the farm jointly focussed on maintaining productivity (as dilution is a significant part of reducing costs per KgMS) and ensuring farm inputs were generating maximum benefit.

Whole paddock soil testing had begun a few years earlier, which enabled the farm to defer maintenance phosphate on some paddocks in 2015-16, knowing these areas had above-optimum phosphate levels. Nitrogen fertiliser was also modified, with less early spring N, lower rates across the year, and no nitrogen in late autumn. Regrassing has continued, though at a slower rate, primarily because the farm currently has fewer options for easy productivity gains from regrassing. This year the farm is looking at targeted use of N-Protect where conditions are likely to otherwise result in significant volatilisation losses.

Ron adds "We must keep looking at our inputs and farm system and challenging ourselves on the assumptions we use to justify these. We know there's still more efficiency we can generate from our pasture."

* See page Source Code on page 42

GETTING THE BASICS RIGHT

The 2016 New Zealand Dairy Industry Award Share Farmer and Ravensdown Pasture Performance Winners, Mark and Jaime Arnold from Dannevirke, explain what made them stand out when it comes to the green stuff.

"Our biggest philosophy is focusing on the basics and trying to get those right," says Mark, after a whirlwind few months of being in the national spotlight.

We have a really low input system so in a low pay-out we're still remaining profitable and in a really good pay-out we're thriving – we don't do anything fancy," adds Jaime.

It's humble comments like this that make you wonder whether it's really that simple or is it the old adage that the smartest operators make it sound easy. An out-take from the New Zealand Dairy Industry Award judges paints a picture of Mark and Jaime's superior knowledge of pasture and supplements.

"The five years' worth of detailed pasture data allowed Mark and Jaime to demonstrate to the judges how important pasture is, allowing them to make sound management decisions. The results they were achieving on rolling country were well above benchmark for their region. They showed a good understanding of the cost benefit for each supplement that was introduced into the herd to ensure and maximise profitability. The results being achieved on their farm show Mark and Jaime's dedication to pasture management."

Targeting a pre-graze of 2700-3000kg DM/ha cover and a post-graze cover of 1500-1600kg DM/ha, utilising pasture growth rates in response to urea, they import around 14% of their feed as grass-based supplements.

"We've just started doing new pastures in the past three seasons, while not the recommended 10% we see regrassing 4.5% annually as a step in the right direction," Mark says.

"The new grass out-performs the old with one of our paddocks giving us 23% more yield. Our milk production has also lifted as a result, with stock coming off the new grass producing about a litre more."

Jaime says it's important to know what you've got before you start. "Matt Johnston (Ravensdown Agri Manager) has just been here to soil test the farm, which we do every two years, and then he gives us a recommendation that we always follow because our policy is that 'the farm always gets what it needs'."

Mark and Jaime are now in their fourth season of using turnips for summer crops, averaging 12-13 tonnes from each crop. To spread the risk, they like to use a mixture of pastures such as perennial rye grass (Bealey and One50) with different heading dates.

"Some pastures grow better in this climate than others. It's trial and error, seeing what works and taking advice. Currently our best performing pasture is Bealey. This new species of ryegrass works well and also holds on during the summer," says Mark.

The couple measure 98% of their farm every 7-10 days so they know where they are and are able to keep their monthly feed budgets as accurate as possible. Pasture is of high value to Mark and Jaime and its utilisation is the key driver to their profitability.

NZDIA 2016 SHARE FARMERS AND RAVENSDOWN PASTURE PERFORMANCE WINNERS JAIME AND MARK ARNOLD ON THEIR DANNEVIRKE DAIRY FARM.

NEW ZEALAND DAIRY INDUSTRY AWARDS

CURRENT REGULATORY FRAMEWORK IN NEW ZEALAND

Further to the article in the first edition of Ground Effect (Spring 2015), here is an updated 'snapshot' of some regional councils' approaches to nutrient management nationwide.

Northland region

- Draft Freshwater Plan released for public feedback in August 2016
- Proposed Freshwater Plan to be notified by August 2017.

Auckland region

- Unitary plan released September 2016
- No current focus on property-specific nitrogen (N) loss limits
- Council will look to beginning the limit-setting process over the next 3-4 years.

Waikato region

- Healthy Rivers Wai Ora plan change notified in September 2016
- First part of an 80-year process to restore and protect the Waikato and Waipa rivers
- Involves the requirement to benchmark the farm's N losses as estimated by OVERSEER® and ensure that future losses do not exceed that benchmark
- Public hearing process in 2017.

Bay of Plenty region

- Proposed Plan Change for the Lake Rotorua catchment as of November 2016
- Farms need to contribute to the goal of reducing N inputs to the lake
- Farm-specific N loss assessment with OVERSEER® against dairy or drystock reference files.

Gisborne region

- Proposed Freshwater Plan as of November 2016.

Hawke's Bay region

- Tukituki catchment plan fully operative and being actively implemented
- Requires farms to comply with N losses based on property's Land Use Capability (LUC) class
- Council have begun the TANK process (Tutaekuri, Ahuriri, Ngaruroro and Karamu catchments) with a proposed plan change expected by December 2017.

Taranaki region

- Draft Freshwater Plan released earlier in 2016, but is currently on hold and a proposed plan will go out for public consultation as soon as possible.

Horizons region

- The One Plan is now operative and three years into the implementation phase
- Intensive farming is required to gain consent in the priority catchments and operate in accordance with their nutrient management plan.

