ravensdown

INSIGHT AND ACTION FOR AGRICULTURAL SUCCESS

ground EFFECT

SPRING 2016
EDITION 3

"We love pushing the limits."

Mary Andrews, Matariki Partnership, Waiomatatini Valley

More for the beer:

Hops and their explosive growth

Fertilising on a budget

Dr Ants Roberts

WELCOME TO THE THIRD EDITION OF GROUND EFFECT™ FROM RAVENSDOWN

So here we are with another spring edition of Ground Effect packed with insights and tips that can help boost the performance of the agri-sector for the benefit of New Zealand.

First cab off the rank is popular radio host and former All Black Richard Loe reflecting on the importance health and safety holds for him.

As we leave winter behind, Tim Lissaman, one of our Farm Environmental Consultants points out how changing to wintering dairy herds on farm can be a false economy when N-loss and nutrient budget impacts are included. Next winter may seem like a long way off, but if you're considering starting to winter cows on farm, it is well worth planning ahead.

On page 6, shareholder Grant McKenzie talks about how the environmental consultancy helped him with a land use change. This dedicated team within Ravensdown continues to be extremely busy which demonstrates how many shareholders are taking their environmental performance seriously. Meanwhile fellow shareholders Rob and Mary Andrews describe the ideas at the heart of their improvement philosophy on page 12.

Our field-based team are out there talking to farmers facing a huge variety of challenges. Dr Ants Roberts looks at getting bangs for buck from fertiliser investment and how to avoid throwing out the belt-tightened baby with budget-cut bathwater. Agri Manager James Bryan outlines the benefit of controlled release urea while Agri Manager Marty O'Connor discusses the spring 'pinch-point' for pasture production.

Our tried and tested pasture-first philosophy seems timely in tighter times and has always played to New Zealand's competitive advantage. Innovation Development Manager Dr Rob Murray tells us about how recent innovations to our Smart Maps technology can future-proof your business with good decision-making from

managing information. A track record of soil tests and fertiliser maps can show what's been effective in the past. This historical evidence can now be combined with future-facing data such as weather forecasts, soil temperatures and other environmental conditions.

The ballistics model underpinning our IntelliSpread precision aerial spreading service also deals with predictions based on complex calculations cross-checked against actual results. This helps pilots and farmers by predicting where fertiliser will land given the speed of the plane and the wind. The computer-controlled doors then adjust automatically so that the fertiliser lands where it's intended.

If this edition triggers any ideas, thoughts or questions I'd be happy to hear of them at the email address below. After all, combining our thinking is how New Zealand can move forward.

Best Regards
Greg Campbell
Ravensdown Chief Executive

CEO@RAVENSDOWN.CO.NZ

This edition

Thought leaders

Science and advice

COVER IMAGE: MARY ANDREWS

BEHIND THE SCENES

Ravensdown is collaborating for a sustainable future

Encouraging nutrient research studies

Senior Agri Manager Bec Meyer congratulates Grace Chibuike of Massey University who recently received a $5000 Ravensdown Agricultural Research Scholarship towards her PhD at Massey "Investigating and enhancing nutrient attenuation capacity and pathways in pastoral hill country landscapes".

Appreciation shown for precision approach

Ravensdown shareholder Craige Mackenzie was recognised as the International Precision Agriculture Farmer of the Year by the International Society of Precision Agriculture. Craige also chairs the Precision Agriculture Association of New Zealand on the organising committee with Mike Manning Ravensdown General Manager Innovation and Strategy.

Maps to target nutrient losses

Ravensdown continues its collaboration with Victoria University introducing a bespoke version of a Land Utilisation & Capability Indicator (LUCI) that features improved spatially-explicit detail of nutrient transfer across farm and provides guidance on appropriate targeted mitigations where needed.

Measuring actual nutrient losses

The 120 devices loaned by Ravensdown, that study the extent of nitrate leaching in a variety of cropping situations, continue to generate data that helps to inform the OVERSEER™ modelling tool. Ravensdown was instrumental in setting up the monitoring project being led by the Foundation for Arable Research, which measures how closely reality is matching predictions in several regions. Analytical Research Laboratories (ARL) have been testing the water samples captured under different crops and soils.

Point of View // Richard Loe

WALKING THE WALK

Championing farm health and safety

Farmer, former All Black and Ravensdown shareholder, Richard Loe, has never been backward about coming forward, whether on the rugby field or as a commentator on farming and sporting issues. Now he's bringing that plain-speaking to bear as ambassador for WorkSafe's Safer Farms programme, working with farmers to tackle the high number of deaths and serious injuries on farms.

I grew up on a farm. After school and during school holidays, we'd grab a horse, without a saddle or bridle, and head off to work.

I'm the first to admit that in my younger days I didn't give much thought to health and safety, nor for that matter, in my early days of farming.

But then three years ago, I was asked to co-present a health and safety training video for Landcorp staff. I heard from Landcorp workers about what they were doing and how they had learnt from others. It made me think "I need to be walking the walk".

After all, in 2015 alone, there were 19 deaths on New Zealand farms and thousands more injuries. This resulted in millions of dollars in ACC payouts, alongside a significant impact on farm productivity.

I took a fresh look at what I was doing at my own place – a run of the mill farm, with a Donnie Merino stud operation and some beef, overlooking the Waimakariri Gorge in Canterbury.

I've found out for myself that creating a hazard register and managing risk is straightforward. It doesn't mean a lot of paperwork. You just need to be aware of the risks on your farm and communicate that to the people who need to know.

Some farmers may think the new Health and Safety in Work Act is too daunting. I thought it would be too, but when you look at WorkSafe's 'Keep Safe, Keep Farming' tool-kit, you realise that it's just about being a good farmer.

"I'm the first to admit that in my younger days I didn't give much thought to health and safety."

For Ravensdown shareholders, most of it will be stuff you are already doing to meet the requirements of your meat or milk processors. You can go through and tick off what you are doing now and if there are any areas you need to brush up on, then look it up on the Safer Farms website www.saferfarms.org.nz. Often all that's needed is a few simple steps.

Or ask someone. We can all learn from one another. Look over your neighbours' fences and ask them what they've got on their hazard register.

Learn from your agricultural contractors. My hay baler employs 20 people and he's up to speed on all this stuff so I learn from him. Let's make spreading good health and safety practice in farming a two-way street. For instance, if you've got a contractor coming in to spread fertiliser, think about what you need to tell them about – the stroppy bull in a paddock, the flooded field or any ruts and ditches they should look out for.

Before tackling a job, think about what's the best equipment to use. You wouldn't take a hand fork to dig the paddock, so why take a quad up a steep pasture or to tow heavy spraying equipment?

Check your vehicle and tyre pressure before you go out and think ahead about the terrain and any hazards that change the game, like slippery slopes after rain.

RICHARD LOE IS FRONT-FOOTING HEALTH AND SAFETY ON HIS CANTERBURY FARM.

"You wouldn't take a hand fork to dig the paddock, so why take a quad up a steep pasture or to tow heavy spraying equipment?"

Make sure children, particularly younger ones, are well supervised. It's a total myth, by the way, that the new regulations mean no kids on farms. Family is a vital part of farming. No one is trying to stop that - but children feature large in the high death toll on our farms so we have to take that on board.

For too long, we as farmers have been saying we learn by our mistakes. However, that's no use when someone is killed or too badly injured to come back from it. I wouldn't want to carry the burden of knowing that happened on my farm.

I could name a dozen farmers in my area who've talked to me about near-misses they've had over the last few years. They say "I won't do that again". I've had a few myself. We are all very lucky to still be here. Others haven't been so fortunate.

I'm not a preacher. I'm an advocate. I've got a son who is farming and I want him to be safe. By taking simple steps, by using the tools and guidelines like those provided on the Safer Farms website and by talking about and sharing what we are doing, it will spread incrementally.

My challenge to you is to give health and safety the same priority as the brand of tractor or fertiliser you use. It should be part of being a good farmer.

You'll be seeing me round the traps talking about health and safety – so please do just that – come and say "hello", let me know what you think, and we'll talk about it.

For more details see www.saferfarms.org.nz

Focus On // Environmental Case Study

GETTING IT DONE ONCE AND GETTING IT DONE RIGHT

- the value of a fit-for-purpose nutrient budget

When you've invested over a million dollars and a year of your life into building a dairy barn, the last thing you want is to have that squandered in the consenting process.

When talking about the environmental reporting process Grant McKenzie went through this year, he says "Get it done once and get it done right".

"Building this dairy barn for me was about future-proofing my business, both environmentally and financially," Grant says.

Grant explains that the dairy barn wouldn't be possible if the farm didn't have a run-off block to produce the feed they needed to keep the herds on-farm in winter.

The benefit is that the barn will be able to winter 600 cows, utilising feed to 100% and will house cows and heifers during calving and the colostrum herd post calving.

"This not only creates more productivity and efficiency gains for the farm but creates a much nicer working environment for my staff," Grant says.

The barn will also capture the run-off and effluent from the cows and be used as fertiliser to offset the upkeep costs.

"We have to be financially viable in all of this. By capturing the effluent and using it as a fertiliser, we hope to break-even on the operational costs of the shed and the refreshing of the woodchips each year and replacing the woodchips every four or five years."

"The investment is a gamble if you don't have the nutrient budget and modelling to prove you can change your farm system within the limits."