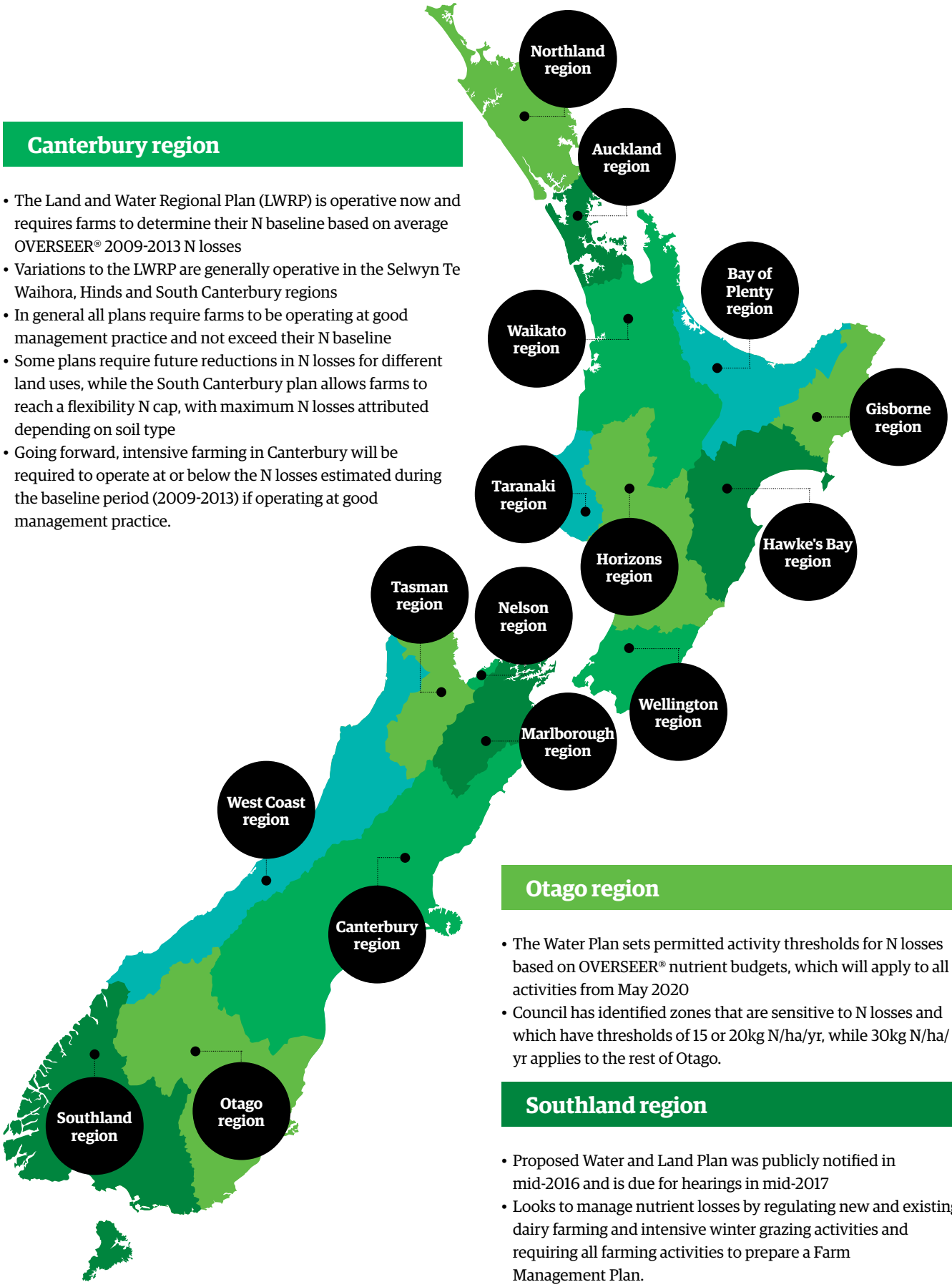
Wellington region

- Natural Resources Plan released July 2015 and the hearing will be held from March 2017
- Whaitua (zone) limit-setting processes to begin in 2017.

NB: This information was correct at the time of writing in December 2016.

Canterbury region

- The Land and Water Regional Plan (LWRP) is operative now and requires farms to determine their N baseline based on average OVERSEER® 2009-2013 N losses
- Variations to the LWRP are generally operative in the Selwyn Te Waihora, Hinds and South Canterbury regions
- In general all plans require farms to be operating at good management practice and not exceed their N baseline
- Some plans require future reductions in N losses for different land uses, while the South Canterbury plan allows farms to reach a flexibility N cap, with maximum N losses attributed depending on soil type
- Going forward, intensive farming in Canterbury will be required to operate at or below the N losses estimated during the baseline period (2009-2013) if operating at good management practice.



Otago region

- The Water Plan sets permitted activity thresholds for N losses based on OVERSEER® nutrient budgets, which will apply to all activities from May 2020
- Council has identified zones that are sensitive to N losses and which have thresholds of 15 or 20kg N/ha/yr, while 30kg N/ha/yr applies to the rest of Otago.

Southland region

- Proposed Water and Land Plan was publicly notified in mid-2016 and is due for hearings in mid-2017
- Looks to manage nutrient losses by regulating new and existing dairy farming and intensive winter grazing activities and requiring all farming activities to prepare a Farm Management Plan.

"It's also important to us to work to our strengths"

MATT WITH HIS CHILDREN, ALEX (LEFT) AND CAMERON WYETH (RIGHT)

WHERE EFFICIENCY MEETS FARMING

In 2010 the Wyeths' had a horrific snow event during lambing that left them heartbroken as farmers. They had to watch their lambs perish, because there were only so many they could bring back to the house and put in front of the fire. Watching the fruits of their labour, and ultimately profit, be washed away they made a decision not to go through it again, so they set up a facility to minimise their business risk and build resilience into their farming system.

"We feel we have an animal welfare obligation to give everything a fighting chance - essentially we're a sheep and beef business with an orphan lamb system running inside," says Matt Wyeth. "As we're doing our lambing beat we take the miss-mothered lambs, and ones that just won't survive outside, to an indoor facility where we can make sure they not only survive but thrive.

"We've also spread our risk and workload over five lambing dates and land class units. Rather than put all our stock at risk of being hit by one weather event, we've staggered our breeding so that the risk is spread. We've also put different mobs on different land classes, dependent on their physical attributes and lambing requirements, bringing the highest risk ewes (two-tooths and triplets) closer to home where we can have a higher influence on them. Our late-stage ewes (having single lambs) are put on our high country because of its later growth curve and warmth."

Drawing parallels with dairy

Spring Valley's team of seven in Masterton involves Matt and his wife Lynley, their two sons, Alex (11) and Cameron (9), Block Manager Andrew Mckay, Fencer and Project Manager Jason Jamieson, and Shepherd Scott Materman. The team manage 1300ha over two farms, running 12,500 stock units.

"Alex does the lambing beat around the triplet ewes with our drone before he goes to school and gives me a call to let me know if there's anything I need to go and attend to," says Matt. "The other team members have boxes on their bikes for any lambs they discover on their beats, bringing them back to Lynley at the orphan shed. Lynley has developed strict protocols

INDOOR HOUSING FOR ORPHAN AND TRIPLET LAMBS GIVES THEM A FIGHTING CHANCE.

to raise the lambs (500 approx) efficiently and effectively until weaning at approximately six weeks of age. Early rumen development and weaning onto high quality pasture and with ad-lib access to lamb pellets is key.

It's no different to what a dairy farmer does when rearing calves. It feels good to give every lamb a fighting chance.

It's also important to us to work to our strengths - spreading the work-load means we keep the morale high and we can focus on a team culture. Rather than tailing 11,000 lambs we've made it more manageable by staggering 1200 lambs at a time."

Matt and his team also align their pasture productivity to maximise lambing carcass weight (per hectare) leaving the property. They use all forage-based pasture - with fodder beet, rape and plantain on the flat country and rye grass and native grass on the hill country, monitoring their soil and water nutrients very closely.