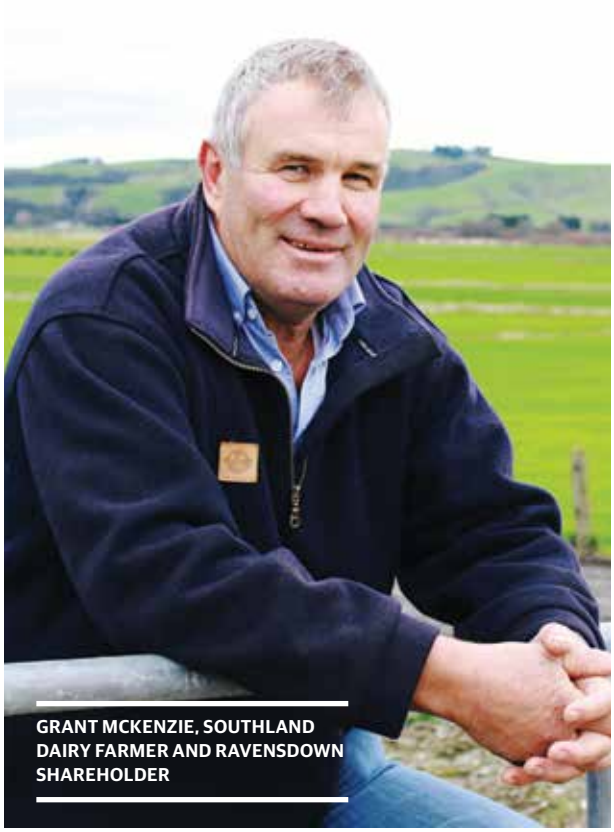
Financial viability of the housing unit is paramount but Grant adds you have to have consent for that to even be an issue.

"The investment is a gamble if you don't have the nutrient budget and modelling to prove you can change your farm system within the limits."

That's where Grant used Ravensdown's environmental consultancy service to ensure he met the council's consent requirements to be up and running by the 1 June this year.

He initially employed a consultant to do his discharge consent, then got Ravensdown's Environmental Consultant Mark Crawford to do his nutrient budget for the whole farm using OVERSEER™.

LEFT: AGRI MANAGER KIERAN ANDERSON CATCHES UP ON GRANT'S PROGRESS WITH HIS NEW BARN.



GRANT MCKENZIE, SOUTHLAND DAIRY FARMER AND RAVENSDOWN SHAREHOLDER

The planning consultant felt that the predictive nutrient budget done by Grant's agri manager was good enough to go forward to council as part of the consent documentation. It wasn't until a farm visit with the consultant revealed some key differences between predictive fertiliser and scenario nutrient budgets, such as effluent areas and taking in all the farm-effective grazeable areas, which requires a fit-for-purpose nutrient budget to complement the consent documentation.

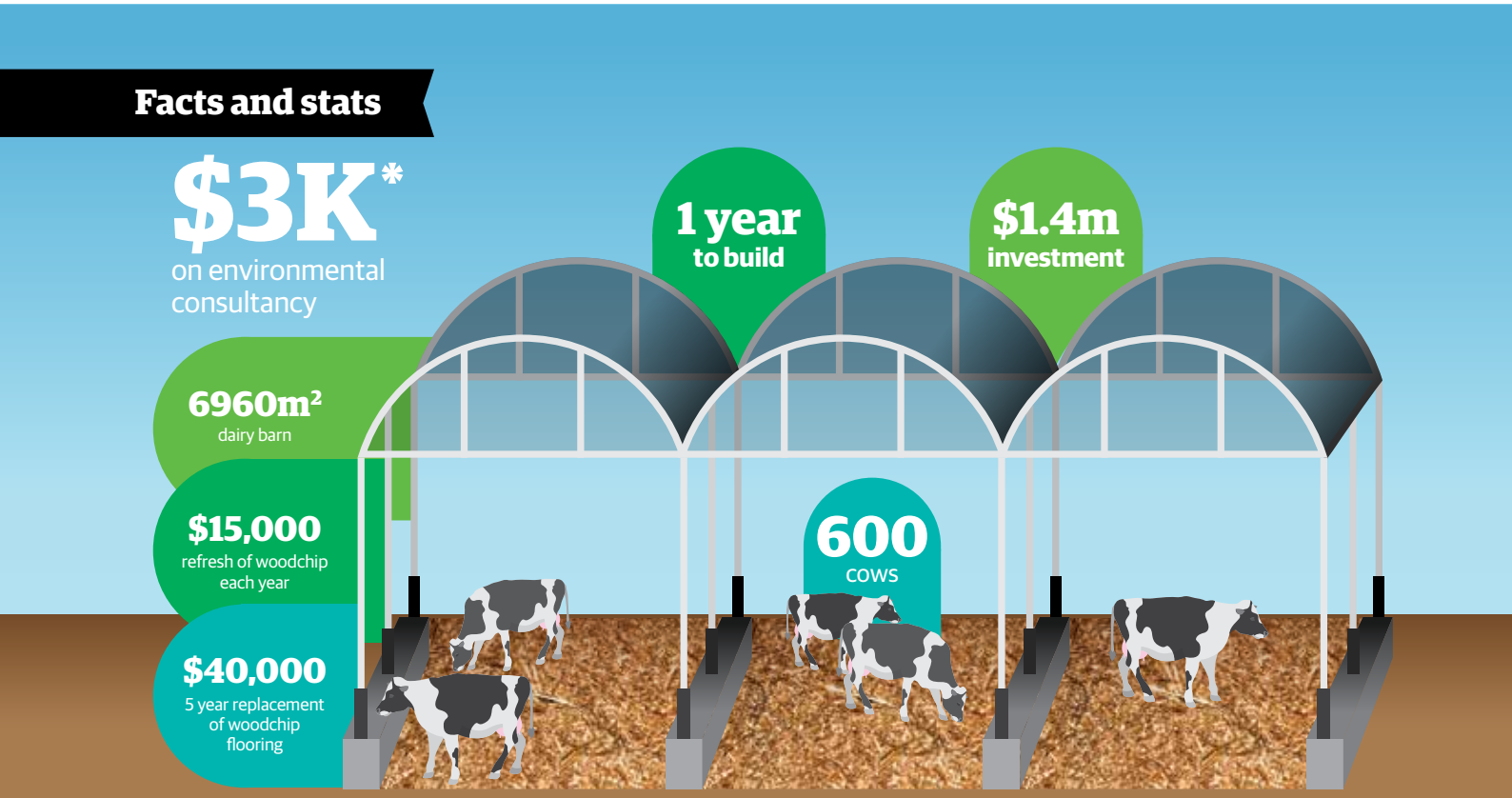
"Grant needed to show the council that his land use change could still operate within the yet-to-be determined nutrient limits in order to make his investment come to fruition. Kieran (Anderson), Grant's agri manager, phoned me, concerned that Grant required an in-depth nutrient budget of the whole farm to ensure the project would get across the line," Mark says.

Grant says "Once he got Mark on board, he took over and had everything done in three days." He did an in-depth interview with me about what changes were happening to our system and the consequences of that. Once he had done his due-diligence it was full steam ahead. He really took the problem out my hands."

Once the report was produced, they put it front of Environment Southland who were "very happy" with it. Now Grant has his permit, the farm has been up and running for over a month, which he says was down to the level of service Mark provided.

"The service Ravensdown supplied took the worry about the consent out of my hands. They supplied the expertise that I didn't have, and the cost was absolutely worth it. You absolutely have to have the confidence that you have everything covered when you're investing at this level. It's smart business."

Facts and stats



(*) See page 42 source code

Focus On // Environment

Dairy downturn – the unintended consequences

By Tim Lissaman, Ravensdown Farm Environmental Consultant

South Canterbury Ravensdown Farm Environmental Consultant, Tim Lissaman, talks potential consequences of wintering cows to save costs.

The dairy downturn has farmers looking for areas of expenditure to cut, including external grazing being put under the microscope.

Just coming out of winter, some readers will be familiar with the costs of winter grazing, which typically ranges from $0.50 to $0.60 kgMS when cows are grazed off-farm. Naturally, this has been identified by many as an area where significant reductions in costs can be made because of the added advantage of controlling the feeding and weight gains in-house.

While the control gained and significant saving may have helped you this winter, grazing a larger number of cows on your dairy platform, made possible by the ability to achieve high daily weight gains on fodder beet, will likely test your nutrient limits.

Wintering cows could exceed your Land Use Consent

Though the economics of growing crop on-farm appear attractive at first glance, it is important to consider the unintended consequences of farm system changes. Environmental compliance is required for many parts of the country, with other regions not far behind. An example is Canterbury's regional council, ECan, which has a Land and Water Regional Plan that sets the nutrient tolerance for nitrogen (N) loss at +5kgN/ha relative to the baseline period (2009 - 2013) in Orange and Green zones, with no increase in N-loss for Red zones (*). For those farms at or near the allowable N-loss limit, wintering cows at home or increasing winter crop area has the potential to exceed land use consented N limits.

While maintaining resilience should be the priority first and foremost, when planning a change in your farm system to include wintering, the effects on environmental indicators, such as potential N-loss to water, need to be considered.

The following example of an irrigated dairy farm system in mid Canterbury offers insight into the effects of inclusion of fodder beet crop on the dairy platform. Three systems have been compared:

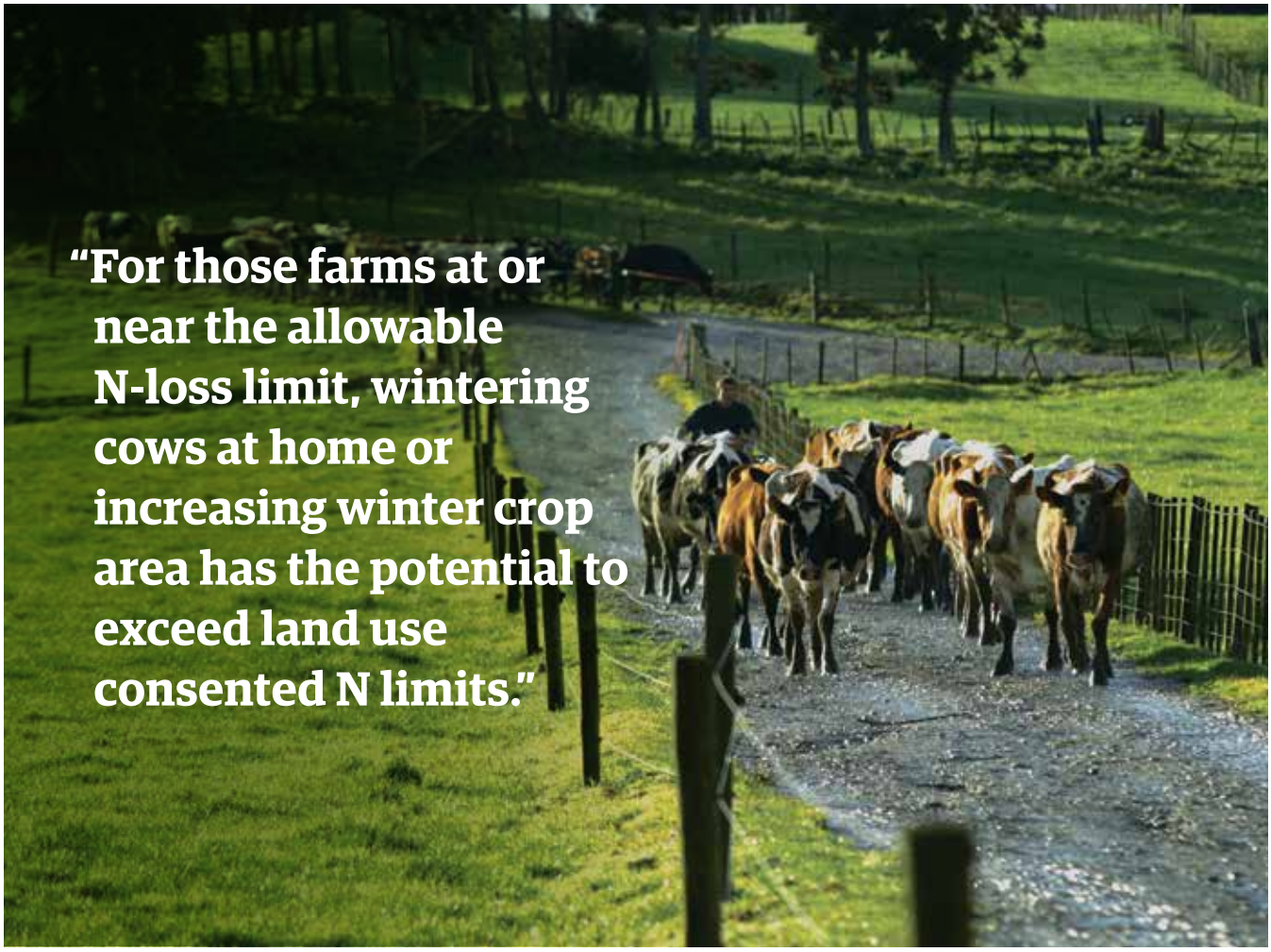
A) Pasture only grazing system wintering cows off-farm
B) Fodder beet grown to winter all cows on-farm
C) Fodder beet grown to provide late autumn and early spring feed.

Table 1. Scenario model using OVERSEER™

	A) No crop grown (winter off)	B) Beet grown to winter herd (June/July)	C) Beet fed to milkers (April, May, August)
Cows per hectare - total area	3.7	3.4	3.5
Cows per hectare - pasture area	3.7	3.7	3.7
KgMS/cow	426	426	426
Crop area grown (% of farm)	0	8%[1]	5%[2]
Supplement imported T DM/yr & (kg/cow)	316 (425kg/cow)	486 (715kg/cow)[3]	95 (135kg/cow)
Fodder beet yield (T DM/ha)		25	23[4]

[1] Crop area based on wintering herd on milking platform at 10kg crop/cow/day for June & July
[2] Crop area to provide supplement during April, May, and August
[3] Imported supplements include silage/straw for wintering
[4] Fodder beet yield lower reflecting earlier grazing
[5] Scenario farm. 200ha dairy farm on Lismore 2a.1 soils, 10km from east coast. 609mm rainfall, 771mm PET, 11˚C mean annual temperature.
[6] Soil moisture tapes to schedule centre pivot irrigation. Annual applied irrigation of 405mm to pasture and 345mm to fodder beet
[7] 260kg N/ha/yr applied to pasture, 137kgN/ha/yr to fodder beet
[8] Median calving date 15th August, dry off 31st May.

(*) See Source Code on page 42



"For those farms at or near the allowable N-loss limit, wintering cows at home or increasing winter crop area has the potential to exceed land use consented N limits."

Unintended consequences

Table 2 shows that the inclusion of crops significantly increased N loss by 17kg N/ha/yr on average over the entire property. When fodder beet was used for wintering cows, it tripled the N-loss. When returning back to permanent pasture, N-loss remains around 90% higher than existing pasture, reflecting the quantity of urine-N left in the soil following the grazing of fodder beet, which is available for leaching.

Wintering the entire herd on-farm may not be an achievable option in this example without a significant reduction in stocking rate or changes to the farm system, such as addition of a herd home (see Grant McKenzie's story on page 6). However, the inclusion of fodder beet to replace more expensive alternative supplements may be possible, to provide late autumn and early spring feed. Here, farm N-loss increased a much smaller 8kg/ha when fed in the shoulders of the season.

Inclusion of crops to help reduce feed costs may still be possible whilst meeting regulatory requirements when using scenario modelling with OVERSEER™ to identify mitigating options.

If you are planning inclusion of crops for winter, contact your agri manager or Ravensdown Environmental team to discuss potential management solutions.

Table 2. Nitrogen loss to water scenario using OVERSEER™ (kg N/ha/yr)

	A) No crop grown – winter off	B) Winter on fodder beet	C) Fodder beet fed during milking season
Pasture	75	75	71
Fodder beet		224	237
Pasture ex fodder beet		144	147
Farm average	76	93	84
Increase from pasture only- kg N/ha/yr (%)		+17 (+22%)	+8 (+11%)

Note.

1. Nitrogen losses calculated relate to this farm system modelled using OVERSEER™ 6.2.2.
2. Although this example is on a shallow well-drained soil (often the first choice for wintering on), a similar relationship exists on heavier soils, albeit with different absolute values.

Focus On // Fertiliser

FERTILISING ON A BUDGET

By Dr Ants Roberts, Chief Scientific Officer

The saying goes that there is nothing surer than death and taxes, although usually the latter comes before the former! However, in New Zealand agriculture, you can also be sure that some years your income will be high and others it will be low while your costs keep climbing.

Historical information suggests fertiliser is a major investment in most farm budgets but is often treated as a discretionary expense, cut during downturns in the farming economy. While your families, the bank manager and accountant all need to be looked after, your decision to cut fertiliser expenditure should be well researched and justified. The temptation will be great to reduce or forgo fertiliser to assist balancing the books. In this case, the wise words of my wood-work teacher at high school to "measure twice and cut once" spring to mind.

Lessons from the past

If we do not learn from history, we are doomed to repeat it! In most New Zealand soils we are inherently deficient in the nutrients nitrogen (N), phosphorus (P), sulphur (S) and to a lesser extent potassium (K) as well as some trace elements e.g., molybdenum (Mo), copper (Cu) and boron (B) for growing pastures and forage crops (see pages 22-23).

The early settlers discovered that the natural fertility and residual nutrients released from the ash and organic matter after felling and burning vegetation was soon depleted by farming introduced pastures and crops. Farmers quickly learned that lime and fertiliser greatly improved the success of their crops on which their farms depended, but it was not until the 1920s that significant fertiliser applications occurred.

Furthermore, the climate in New Zealand was found to be very favourable for clover growth, enriching the land. There were few pests and diseases to attack the clover (unfortunately not true today!), so pastoral farming began to flourish based on pastures of mixed grasses and clover on which livestock could be grazed all year round.

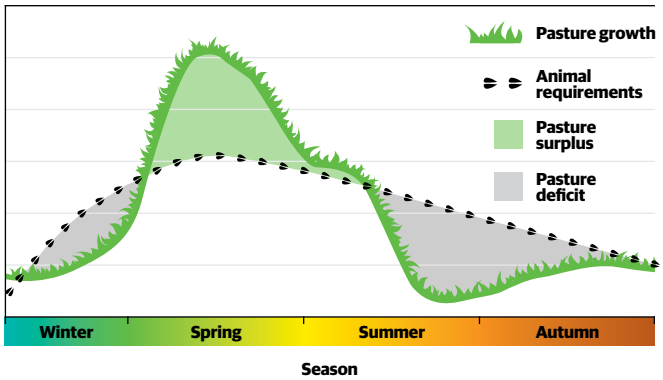
Information is power

If you want to grow as much quality grass/clover pasture as possible (the cheapest animal feed you will ever get), there is no substitute for applying cost-effective fertiliser nutrients and lime (see page 41) to raise the plant-available levels. It is very important you gather the required specialist information from people you trust to help formulate your fertiliser policy and

understand what the positive or negative consequences will be. Looking on the bright side, because fertiliser does represent a large input cost, it deserves some time, effort and mental anguish to nut out exactly what your response to the current cost:return relationship for your farm will be.

The figure below shows the general mismatch of animal requirements relative to pasture growth (in this case with no irrigation), and shows pasture deficits in winter/early spring and summer. These deficits are greater when soil fertility is sub-optimal because wet, cold and dry soil conditions restrict the ability of soil biological and chemical processes to keep nutrients cycling in soils and plants growing.

Figure 1: Pasture growth and animal requirement curves



Belt-tightening options and advice to get the best from your fertiliser spend:

1. Soil and herbage (when pasture is growing well) tests to identify soil fertility levels for major and trace elements

- **a.** Dairy – consider 'whole-farm testing' to determine areas requiring capital, maintenance and sub-maintenance rates of lime and/or fertiliser nutrients
- **b.** Mixed livestock – consider dividing the farm up into land management units (LMUs) based on slope, aspect and topography factors which affect production. Soil test these LMUs separately to develop a differential fertiliser and lime application plan to maximise the return from your spend.

2. Reducing applications of one nutrient can have a domino effect. For example reducing P because your soil P levels are at or above the biological optimum for your farm, could reduce S inputs by accident, i.e., if you use superphosphate to supply P (and S) then reducing or withholding super will also reduce or withhold S.

3. Identify planting areas for winter or summer forage crops early. This way, soil testing and corrective lime and fertiliser application can be carried out prior to planting ensuring the right type and amount of nutrients are applied at planting, and side dressing if necessary, to ensure you get the maximum yield possible. Growing crops is an expensive business if you get poor yields.