"We are making sure we are sustainable while ensuring our stock are efficient in converting the nutrients into available product as quickly and efficiently as possible. Ravensdown monitor and measure all our nutrients for us and did our Farm Environmental Management Plan," says Matt.

"They (Ravensdown) have been an instrumental part of our team. We like to align ourselves with companies with the same values of looking after our land, environment and stock. It's about the people and ensuring the relationships are enduring, built up over time. They have really helped us out and bought into our concepts and philosophies of where farming is going to be in 20 years' time."

Making the most of the team

Matt says he seeks advice regularly from his animal health advisor and agri manager at Ravensdown and quips that the more fertiliser he puts on the luckier he gets.

"It's about growing as much grass as we can and converting it at the right time - we rely on Greig McLeod (Senior Agri Manager) for his knowledge first and product afterwards to get to where we want to go. Paul McKee's (Animal Health Advisor) advice is also sought regularly throughout the season on different drenches, and stages of animal productivity. We've done a number of drench reduction tests with him; he's another part of the cog in our enterprise, making sure that our animal health policies are correct for the season, the environment and expected productivity."

The drone technology used by Matt's son is a new tool but highly valued for its efficiency for checking over all livestock without disturbing them, and for the health and safety bonus of not having to drive all over the farm opening and shutting the '50-odd gates'.

"We call it God's eye," Matt says. "We can see ewes having trouble giving birth that we can go and attend. My son loves it because it's a cool toy but also one way he can contribute - he's a valued member of the team. It really is the next generation's tool, and it helps showcase that farming is attractive and exciting to his friends at school."

The farm's lambing percentage now constantly hits 160 percent, lambing 11,000 from 7000 ewes and orphaning approximately 500. This kind of efficiency sits at the epicentre of the farm's mantra 'Proud and passionate about our industry, where efficiency meets farming.

Spring Valley Beef & Lamb trial

1. Orphan lambing (housing indoors? capturing resource on-farm and making it into saleable product
2. Triplet management (housing indoor triplets) taking high risk ewes and turning them into an opportunity in increasing survival
3. Early weaning - Increasing on-farm efficiency by growing lambs faster on grass
4. Grain assist for cattle -making better use of our forage crops in winter - by finding out nutritionally what they're missing in their diet and filling the gap with grain.

NB: Crops tested by Ravensdown for dietary info.

Thought Leader

CHANGING THE FREQUENCY

If there was ever a role model to illustrate what is possible with the significant advances in New Zealand farming technology, it's Craige Mackenzie. The success of his Canterbury Plains farm has been recognised, not only nationally, but at a global level.

Craige's agricultural career started like almost every other New Zealand farmer when he took over the family farm, Greenvale Pastures, where he has lived since 1970. Initially it was a run-down enterprise but with the addition of more land from the neighbours (now Three Springs Dairies), the Mackenzies have transformed it into a showcase of the best in precision agriculture farming practices.

Two hundred hectares are dedicated to intensive cropping while the dairying operation utilises a further 330 hectares, milking around 1200 cows.

Like everyone, the Mackenzies haven't escaped the challenges currently facing the industry.

"I think we're all going to face more regulation as we go forward – it's about how we embrace the technology to help us continue to have the right to farm. With rights, there are responsibilities and we're going to come under some significant pressure," Craige says.

Shaping the future

The Mackenzies aren't overly worried about regulation, because they would prefer to be ahead of it.

"We'd rather shape regulation than push back on it. Generally, what's good for the environment is also good for your financial stability so those two things go hand in hand. I think we've got some real challenges on how we work collectively with our urban cousins and we need to be able to show we're undertaking good practice and help them understand that intensification can actually be sustainable," Craige says.

"We've developed technology where we can actually put nitrogen in-between every urine patch on a dairy pasture in real-time, rather than on them. You can also drop herbicide or fertiliser in-between transplants in a horticultural situation, in-between every plant down a row. This could probably save significantly on your fertiliser with a lettuce crop."

With the implementation of precision irrigation based on electromagnetic soil mapping Craige knows exactly what the variability of his soil is, which means he can spatially apply water. Every individual drop on an irrigator is individually controlled which allows him to save about 30% of his water on average. With soil moisture probes in each of the 35 zones across the property, each individually managed, the data collated from the last three years shows no irrigation water has ever left the root zone of the crop through the growing season. This means no nitrates or nutrients have left it either.

"This delivers major savings for the environment, savings on fertiliser for us whilst driving production at the same time. The end result is a much bigger positive impact on profitability," Craig says.

It is this approach that has seen Craige win the international PrecisionAg Farmer of the Year Award, in recognition of the range of technologies he has implemented on the family farm. He also took out the Environment Canterbury Award for his efficient use of nutrients and water and environmental sustainability.

"We'd rather shape regulation than push back on it. Generally, what's good for the environment is also good for your financial stability."

"I think we're at a very exciting time with a lot of technology and opportunity."

Craige has won countless other farm environment awards over the years, including the prestigious Nuffield Farming Scholarship when he spent six months travelling around the world studying agricultural innovations and farming systems.

He says the family is now looking at different technology that they use on the cropping farm and how they could implement some of that into the dairy operation.

"Saving on fertiliser provides a large environmental benefit. If we're able to put on only what the crop requires, which we're able to do through a number of testing techniques, we won't have any excess fertiliser going anywhere. So big advantages for fertiliser, but also for water if we can actually use our water wisely.

Ravensdown works closely with our precision ag business. It's been a good relationship that they've been able to help spread the word of what's available and encourage staff to go to the farmers and help them both financially and environmentally. Lots of people have asked why fertiliser companies should be involved in this space, but I think, as a co-operative, they recognise there are also responsibilities that go with the sale of products.

Technology is a journey

"We used to grow crops that probably would only have done about four tonne to the hectare on dry land. We would run a lot of risk as we would put a suggested amount of fertiliser on but didn't know how much the crop was actually going to remove. Now we actually budget on 12 tonne to the hectare and we know exactly how many kilograms of nitrogen we need to put on for every tonne of grain we're going to produce, and we can back it up with the amount of water we put on.

We can see exactly where every kilogram of fertiliser has gone so we've got total proof of placement, while in the past it was just a guess. Not only are we much more accurate applying it but we are actually much more accurate at recording it and we know exactly how much the crop requires. We aim to prove that intensive agriculture can be sustainable, but if you don't have ways to prove it, you can't do that."

The Mackenzies currently operate under the Ashburton Lyndhurst Irrigation Scheme and have a couple of bores that are now 15 or 16 years old.

"This scheme has been very innovative and we actually have water delivered here on-farm, under pressure from an alpine source. We used to do about 3200 hectares of irrigation, but now the same amount of water does 4000 hectares and we've actually saved enough energy for 300 houses annually on this particular scheme," Craige says.