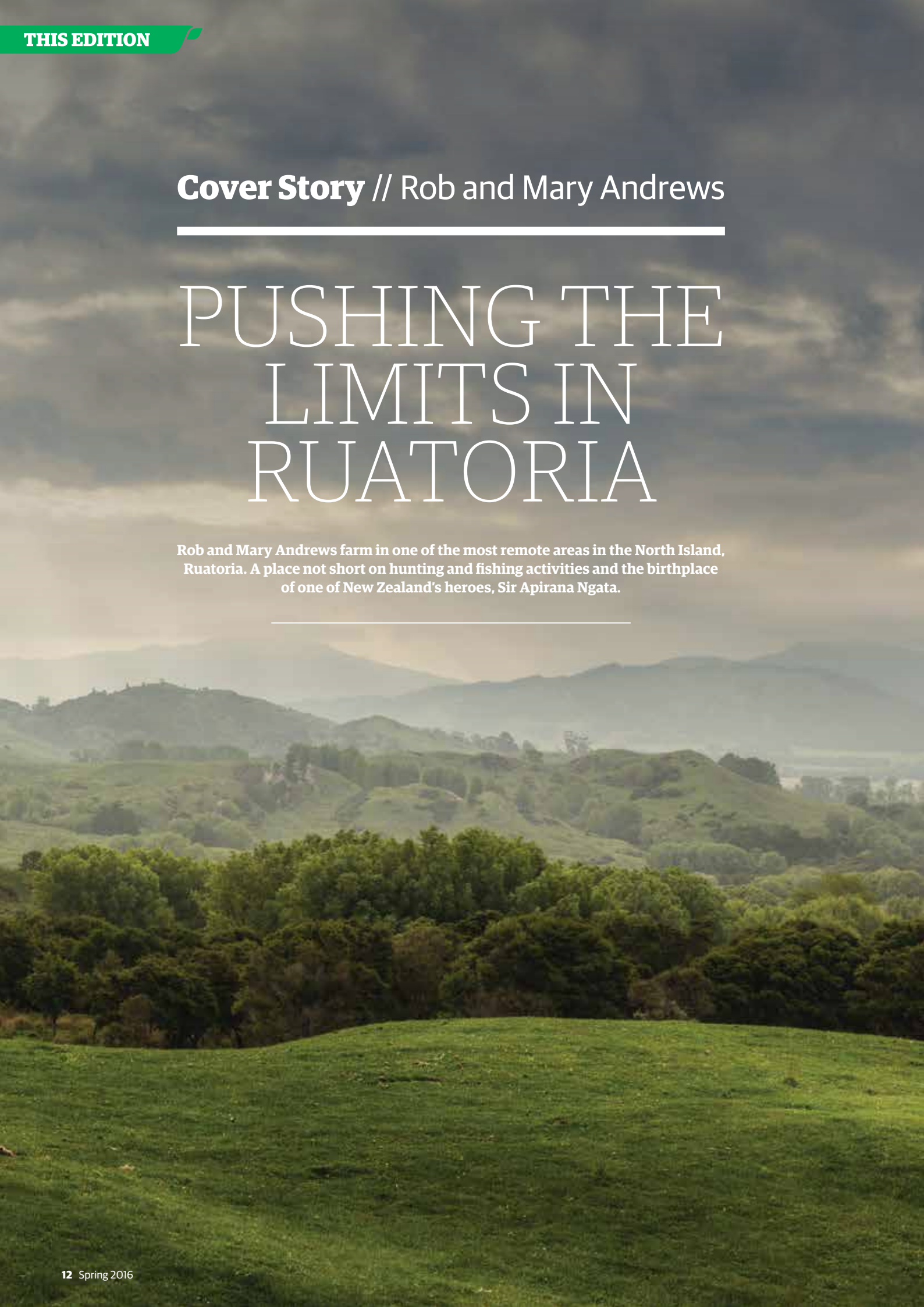
4. Use nitrogen fertiliser tactically to fill predicted feed gaps when climatic conditions allow, i.e., adequate temperature and moisture, but not in conditions that will promote direct leaching of N fertiliser.

Fertiliser nutrients are a key input to develop productive, quality feed for your livestock. Most New Zealand soils do not have a significant 'natural' supply of important mineral nutrients to develop and sustain the production of quality pastures in the long term. If you are prepared for some reduction in farm performance to survive, then reducing or ceasing fertiliser application should only be considered a very short-term solution. Ideally, you should then 'catch-up' when financial conditions improve.

Cover Story // Rob and Mary Andrews

PUSHING THE LIMITS IN RUATORIA

Rob and Mary Andrews farm in one of the most remote areas in the North Island, Ruatoria. A place not short on hunting and fishing activities and the birthplace of one of New Zealand's heroes, Sir Apirana Ngata.



ROB ANDREWS

Rob and Mary's success story starts five years ago when they came to the Matariki Partnership farm in the Waiomatatini valley. Here they began an intensification project including regrassing and building a productive pasture-base. This huge undertaking has now seen them generate an increased stocking capacity of 38% and a lamb finishing rate of 95%.

Rob says, "When we came here five years ago the flats were underutilised with run-out-pastures that needed to be renewed. That's been a big driver for us to get higher performing pastures and subdivide the paddocks a bit more."

Mary explains that coming from a bull-finishing farm previously, Rob had a good eye for opportunity when it came to developing the flats and increasing productivity.

The high school sweet-hearts who started out dairy farming say they quickly realised they needed more variety in their lives and something that was going to allow them to push the boundaries, so they went sheep and beef farming and haven't looked back.

"We love the variety of things you have to do and the broad set of skills you need," Rob says.

Mary says, "We try something new every year. We love pushing the limits and hitting our targets. If it doesn't work we come up with more crazy ideas to try."

"We try something new every year. We love pushing the limits and hitting our targets. If it doesn't work we come up with more crazy ideas to try."

"Lucerne has given us the ability to finish our lambs and summer-proof us a bit more."

They say their best crazy idea was bringing lucerne to the East Cape.

"Lucerne wasn't common in the area, but we saw a big opportunity to cover our backsides during the summer, so we went to our supervisor who championed it to the board," Rob says.

"Our first year went really well but we have had some ups and downs with it. We went to Doug Avery's in Marlborough to get some ideas on how to set the systems up, but a lot of stuff that worked for him didn't work for us, so we had to figure it out for ourselves.

"Now we've got our lucerne and other pastures running smoothly together, it has given us the ability to finish our lambs and summer-proof us a bit more. We've pretty much gone from selling everything to store to finishing everything."

When Rob and Mary arrived in 2011 with their two boys Brayden and Dylan, the farm was producing 4000 lambs. Last year they produced 6500 from the same number of sheep, which they attribute to the work they've done on the flats, getting the right pasture mix of plantain, chicory and lucerne.

"The pastures we have now complement each other at different times of the year. We've made our system match what classes of stock we run in each block at that time of the year," Rob says.

"It's something we've evolved over the last five years."

Looking at the flats now, they say it's great to see the progress, but often miss the opportunity to enjoy what they've achieved as they're always looking to the next project that needs to be done.

"We've made the big gains in our stock performance, it's now just fine tuning it really. We go over the cropping plans about four

LUCERNE WASN'T COMMON IN THE EAST CAPE

"We go over the cropping plans about four to five times a year with our Agri Manager Sue, then she'll come up pre and post planting to see how things are going."

to five times a year with our Agri Manager Sue (Quilter), then she'll come up pre and post planting to see how things are going."

Mary adds "Sue is great, she's really enthusiastic and full of ideas as well – if we get stumped on something she's normally got an answer for us," Rob says.

Rob and Mary are avid users of soil tests on the flats, testing before each cropping round and every two years on the hill country. Now the flats are up and running, their hill country is about to see a lot more attention.

"Our plans for the hill country are to tackle the gorse issue first then do target cropping," Rob says. "Rather than blanket spraying the gorse we're going to spray the more productive land first and work in a cropping plan to maximise the production up there."

Currently run as a breeding unit, they're not ruling out being able to finish more stock on the hill country once they've got their pasture and fertility right.

"At the moment we're just seeing how it goes but we're going to try and get a bit more structured about how we tackle it now the easy stuff is out of the way," Rob says.

With a base team of four, Mary emphasises that the farm has got to where it is over the past five years through team work and a collaborative process with all their advisors and contractors.

MERINO BREEDING RAMS AT MATARIKI

Focus On // Animal Health

Small things that make a big difference in growing great lambs

By Paul McKee, Ravensdown Animal Health Technical Manager

If you were to look at the range of lamb daily growth rates on sheep farms in New Zealand, you would find a huge range, from as low as 80gm - 350 plus grams per lamb per day. To get to the top of this range requires attention to detail.

Ewe condition score, pasture quality and quantity, climatic conditions, trace elements and genetics are just some of the variables farmers need to manage. It only takes one of these ingredients to be missing or to be in short supply to make it difficult for lambs to reach target weights.

Although only required in small amounts, trace elements are a key part of this big picture. Adequate dietary levels are essential for healthy lamb growth and production. Selenium and cobalt (used to make Vitamin B12) are of particular importance in New Zealand farming systems (see page 22 for NZ cobalt pasture levels). Providing the ewe's selenium and B12 levels are adequate, her suckling lambs should receive enough of these minerals through to weaning. If the ewe's mineral levels are not adequate then additional supplementation may be necessary to ensure good lamb growth rates. The trick is to know if you need extra supplementation and whether to give this to the ewe or the lamb. If targeting the ewe, then a pre-lamb mineral boost is ideal, if targeting the lamb, then docking/tailing is the first ideal opportunity.

Table 1: Ideal Selenium and B12 levels for lambs:

	Herbage (mg/kg DM)	Liver	Serum Blood
(*) Selenium	>0.03	>450 (nmol/kg)	>100 (nmol/L)
(*) Cobalt	>0.10	-	-
(**)Vitamin B12	-	>375 (pmol/Kg)	>500 (pmol/L)

Table Key: > Greater than

Test to supplement

Farmers can take herbage samples in the spring through our Analytical Research Laboratory (ARL), when the grass is actively growing which can give you an idea as to whether the pasture will supply adequate amounts of key minerals. Herbage trace element information should be supported with liver or blood samples, to confirm actual levels for animals and the level for supplementation required.

All stock have different requirements for each trace element, but an animal health professional can help you decide where there may be shortfalls and interpret the results.

There are a range of different options available for boosting animal trace elements, including mineral amended fertilisers, mineralised drenches, injections, pour-ons, etc. If you're looking to boost trace element levels in ewes at lambing this year, then Vita-Mineral Drench® and Lift B12® (selenised or plain) are proven products to use. Ideally, developing a long term mineral strategy will ensure you maximise the health status of your stock. For example, including Ravensdown's patented Selprill Double® in your annual fertiliser application can provide stock with adequate selenium requirements for up to 12 months.

Don't hesitate to get in touch with your regional animal health technical advisor for advice on mineral requirements for your stock this spring.

(*, **) see page 42 Source Code

Focus On // Controlled N

USE OF CONTROLLED-RELEASE UREA IN MAIZE – THE ADVANTAGE OF A POLYMER COATING

By James Bryan, Ravensdown Agri Manager

Maize silage demands and removes large amounts of nutrients and organic matter and is highly responsive to nitrogen (N).

Starter N fertiliser is essential as the cob yield is determined in the first few weeks after sowing. However, by flowering 70% of N has been taken up, but only 50% of its dry matter has been produced, meaning a second application of N is required.

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

Ravensdown has recently imported a new controlled-release urea called "Controlled-N". The polymer-coated urea is designed to release a consistent amount of nitrogen (N) over a 75-day period. Polymer coated urea is not significantly affected by soil properties such as pH, salinity, soil texture or microbial activity (**). The nitrogen release is determined by the permeability characteristics of the polymer coating, affected by temperature and moisture.

(*, **) see page 42 Source Code

The polymer-coated urea is ideal for maize, because it eliminates the need for a side dressing as the release of Controlled-N more closely matches the plant uptake of the maize crop.

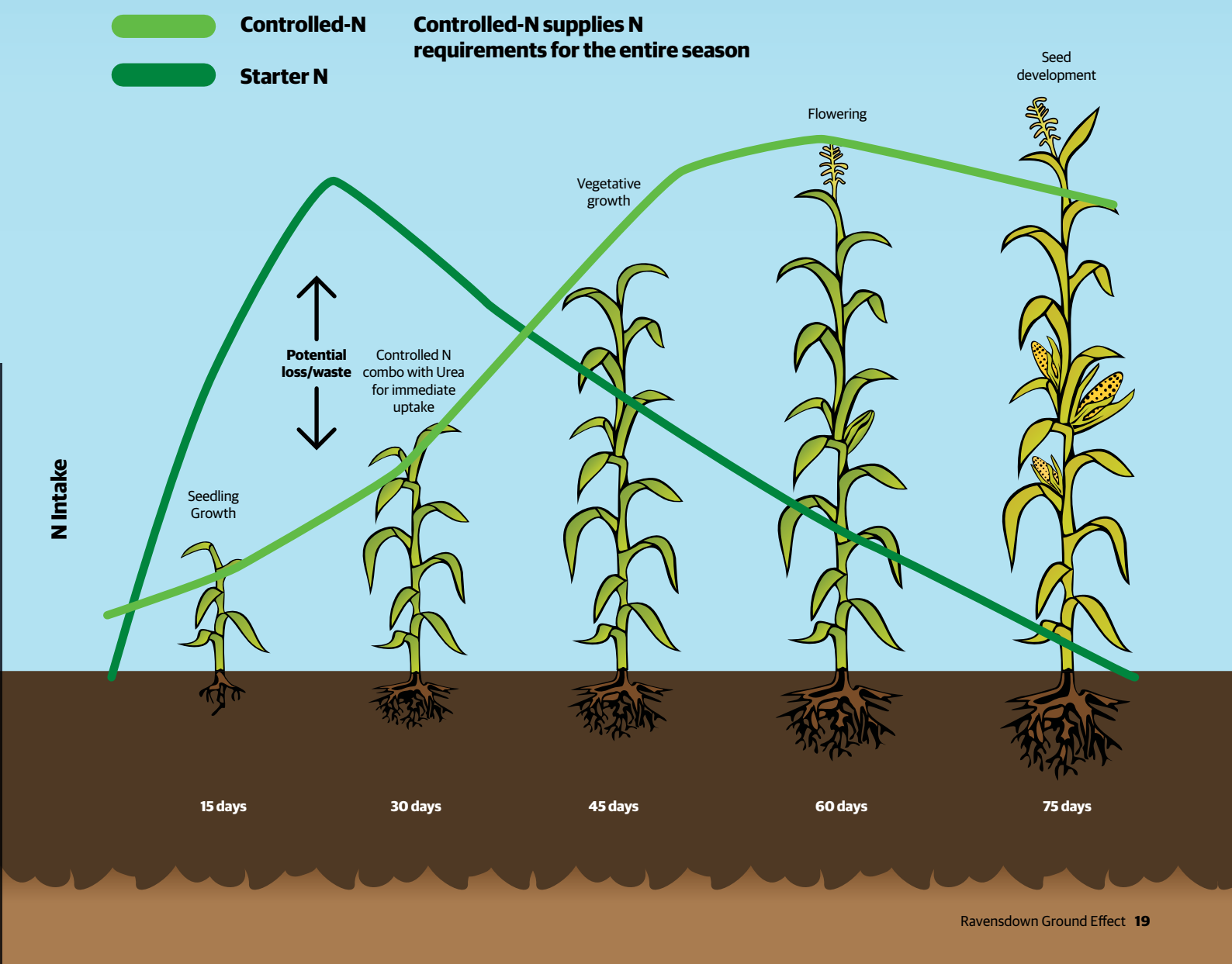
Through applying a mix of urea, for immediate uptake, and Controlled-N, for long-term supply, the plant should receive its nitrogen requirements for the entire season while meeting the plants demand for optimum growth.

Controlled-N's unique polymer coating limits N losses through leaching in wet conditions by slowing down the transmission of nitrogen from the granule into the soil solution. By incorporating N upfront you will improve your N use efficiency by allowing you to get the most out of your maize crop. It also will save you money by being able to combine your N requirements upfront with the remainder of your base fertiliser requirements, meaning you only have to do one application.

Controlled-N, while mainly used to grow maize, can also be used in a variety of other crops as well. The general rule being, where a side dressing has traditionally been used, such as fodder beet, brassicas and cereals, Controlled-N is another viable option.

If you're interested in using Controlled-N, your agri manager can design a nitrogen program featuring Controlled-N for you.

Figure 1. The benefits of using Controlled-N



Focus On // Spring pasture

BANG FOR YOUR BUCK

By Marty O'Connor, Ravensdown Agri Manager

Marty O'Connor, Ravensdown Agri Manager, gives advice for finishing farms, on what to expect from fertiliser as the soil temperatures warm up this spring and how to get the best bang for your buck.

Spring pasture is often the most valuable feed you will produce all year as it is typically a pinch-point in the calendar on many farms.

Whether providing extra feed for lambing ewes or finishing cattle there is typically a good return on increasing the amount of quality pasture you produce early in the season.

Ewes fed well during lactation will produce more milk, meaning more lambs can be drafted on the truck at weaning, when returns are highest and the total amount of dry matter consumed is least.

A good rule of thumb is to time spring nitrogen (N) applications three weeks prior to lambing or calving, as this should be about the time spring pasture growth typically kicks in. High country or cold inland valleys where lambing/calving occurs prior to spring pasture growth would do better with an autumn application when soil temperatures are still conducive to growth.

Cattle will also benefit from more feed during this period, allowing more weight to be added before the schedule starts to drop or pasture quality declines in early summer.

3 things that will drive your pasture production in spring

1. Soil temperature

Farmers often lament the slowness of spring growth, however long-term climate records show that this is often very consistent year on year. Whilst there is nothing we can do to change this, it is good to know when soil temperatures start to lift where you live.

Generally soil temperatures peak in late summer and are often lowest about the time lambing and calving are commencing.

Frost has a big negative impact on soil temperature. Farmers often say they need rain in the spring to get things moving when in reality it is the lack of frost, rather than the moisture, that is needed.

It should be remembered in irrigated areas that wet soil is slower to heat than dry soil. The temptation to irrigate should be resisted as long as possible to allow soil to warm up.

2. Nitrogen

The nitrate (N) and ammonium that is plant available, is the next biggest driver of spring growth.

Most N found in soil is 'organic N' stored in the organic compounds generated by animal returns and breaking-down plant material. It is this N that requires 'bugs' in the soil to convert it to the mineral form mentioned above. These bugs require warm temperatures to perform this at the required rate for rapid pasture growth.

In the meantime, applying fertiliser N, when soil temperatures are increasing in the spring, will dramatically lift pasture growth rates.

I recommend applying a minimum of 30kgN/ha (65kg Urea/ha) to the warmer parts of your property when soil temperatures are 6˚C and rising.

3. Sulphur

Sulphate-sulphur is the last leg of the trifecta to ensure maximum spring growth. Similar to N, the major pool of soil sulphur (S) is also stored in organic matter and can be available in limited quantities in spring. This is easily measured through soil tests that will show the sulphate-sulphur level.

Generally, levels will be good if an S fertiliser has been applied in autumn, or the winter has been dry with limited drainage. Where sulphate sulphur levels are low a product like Ammo 31 or 36 is ideal to provide enough S to ensure that the response to N is maximised.

Evidence of potential on your farm

'Stock Camps' on your farm are areas where large amounts of nutrient returns by animals show potential for growth through the availability of higher levels of N, P, K and S.

Quite rightly, these areas can therefore be avoided when applying N, and possibly S, further increasing the efficiency and bang for your buck.