"I think we're at a very exciting time with a lot of technology and opportunity. But we also have a lot of challenges around being able to continue to farm as we want. If we can actually prove there are clean green outcomes from what we do, I think it will add to the value of our product. I think we should be focused on producing high-quality products for specific markets around the world rather than commodities. We feed 40 million people currently today. There'll be other places in the world that could fill some of those gaps, but some of our specific products and techniques could actually add value if we work closely with marketers in the international market."

What is smart irrigation?

Fig 1. Sensors plus automated variable rate

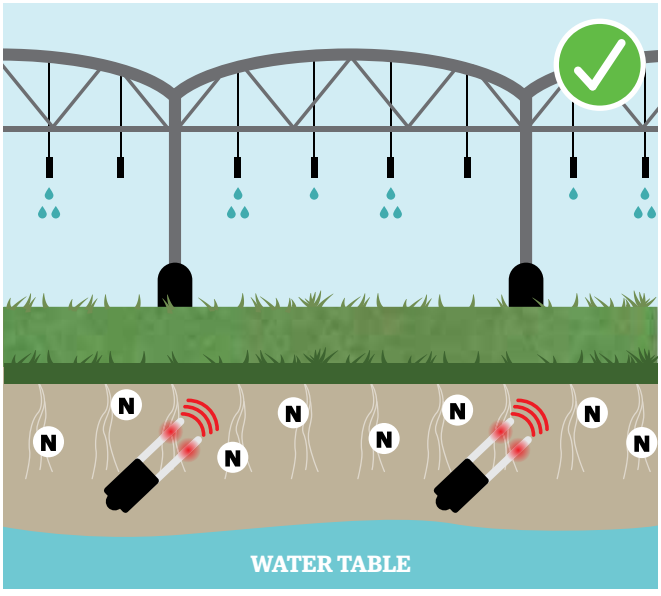
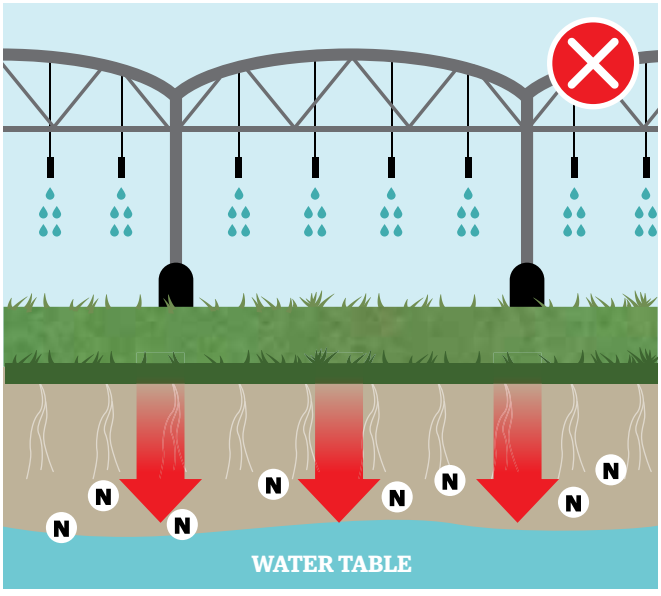


Fig 2. Unmonitored blanket irrigation



Scientific Round Table

FIVE SCIENTISTS, ONE ROOM, ONE TOPIC, ONE DAY...GO!

The future for agriculture is subject to market, financial and regulatory volatility. Ravensdown brought some of the primary industry's top science leaders together to discuss and debate what they see as the single most important thing affecting farmers in the next ten years.

To see the full debate go to our website - www.ravensdown.co.nz/scientific-round-table

Here are the highlights of what was a day of thought provoking and insightful debate amongst those shaping the future of the primary industries - Dr Keith Cameron, Dr Jacqueline Rowarth, Dr Ian Yule, Dr Ants Roberts, chaired by Mike Manning.

Dr Ants Roberts, B.Agr.Sc (Hons 1st Class); Ph.D (Soils), Chief Scientific Officer at Ravensdown

"I think the biggest challenge for farmers in the next ten years is to maximise the elasticity of their business and the flexibility of the farm system. By elasticity I mean the business has the ability to maximise income when commodity prices are high and minimise the damage when the commodity prices are low, so farmers can survive for the next five to ten years. What do I mean by the flexibility of the farm system? I mean, they have to constantly keep adapting to meet a more variable climate and regulatory controls that are constantly affecting their ability to farm."

Dr Jacqueline Rowarth CNZM, CRSNZ, FNZIAHS, former Professor of Agribusiness at the University of Waikato

"Within the farm boundary I'm with Ants: we have to maintain the economic viability of all our farms. We're looking at a lot of farmers who will, within the next ten years, be trying to bring the family home. We know that our younger generation want to make a difference. They're not going to want to take over a property where the regional council, for whatever reasons, is saying, 'No, you can't make any changes at all because it'll endanger your nutrient budget.' That's the importance of education and all the support people and support industries around the individual farmers who are able to look at their whole process holistically and say 'we can help you maintain a low environmental impact whilst creating economic viability'. Sustainability and resilience for the business are still our key imperatives."

"Sustainability and resilience for the business are still our key imperatives."

Dr Ian Yule Professor in Precision Agriculture at Massey University and Director of the New Zealand Centre for Precision Agriculture

"We've arrived in a situation where we've got monocultures and the market has changed, so I disagree with Ants, the point is how we do it and I think it's about mixed farming rather than the dominant forage supply system we have at the moment. We need to mix it up a little bit. Some other things I think are really important are what we're trying to do in terms of food production and should we be really clear about trying to get people off commodities? Not everybody is going to be doing that, but I think there is a whole range of things we can do to try to get over this vulnerability we have to commodity price change."

"I think it's about mixed farming rather than the dominant forage supply system we have at the moment."

"There's an absolute need in the future that farmers understand how to manage the farm system so that there are less leaks."

Professor Keith C. Cameron ONZM FNZIAS FNZSSS FRSNZ, Professor of Soil Science at Lincoln University

"The Government's National Policy Statement for Fresh Water Management has set a new direction that puts more pressure on farmers to address environmental protection and farm production together. There's an absolute need in the future that farmers understand how to manage the farm system so that there are less nutrient leaks. Equally, the environmentalists in New Zealand really need to have more understanding of the farming sector so that we're realistic about what can be achieved. We actually need integrated teams of people working together to understand the effects of farming and where gains can be made and where we can solve environmental problems. It's the integration of soils, plants, animals, and farm systems all together that will provide the solutions to the problems, and we need to bring that together with the environmental and agricultural sciences."

Mike Manning B.Ag.Sc, General Manager Innovation & Strategy at Ravensdown

"There's one thing that does worry me if I think about the next ten years and it's in the disruption area specifically. It's in the policy area around nutrients, sediment and bugs. If I look at the landscape, to pick Waikato Regional Council as an example and there are others, what you see coming down the track is a target that is well intended but an aspirational target that if adopted would provide a material economic dislocation, and so how do we resolve that? I mean it's nice to have these targets but how do we engage with the whole community to determine if that's indeed what they want?

"What you see coming down the track is a target that is well intended but an aspirational target if adopted would provide a material economic dislocation."

What tools do we need to navigate the next 10 years?

KC: "Jobs will be more specialised in the future and will require people with strong education and training. Farm and environmental systems knowledge will be needed to improve productivity on-farm and meet requirements for environmental sustainability. There'll therefore be increased demand for professional support from researchers, rural consultants, vets, agronomists, soil scientists and irrigation specialists."

JR: "We're not seeing the agricultural understanding and capability in regional councils at the moment. Changes are being made with the best of intentions, but not always with understanding of the facts. All political people, whether they're local or national, want to be elected and tend to go with what society thinks. What we need is good people in policy and on farm. We need good people everywhere."

IY: "We need better control of food processes in terms of how we apply nutrients and chemicals. Overseer® is always going to be catching up with what's happening. What annoys me is there is a lot of emotion in the debate, and as an academic we've got to get the facts out to people. I think a lot of farmers are beginning to grasp what's going on, but there's also a whole society that contributes to the problems we're facing."

AR: "This isn't going to be a universal solution, but the most effective way of getting all those principles (research and tools) in front of people who make decisions on farm is one-on-one. We also need to get better at extending the information and providing ways for farmers to work out and adapt this for their own unique farming situation."

Taking a multi-disciplinary approach

MM: "The gap between the university capabilities, research and farmers is really important. For the next ten years, what sort of people, skills, opportunities do we need to take it from research, to something farmers can debate, discuss and achieve flexibilty. What do those skills look like in the extension industry?"

AR:"As farm size increases and businesses amalgamate into entities, the best thing for promoting change and getting knowledge on farm is for a farm with a big enough enterprise to have a group of specialists who sit around and strategise on the farm business. But you've got to be there for the long term, working through the process, supporting the farmer in making those change decisions. I'd be trying to take precision agriculture tools to assist farmers to make the right decisions and implement them at the right time and in the right place."

KC: "We need to challenge the use of absolute leaching loss values in isolation when assessing farm environmental performance and find ways to help the farmers to continue to reduce their losses. We also need to improve education so that we all understand what is possible. It would be better if the discussion

with the regional council revolved around the 'farm environmental plan', where the farmer demonstrates how they're going to try reduce their environmental footprint rather than be judged solely on a single number of leaching loss from their farm."

JR: "It's about social acceptance and it also must be about economic viability, otherwise we won't get the young in. In order to sort this out, we have to ask the serious questions: what's the concern, what's the context of that concern, where's the science, the facts, evidence and data that might help us sort out the concerns within its context and what are the alternatives? If you cannot evaluate those you can end up flying off into a wonderful trajectory that ends you up in a worse mess."

IY: "Everyone talks about big data and all those sorts of things, but in reality I think that one of the things that we need to do is actually push forward with an advanced sort of mathematics about how we analyse that data and that for me is probably one of the key objectives - how we actually incorporate a lot of that advanced mathematics into understanding what these sensors are telling us. The better I do my job, the easier it will be for Ants."

Significant research ideas in the next 3-5 years to address the issues facing farmers?

AR: "I'm a fan of and want to maintain and improve pastoral farming in New Zealand. So one of the tools, along with a lot of what's been talked about here today, is in better forage species. There's a ryegrass plant that has been genetically manipulated to have twice the lipid content of current ryegrass varieties, which means it has a higher energy value so animals will produce the same meat, wool, milk and only need half the amount of intake. Conversely, you get nearly twice the animal production for the same feed intake. I want to put that into a farm system and evaluate it. Apparently the other benefits of this is that it reduces greenhouse gas emissions from the plant itself and also from the animal. It's more efficient in terms of utilisation of soil nitrogen or added nitrogen and is likely to reduce N emissions in urine. The problem is, of course, that this is pie in the sky because New Zealand won't allow genetically engineered crops or plants to be evaluated in the field. So if we got over that problem this could be

quite a game-changing technology and as I understand it, the genes that turn this lipid production on can be translated to other plant species. So it's not just necessarily limited to ryegrass."

JR: "I'm going to amend Ants' one because you're talking about engineering the lipid gene, which actually requires some material from somewhere else to be inserted, whereas Susanne Rasmussen's work at AgResearch actually identified the gene that overcomes the growth limitation to nitrogen. It's the gene that allows the same amount of grass for less nitrogen, or more grass for the same amount of nitrogen. New technologies are being developed and in America, as long as no new material is introduced in the 'modification' process, the result is not considered to be genetically-engineered. So, maybe my second project is about how we get society to understand the safety or risk factors involved in the work we're doing."

IY: "I agree with Ants about genetic modification and GE, it is nonsense that we've got regional and local authorities declaring they are going to be GE-free zones. Why are we not having a sensible debate about it? In terms of my project, I guess the work that we've done with the PGP project and hyperspectral imaging, which I've kind of fallen in love with because of its amazingly versatile technology and accuracy. With hyperspectral imaging or sensing you can do a lot of things equally well and so I would like to see a whole decade of work to try and understand our interactions within our environment and how our environment responds to nutrients and so on. There are a lot of people looking at pathogens, so there's all sorts of things that can be done using one technology. For me, I'd want to establish a New Zealand-based resource of hyperspectral imaging and sensing, and really get to grips with it and make some progress with it."

KC: "The main aim of my future research would be to discover ways to reduce nitrate leaching, which you can use on farm, one of those would be to discover a new nitrification inhibitor. The work we did over 18 years of concerted effort showed clearly that Eco-N was very effective at keeping nitrogen in the soil as ammonium for the plants to use, reducing nitrate leaching substantially, and reducing greenhouse gas nitrous oxide emissions considerably. That proof of concept shows that a nitrification inhibitor can benefit the environment and benefit production. Unfortunately it's no longer available and so the search is on by our research team and others to find an alternative to allow farmers to get the benefits that come from a nitrification inhibitor. Another would be to try to find ways to reduce the effects of, and the problems created by, large amounts of dairy effluent on the farm. Larger and larger storage ponds are being built to store the effluent until later in the year; surely we can do better than that? So, I'd like to look at exploring ways to reduce the risk, reduce the worry the farmer has around the effluent on the dairy farm."

Taking a global view

JR: "We've spent our lives in environmental agriculture, whether we called it that or not. I entered into agriculture back in 1974 to save the world, because it's about sustainable food production. Sustainable food production is what will manage the environment whilst feeding the populace. How are we going to get people involved enough to understand? More and more people in the world, but fewer and fewer as a proportion are engaged in our area. So what will we, the teachers and employers, be able to do? How will we make that difference?"