Marty's Nitrogen Tips:

- It's important to note that the use of Ammo 31 or 36 (ammonium sulphate urea mix) will only provide a benefit if sulphate-sulphur is limiting
- If it's warm enough for pasture to grow, you should be applying urea rather than Ammonium Sulphate Nitrate (ASN) which is more suitable in cropping situations
- On a dairy platform, I advise applying N to the two-thirds of the platform that has the lowest pasture cover, when the cows return from winter grazing. Apply urea to paddocks once grazed. This ensures maximum potential growth when feed is often limiting at the end of the first grazing round, allowing cows to be fully fed early in the lactation, achieving a higher peak
- Nitrogen can be re-applied to the wetter parts of the farm in late spring to boost the production from these summer safe areas.

Longer-term strategy

Use of alternative plant species is another more permanent option

- Lucerne is great at providing early feed as its growing points are in the tips of its shoots rather than at its base like grass. This allows it to come away earlier in spring, and as a legume will "fix" its own N!
- The use of annual or Italian ryegrass on your farm will also ensure greater early season production with its more vigorous cool season growth. This can also be used to transition into a brassica crop or a regrassing programme.

Focus On // Cobalt and copper

SHORT SUPPLY OF COBALT AND COPPER – HAVE WE LEARNED LESSONS FROM OUR PAST?

By Dr Hendrik Venter, Ravensdown Analytical Research Laboratory (ARL) Technical Director, and Natalie Chrystal, Nutritionist Complete Feed Solutions

In the past, inadequate amounts of the trace elements cobalt and copper have adversely affected agricultural production in New Zealand. The aim of this article is to determine whether we have learnt our lessons from the past because short supply does not support profitable production.

Now, more than ever, optimising our use of nutrients is fundamental to maximising farm profitability. We've compared our data analysis results with Knowles and Grace, and McNaught to better understand the mineral status available in our pasture, to identify whether we have what is needed to support whether we have what is farm productivity.

Cobalt (Co) content in pasture

In the 1930s the Cawthron Institute in Nelson was instrumental in identifying cobalt deficiency as the cause of "sheep ailment" or "bush sickness", beating the world in solving the riddle of why some grazing animals wasted away despite having enough pasture (*). Because it is an essential component of vitamin B12, a cobalt deficiency manifests as a deficiency of B12, an important precursor for energy metabolism. New Zealand farmers were quicker than those in any other country to take advantage of the new discovery.

Annually in New Zealand, up to 130 tonnes of cobalt sulphate are applied to pastoral soils to meet the critical levels of 0.1 mg/kg DM and 0.06 mg/kg DM commonly recommended in pasture for sheep and cattle respectively.

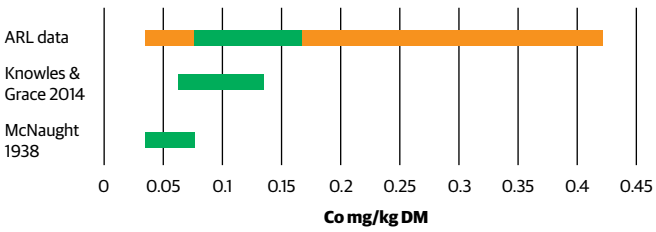
The benefits of cobalt supplementation of ruminant animals is not yet well understood. Despite the critical levels reported above, there is evidence to suggest that cobalt may have some effects independent of vitamin B12 production, with enhanced ruminal digestion of feedstuffs, one of the more commonly reported benefits.

Are we on target?

Historically we can see from Figure 1 that levels of cobalt in pasture were low in the 1930s and had increased considerably by the time Knowles and Grace conducted their investigation into pasture cobalt levels from 2001–2006 (**). Data we have accumulated at ARL over the years (2002-2015) also shows similar levels to those reported in that study.

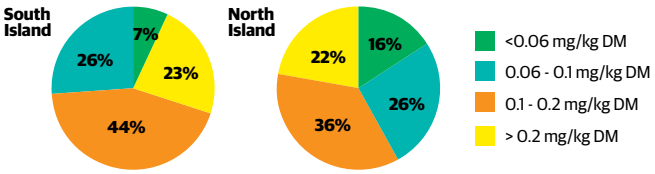
The green bars in the following chart (Figure 1) represent the mid 50% of the observed data, showing that there has been significant progress made since 1938. The orange bars complete the 95% spread of the data.

Figure 1. Cobalt levels in pasture



Despite ongoing application of cobalt to pasture, data collected by ARL (Figure 2) shows that 7% of the samples in the South Island and 16% of samples collected in the North Island have cobalt levels lower than the 0.06mg/kg DM commonly recommended for cattle, while 30% and 42% of samples from the South and North Islands respectively have cobalt levels less than the 0.1mg/kg DM commonly recommended for sheep.

Figure 2. Cobalt value classes for pasture (ARL 2002-2015)

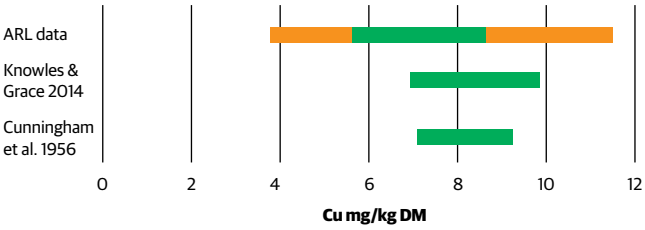


What about copper content in pasture?

Unlike cobalt, where there has been a gradual increase in pasture levels over time, Figure 3 shows that copper levels have decreased over time.

Although the majority of pasture samples still fall within or above the 6-7 mg/kg DM of copper recommended for optimum pasture growth and sheep performance, most samples analysed at ARL are below the 10 mg/kg DM required for optimal performance of sheep and cattle. This decrease in pasture copper content may be a result of an increase in the use of copper supplements either administered orally (fed or drenched) or injected into the animal rather than relying on the application of copper in fertiliser to achieve the higher plant copper levels required for dairy animals.

Figure 3. Copper levels in pasture

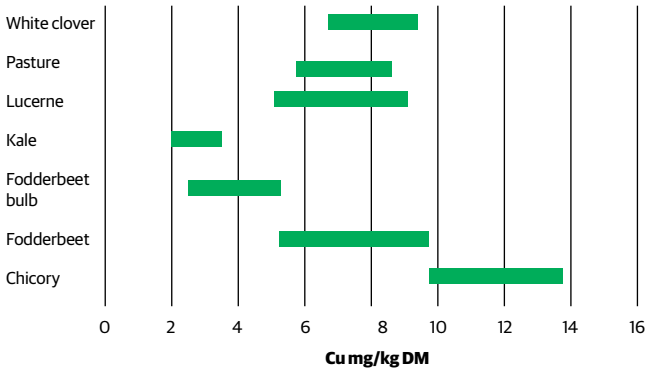


Copper deficiency is known to cause several syndromes including enzootic ataxia (swayback), peat scours, steely wool, coat and wool colour changes, poor production, reproduction and growth rates. So it is important to ensure that, even if copper levels in pasture meet the optimum levels for pasture growth, the requirement for animal health and performance, particularly for cattle and deer, are met by supplementation with additional copper (**).

Producers making use of feeds such as fodder beet and kale, which tend to be lower in copper than pasture (Figure 4), should pay close attention to the amount of copper they are supplementing to ensure that deficiency does not occur.

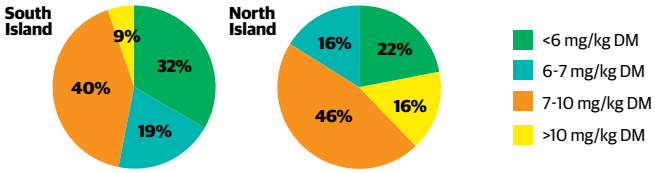
(*, **) see page 42 Source Code

Figure 4. Copper levels in typical forages grown in NZ



Data from the pasture samples analysed at ARL (Figure 5) shows that 32% of samples collected in the South Island contain less than 6mg/kg DM of copper, while 90% of samples would fall below the recommended 10mg/kg DM required for optimal performance of dairy cattle. Samples collected in the North Island indicate higher copper levels on average, with only 21% of samples containing less than 6mg/kg DM of copper, while 15% of samples had copper levels above the 10mg/kg DM typically recommended for optimum performance of dairy cattle. This may be attributed to fertiliser copper applications made to peat soils, well known for copper deficiencies.

Figure 5. Copper value classes for pasture (ARL 2002-2015)