KC: "Well, if the figures are correct, we expect nine billion people on the planet by 2050. There will be global food shortages. But how are we going to produce more food from the land?

The Food and Agriculture Organisation of the United Nations say that there isn't much land left to be developed and that most of the increase in food production will come from intensification. If that's the case how do we meet these competing challenges of protection of the environment and sustainable production? The contribution I think that the universities are going to make will be in the education of the next generation of farmers, the next generation of farm support and consultants, and conducting advanced research that ensures those students take the latest technology out to farming businesses and the consultancy positions."

IY: "Water is going to be one of the most contributing factors. We're blessed in New Zealand with our quality of water and the amount we can utilise. But taking a world view, I think, for example, in more highly populated areas we're good at 3D farming or vertical farming, where we're growing things under hydroponics so we're getting larger output in smaller areas."

AR: "My understanding is that from a global perspective, 30% of the food produced in the world is wasted in the process of moving that product from paddock to plate. So that's a global issue which, if solved, will help reduce the need for increased intensification. The other factor is that New Zealand can only feed 40 million people in terms of protein, so we're aiming to feed the people who eat food for fashion as opposed to nutrition. I think that's a wrong use of food, particularly, in a world that'll be constrained by resources and food. We grow the cheapest protein in the world, in pastures, perhaps we should cut out the grazing animal and actually just extract the protein from the forage that we grow, which is cheaper than soybean protein, but the problem is we don't have a viable process for extracting it." ■

CROPMARK'S PLANT BREEDERS INSPECTING VARIETIES WITHIN THEIR PERSISTENCE NURSERY.

BREEDING RESILIENCE IN YOUR FORAGE PLANTS AND SEEDS

Based at Darfield in Canterbury, the Cropmark Seeds plant breeding programme is focussed on producing elite high-yielding forage species including ryegrasses, meadow and tall fescues, cocksfoot, clovers, brassicas and forage herbs.

A feature of this work is the breeding of inter-species crosses between ryegrasses with fescue species to produce resilient grasses (festuloliums) which display the best traits of each parent species. Products such as Matrix and Ultra are examples of the success of this approach. A feature of the breeding has been to delay the head emergence date to improve forage quality in late spring, which improves palatability, and to select for resistance to a range of leaf and stem diseases.

The company is taking the same approach to clover breeding, crossing white clovers with other clover species as part of a long-term project to improve traits such as drought and salt tolerance as well as yield in the resultant hybrid clovers.

Endophyte development for seed

Cropmark has a significant endophyte development programme running in conjunction with its plant breeding programme. Endophytes are an internally hosted grass fungus, which can produce unique chemicals called alkaloids that can provide significant insect deterrence and are being developed to provide greater safety to grazing animals.

Over the last 20 years, Cropmark has invested in a comprehensive laboratory to develop and inoculate new endophytes into a range of forage and turf material. The laboratory facility includes DNA and alkaloid-measuring equipment to help them select these novel endophyte strains. With this technology they have been able to research into the uncinatum endophyte, which is naturally found in meadow fescue, but not in ryegrass. By using inter-species crossing, they are able to get interspecies grasses to host the endophyte, and therefore improve their tolerance of insect pests.

Uncinatum endophytes such as the GrubOUT® U2 endophyte offer a wider range of insect tolerance of host plants than other ryegrass endophytes available in the market because of the lolines they produce. It is safer to use with grazing animals and does not cause grass staggers or heat stress.

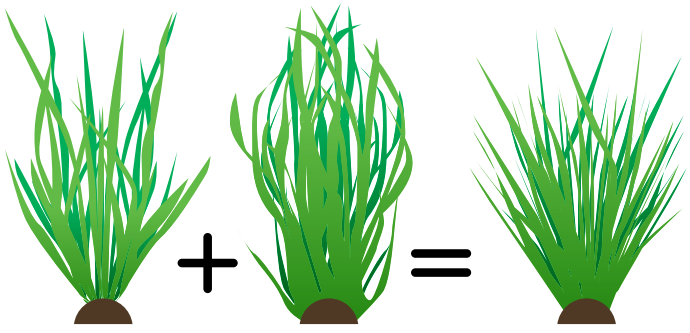
Unlike many other endophytes that only operate in the top parts of grasses (leaves and crowns), uncinatum endophytes operate both above and below ground. They provide protection of host grasses from root-feeding-insects as well as from above-ground-feeding-insects (*).

PLANT BREEDER NICK CAMERON IN THE CROPMARK'S INTER-SPECIES CROSSING NURSERY.

Pasture breakthrough

Research has confirmed that the GrubOUT® U2 endophyte provides protection against black beetle adults and larvae, grass grub larvae, porina caterpillar, black field cricket, Argentine stem weevil, root aphid and pasture mealybug (*). Together these insects represent some of the greatest challenges to pasture production and persistence and cause tens of millions of dollars damage to pastures and lost production on farms around the country each year.

Plant breeding is no longer simply crossing one plant with the next. In today's environment, plant breeding involves a highly scientific approach and large investment in the very latest research equipment. It takes long-term research to breed a grass and get it to the point of commercialisation. It can take up to 20 years and cost millions of dollars in research and development - particularly where endophytes are incorporated into the grass, but it doesn't stop there. Once the company has enabled the grass plant to host the endophyte, it needs to ensure that the product is safe for animals, that it is high performing and that it will add value on-farm. This involves a range of intensive trialling, including on-farm yield performance trials, persistence trials, pasture quality testing, animal safety trials and animal performance trials. ■



Inter-species crossing to improve the yield and quality of the parent grass species, such as:

- Perennial ryegrass for yield, persistence and adaptability to NZ grazing systems
- Italian ryegrass for speed of establishment, yield and quality
- Meadow fescue for pasture quality, palatability and the endophyte
- Tall fescue for its large root structure, salt and drought tolerance (while leaving behind its slow establishment and coarse, less digestible leaves).

(*) See Source Code on page 42

TO DRILL OR BROADCAST, THAT IS THE QUESTION...

GEORGE KERSE, AGROCHEMICAL PRODUCT MANAGER

Protecting newly sown pastures and crops against slug damage with slug bait can now be done above and below the ground. What is the best approach for you?

Discouraging slugs

Cultivation is the main way to discourage slugs. The habitat disruption will kill a proportion of the slugs and for those that survive it slows down the build-up in slug numbers.

Mob stocking also helps reduce trash and trample slugs, and a fine and firm seedbed will discourage slugs from burrowing into soil.

Broadcasting baits

Broadcasting slug baits after the spray-out and before drilling can give good control of resident slug populations, because they are introduced when the slug's food sources are disappearing. Mixing and spreading Endure slug bait with fertiliser saves on application costs.

If the drill slot is not covered-over there is a risk that slugs will migrate into the rows before they are exposed to the bait.

Drilling bait

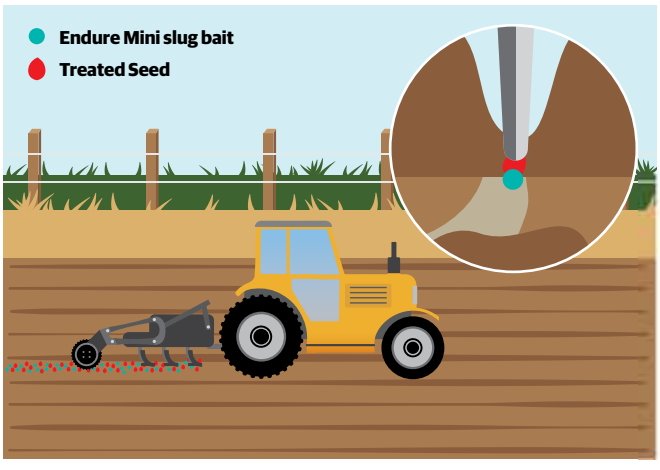
The new Endure Mini is designed for drilling with seed to protect against slugs migrating into the row and feeding on the seed.

Mixing Endure Mini with seed saves time and money and ensures the bait is placed alongside the seed in the drill row. The smaller baits (100,000baits/kg) provide more baits per metre of drill row and have the same effective formula as the larger Endure baits (60,000 baits/kg).

Belt and braces approach

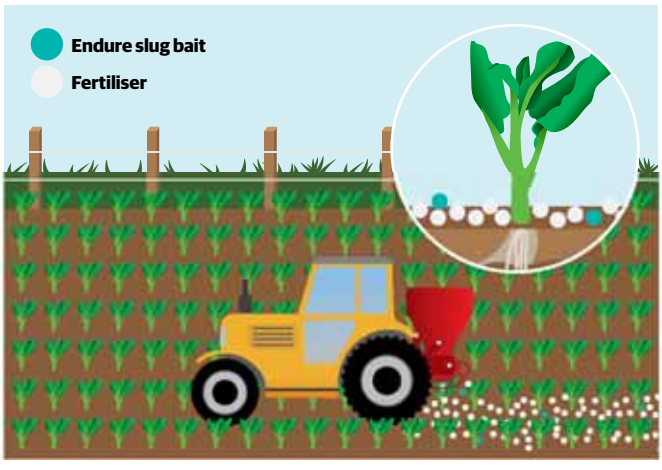
Not all slugs feed in the drill row so a broadcast application of the larger Endure baits may also be required. New Endure Mini means it is possible to provide protection for your newly sown crop, both before and after emergence. ■

Fig 1. Drilling bait



DRILLING ENDURE MINI SLUG BAIT WITH THE SEED ENSURES THE SEED CAN GERMINATE.

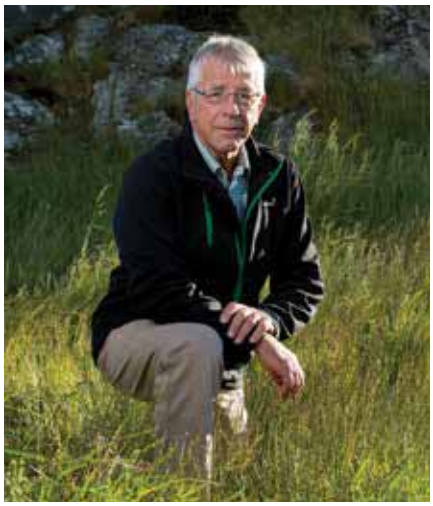
Fig 2. Broadcasting baits



BROADCASTING ENDURE SLUG BAIT WITH FERTILISER ENSURES THE BRASSICA CAN REACH MATURITY AND SAVES ON APPLICATION COSTS.

LET'S GET PHYSICAL!

Dr Ants Roberts,
Chief Scientific Officer



It's raining heavily, blowing a howling southerly, with a little bit of thunder and lightning thrown in. You've underestimated the amount of pasture in the break or paddock that you let the animals into this morning, so they're a bit hungry. They're also cold and a bit upset by the weather, so they start milling around and moving up and down the fence lines, break-fences and/or gateway, hoping you'll move them! This is the start of the pugging cycle.

To get the best out of your soil in terms of pasture production, air and water need to move freely in and out of the soil between the particles (Picture 1). This allows plant roots, earthworms and soil micro-organisms to get on happily with their business which is to take up nutrients, burrow through the soil creating more channels, recycle nutrients and organic matter, and generally create a soil environment which promotes good pasture growth.

Commonly, pugging and soil compaction results when stock are on moist-to-wet soils which then don't have the strength to support the animals' weight. This causes a pugged surface layer and a compacted zone at about 5-10cm depth (Picture 2).

The pugging cycle

When soils are pugged soil structure is lost, soil density increases and porosity (spaces between soil particles), drainage and aeration decreases. The soil stays wetter for longer, and wet soils are more easily pugged - the pugging cycle!

Soil compaction changes soil properties causing greenhouse gas emissions to rise, and increases surface water run-off, nutrient loss, earthworm death and anaerobic soil conditions. It also reduces nutrient uptake by plants and root penetration, leading to pasture 'pulling' by grazing animals and increased 'droughtiness' of pasture when the summer/autumn dry arrives.

Impacts on production

While many New Zealand farms are on soils considered to be physically resilient, such as volcanic ash and pumice-based soils, research in the Waikato has shown that just one soil treading/compaction event depressed pasture production by more than 50%, which then took two months to recover. Clover growth and annual nitrogen fixation has been shown to decline 60% with moderate treading damage and over 80% where treading damage is severe.

Treading damage decreases the soil's macroporosity (the big spaces between soil particles) and 'integrates' the pasture, nutrient and biological effects of soil compaction. Trials on a range of soils have indicated surface soil macro porosity should be 16-20% for highest pasture production, but this is rarely seen in practice. For every one percent increase in macroporosity in the 0-5cm layer there was a 1.8% increase in pasture growth.

Of course, it isn't only stock that cause compaction. Farm machinery on wet soils - such as towing a heavily-laden farm effluent tank over a paddock, ground-spreading fertiliser or even carrying heavy hay and silage bales, or other feed all cause compaction. The wheel ruts will be slow to recover and, on sloping land, may form channels, increasing soil and effluent runoff to drains or streams.