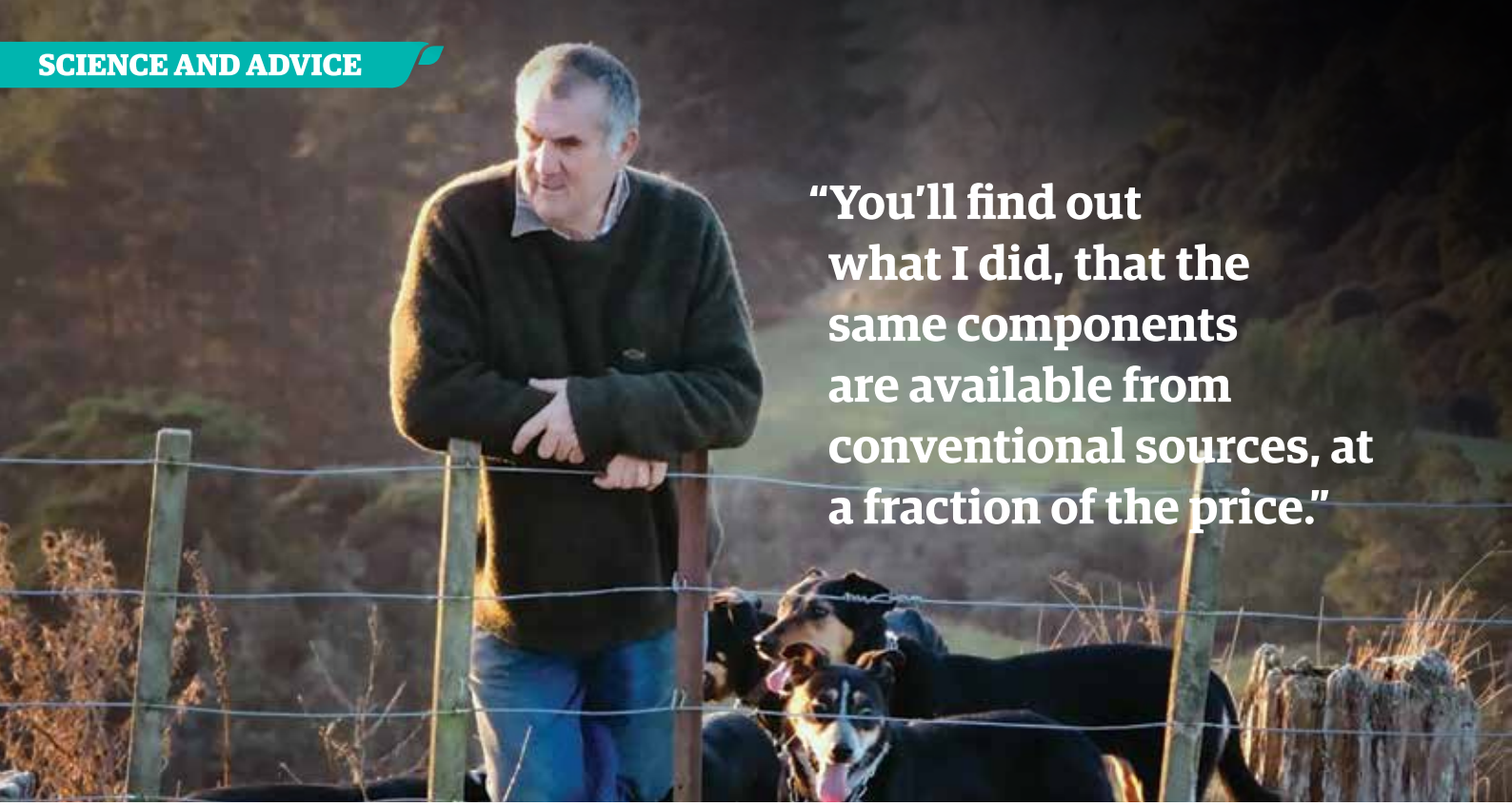
Conclusions

Ongoing collation of data from the vast bank of soil, pasture and other forage specie samples analysed at ARL is helping us to shape a better understanding of where New Zealand soils and pasture are at when it comes to nutrient levels. As you will see on page 28 information is key to boosting productivity.

When combining our understanding of animal requirements for optimum production with our data on nutrient levels in our soil and pasture, we see that pasture copper levels are at the required optimum for pasture growth, however cobalt and copper levels fall short of some animal health requirements.

There are enough low values in the data to suggest that increased pasture testing will identify deficiencies of copper and cobalt in pasture and provide information to support the development of a strategic supplementation plan.

This data also demonstrates and supports the view that in many cases additional supplementation of copper (either via a drench, through the water or in feed or via injection) is required for optimum production of grazing livestock.



"You'll find out what I did, that the same components are available from conventional sources, at a fraction of the price."

Focus On // Soil fertility

BEWARE OF THE SNAKE OIL MERCHANTS IN TIGHT TIMES

By Robert Carter, Kirikau Farmer and Ravensdown Shareholder

On our family farm, my wife Suzanne and son Travis run a 360ha hill country sheep and beef farm 35km down the Wanganui River, south west of Taumarunui at Kirikau.

Suzanne and I arrived in 1988 with two small children, a mortgage and lots of enthusiasm. It's been a great journey and now the two small children are adults, one of them is now bossing me around, and the other has provided us with the joy of our lives, three granddaughters.

One of the key issues right from the start of our career in full-time farming has been the discussion around soil fertility and fencing.

I've always thought that growing feed, controlling it and feeding animals the right amount at the right time was the key to success. Always easier said than done.

So a combination of fencing and fertiliser has been our priority over the years; we put up many metres of cheap but effective fencing in the early days to get the control we needed and fencing is still an ongoing project for us.

Fertiliser is the other key, and surprise surprise, the old adage about fencing and fert was again acknowledged at the Hill Country Symposium, held in Rotorua in April.

When I think about it, I've been involved in the application of fertiliser for well over 50 years now, one way or another.

Because fertiliser technology can be a mystery to many, especially if one does not have a good understanding of basic chemistry, it is easy enough to be drawn to the promises made by some in the industry. Those who peddle half-truths and pseudo-science babble and unsubstantiated claims about "their" cure for soil fertility issues.

Some of these peddlers of promise are very plausible and use some farmers' lack of confidence in conventional practices as a way to get into their heads and their pockets. One of the approaches is the so called "biological" way to deal with soil fertility issues.

They conveniently neglect to mention that chemical (molecular) processes underpin all biological processes. When they talk about biological farming, they're giving an insight into the obvious. Of course we are all biological farmers, and at the same time we are chemical farmers, but somehow a negative connotation has been attached to the word "chemical". This is completely undeserved and just perpetuates the ignorance around the science and the facts. So how do we best get by when times are tougher financially?

You'd be wise to ask a sheep and beef farmer, as we're not aware of too many times when it's not been tough financially!

I've got a few personal rules around fertiliser that I can share with you.

Rob's fert rules

1. Know what you need in terms of soil fertility on your farm. Take soil samples on areas and match the fertility needed to the soil type and the output you intend to take off that area of land.

2. Use good advice for the big picture stuff and find out what the limiting factors may be on your farm. The co-operatives' soil fertility advisers are well trained and are only too happy to help you.

3. Never apply fertiliser if you can't afford to pay for it by the 20th of the following month. This runs counter to the advice that others may give you, but if we're talking about survival here, don't borrow and hope, it's a road to misery; believe me the grass still grows without it, albeit a wee bit slower at times.

4. Get quotes on transport and application.

5. Fine tune the application to the land management units (see point 1).

6. Last and not least, ask questions and don't be sucked in by these charlatans who just want to put your money into their pockets.

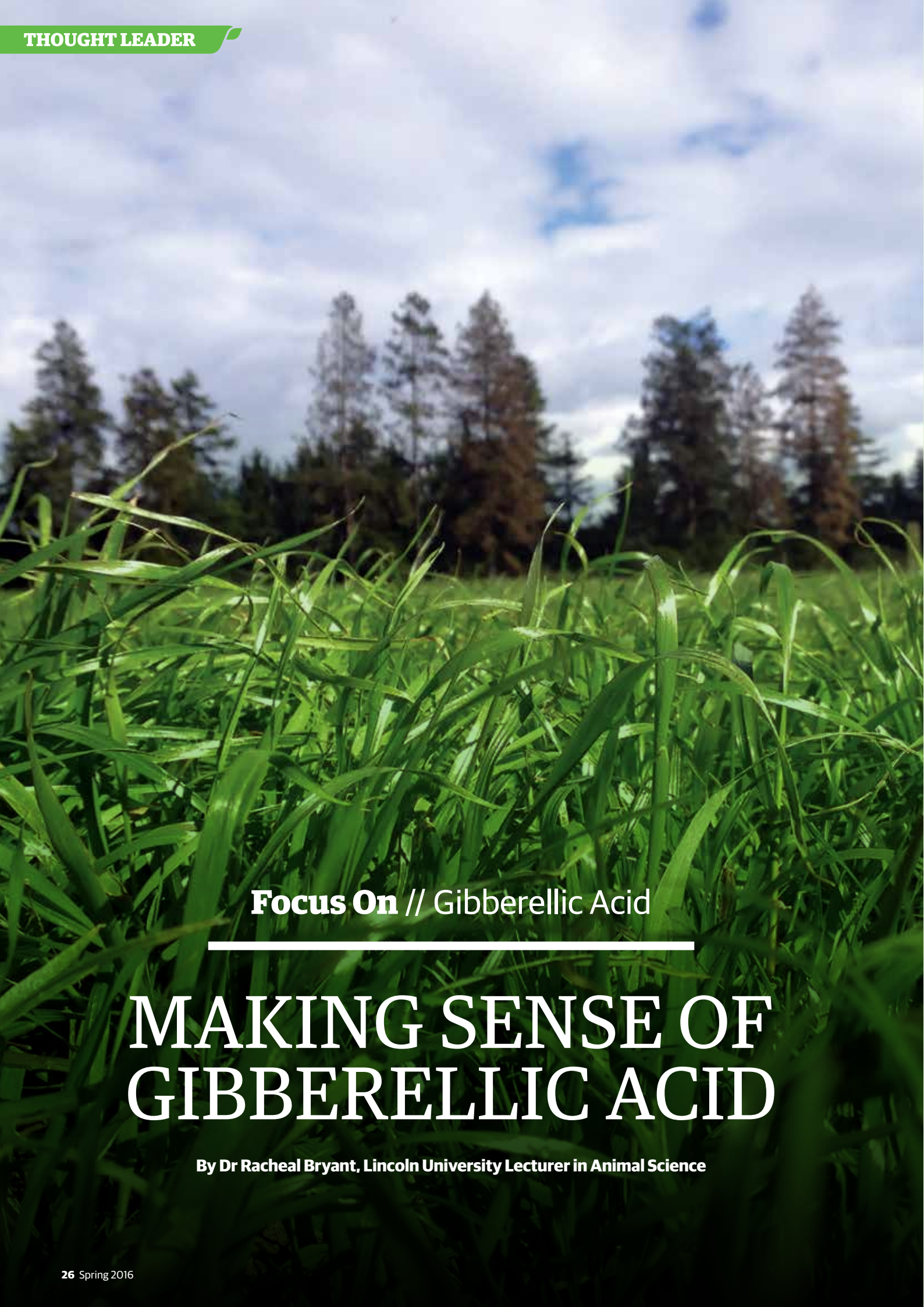
If any of these cheeky peddlers turn up at your place with a wonder brew, get a sample and get it analysed. You'll find out what I did, that the same components are available from conventional sources, at a fraction of the price.