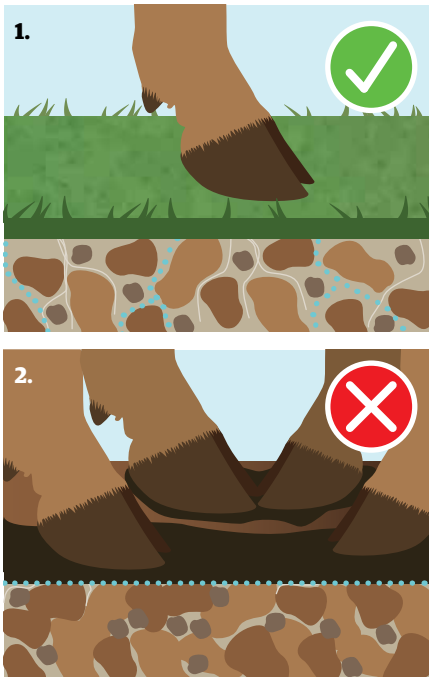
How do you know if you have a problem?

Go out and dig some holes in your paddocks and have a look!

Unaffected soil - will be loose and crumble into aggregates that are small, granular and porous. Roots will be plentiful and there will be plenty of earthworms (late autumn through to spring).

Moderately affected soils - will have many larger, firmer platy looking aggregates, particularly in the 10-15cm zone. Roots may be growing around, rather than through, aggregates. The soil will not crumble into small particles naturally and there will be reddish stains (rust!) along some root channels.

Severely affected soils will have a lumpy surface, and soil aggregates are coarse or absent. The soil will be hard when dry, or soft and plastic when wet. Platy horizontal aggregates are common in the 10-15cm zone and there will be few roots below 5cm depth. Red stains will be seen along root channels but the soil could look greyish and smell unpleasant when wet. There will be few earthworms around. ■



Source Code

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, give the Customer Centre a call on 0800 100 123 to arrange a chat.

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PAGE 6
SOCIAL LICENCE FOR PASTORAL FARMING SYSTEMS – DOES IT REALLY MATTER?

* Often referred to by the USA spelling as "Social License".
** http://www.psandman.com/
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Putting P in its place

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PG 17
GET THE BEST OUT OF YOUR KALE

* Based on REML analysis of three trials (Winton, Telford and Darfield) in 2006-07 over three cultivars (Gruner, Caledonian & a breeding line).

PG 22
PASTURE FIRST: EVERYTHING'S NEGOTIABLE

* SIDDC is a partnership between Lincoln University, DairyNZ, Ravensdown, LIC, Plant & Food Research and SIDE (a network of South Island dairy farmers).

PG 38
BREEDING RESILIENCE IN YOUR FORAGE PLANTS AND SEEDS

* Patchett B, Gooneratne SR, Fletcher L, Chapman RB (2011). Seasonal changes in leaf and stem loline alkaloids in meadow fescue. Crop and Pasture Science 62: 603-609.

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LET'S GET PHYSICAL

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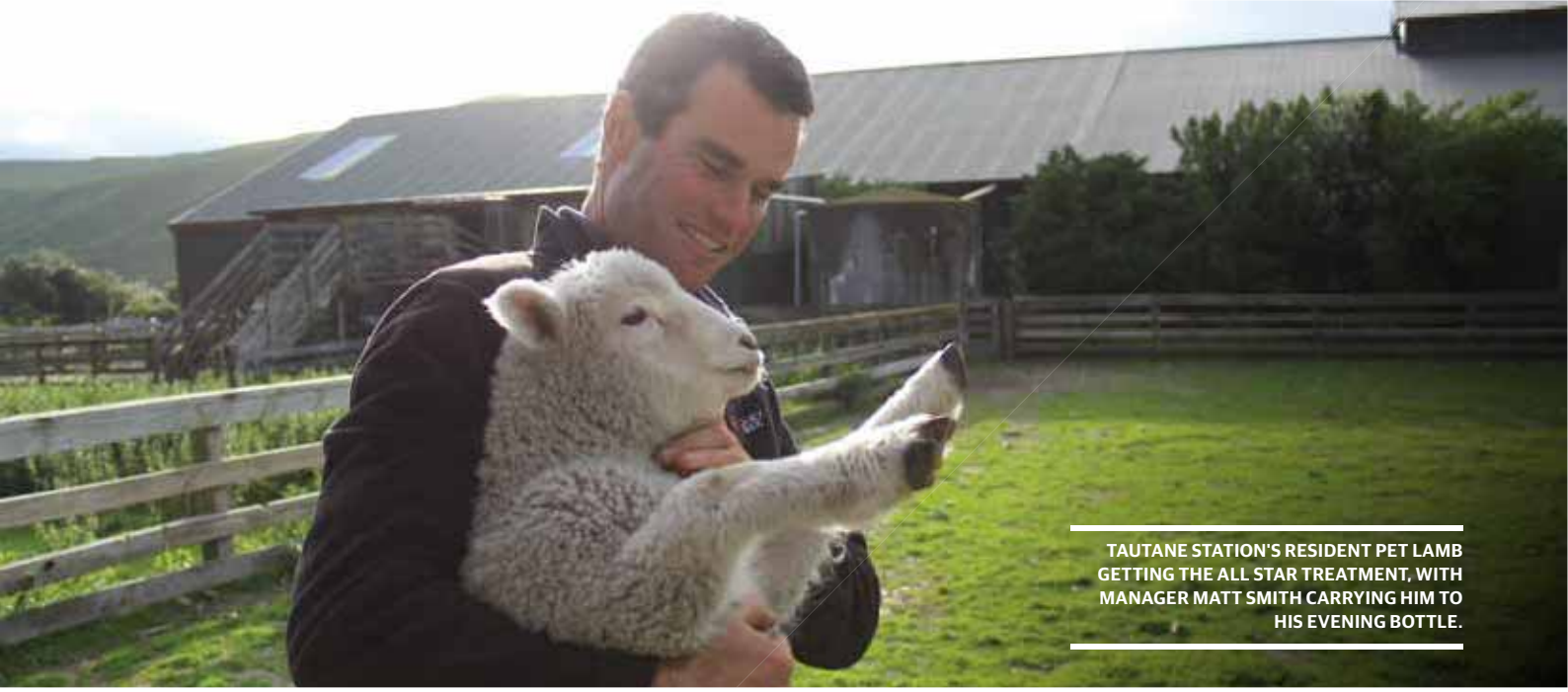

TAUTANE STATION'S RESIDENT PET LAMB GETTING THE ALL STAR TREATMENT, WITH MANAGER MATT SMITH CARRYING HIM TO HIS EVENING BOTTLE.

The Last Word

We hope you enjoyed the fourth edition of Ravensdown's Ground Effect. Let us know what you think, or if you'd like to contribute to the next edition.

You can email us or share your thoughts online through our social media channels.

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Instagram: @ravensdown

On behalf of New Zealand, we'd like to thank those who are doing and using agri-science, capturing insights for the good of the country.

Contributors

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