On our farm, plenty of lime and fertiliser has been applied to the point where the Olsen P levels are above optimum, and the pH is at the optimum 6.0.

Our potassium, sulphur and other elements are below optimum, so we apply special mixes, on advice we can trust, from our Ravensdown Agri Manager Paul Salle and my boss, son Travis, who holds an applied science degree.

No phosphate is applied to these areas. Without the testing and advice I would still be putting it on, unnecessarily wasting funds.

"Some peddlers of promise are very plausible and use some farmers' lack of confidence in conventional practices as a way to get into their heads."



Focus On // Gibberellic Acid

MAKING SENSE OF GIBBERELLIC ACID

By Dr Racheal Bryant, Lincoln University Lecturer in Animal Science

LINCOLN UNIVERSITY DAIRY FARM FIELD TRIAL: GIBBERELLIC TREATED PASTURE ON THE LEFT AND NITROGEN TREATED PASTURE ON THE RIGHT

Dr Racheal Bryant, from Lincoln University, breaks down some of the mysteries of gibberellic acid.

Gibberellic acid is one of those products where you're not quite sure exactly what's happening when you apply it to your pasture. That uncertainty can be a bit of a deterrent at times.

What we do know about gibberellic acid (GA) is that it is a naturally occurring plant-growth hormone of which there are many different types, identified as GAn. According to the order in which they were discovered, the smaller the number the longer we've been aware of its presence in plants. This is mainly because the effect of an increase in concentration of those early GAs was visibly very noticeable.

Commercially, the GA manufactured and commonly used on pastures in New Zealand is GA3. We know that when we apply GA3 to ryegrass-based pastures in spring or autumn we see visible changes in both grass and clover plants (*). The grass initially goes yellow and is taller than untreated plants, while the clover leaves and petioles get bigger.

More often than not, this results in an increase in total yield of between 200-500kg DM/ha following application. When applied with nitrogen (N) the response is even greater because we get an additive N and GA response. However, unlike N, if we keep applying GA we don't continue getting positive yield responses, even though it sometimes looks like the pasture is responding by increased height.

There are still a lot of unknowns when it comes to pasture response when applying GA. Some of the research questions currently being explored include the effect of different rates of GA occurrence of yield reductions in subsequent regrowth, effect of GA on herbs and the effect of long-term continuous applications of GA on yield.

There are also a number of questions around changes in pasture chemical composition and N concentration, which may lead to answers about animal performance and whether GA could be used as a mitigation tool to reduce N losses.

Recently, Ravensdown has begun research to determine whether GA could be applied in combination with pasture herbicides as a cost-effective means of weed control and increased pasture growth in autumn. The findings of that study indicated that the efficacy of one product, when combined in the same sprayer system, would not affect the other product.

Gibberellic acid is useful as a strategic tool, which allows us to shift feed forward at the shoulders of the season. When applied together with nitrogen there are few disadvantages for using GA, particularly in early spring. Indeed, there are benefits from greater clover content and increased pasture height. This means improved grazing management through more bulk density in the upper pasture layers.

(*) see page 42 Source Code

Point of View // Dr Rob Murray

UNPREDICTABLE TIMES CALL FOR PREDICTIVE MEASURES

By Dr Robert Murray, Innovation Development Manager Ravensdown

The combination of the dairy industry's current troubles, market volatilities, more frequent weather extremes and rising debt, leads to a greater uncertainty in the farming community. We're here to talk about putting the predictive back into farming businesses where we can.

The lofty heights of a $7 plus pay out distracted some in the dairy industry away from a "pasture first" approach. The profit margins encouraged the use of higher productivity feeds in the quest for increased production and higher revenue. This inadvertently exposed businesses to increased risk due to market and environmental volatility.

Ravensdown and Dairy NZ have been leading the way with the message to concentrate on growing and utilising as much pasture (our cheapest feed) as possible.

Modern pasture-based farms seek to match feed supply and animal demand, smoothing out peaks and troughs by way of nitrogen (N) fertiliser or supplementary feed. To do this successfully, we need repeated accurate measurements of pasture cover and timely generation of decision management tools.

One way to achieve this is combining the C-Dax Pasture Meter with an engaging online tool. Ravensdown is upgrading its an online farm management tool Smart Maps, which is under continuous review, improvement and expansion. Our recent advances have focussed on enabling farmers to farm with more certainty, particularly in the dairy industry.

While a single day (snapshot) feed wedge is probably the most used grazing management tool at present, recent advances in pasture growth rate predictions allow us to view how the feed situation may look up to two weeks into the future.

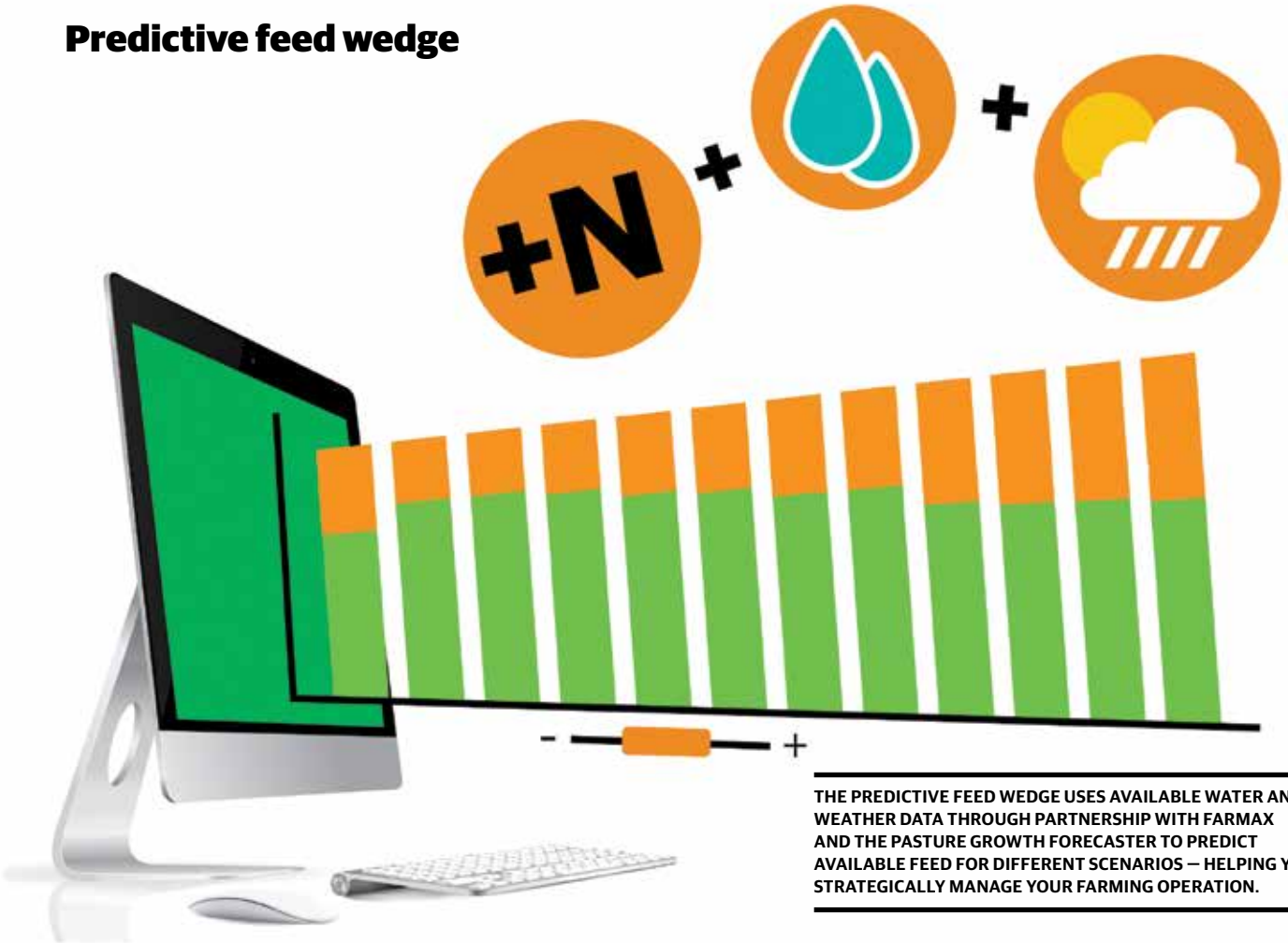
Ravensdown's Smart Maps upgrade will offer an interactive feed wedge where the feed situation is shown over time, with short-term pasture cover predictability and consumption. In addition, the user can interact with the feed wedge allowing supply/demand balancing via tactical use of N and a feed conservation tool.

DR ROBERT MURRAY (LEFT) EXPLAINS THE IMPORTANCE OF ACCURATE MEASUREMENT AS A PRECURSOR FOR GOOD DECISION MAKING.

A typical scenario for a paddock is where the user applies N to boost pasture growth and mitigate a looming feed deficit. This situation can be modelled and animated so good decisions can be made to address the deficit. This same functionality can be used for feed conservation as well.

"We're here to talk about putting the predictive back into farming businesses where we can."

Predictive feed wedge



THE PREDICTIVE FEED WEDGE USES AVAILABLE WATER AND WEATHER DATA THROUGH PARTNERSHIP WITH FARMAX AND THE PASTURE GROWTH FORECASTER TO PREDICT AVAILABLE FEED FOR DIFFERENT SCENARIOS — HELPING YOU STRATEGICALLY MANAGE YOUR FARMING OPERATION.

Figure 1. Smart Maps strategic feed budget

THIS STRATEGIC FEED BUDGET SHOWS SUPPLY AND DEMAND VARIANCES FOR THE YEAR AHEAD, IDENTIFYING WHERE ADJUSTMENTS NEED TO BE MADE AHEAD OF COMMITTING TO PRODUCTION TARGETS INCLUDING N RESPONSE.

Strategic feed budget

Managing feed supply throughout a season presents challenges, due in part to the seasonal highs and lows of pasture growth, varying animal demands and stock movements. A strategic feed budget is often used to identify animal numbers and feed requirements, pasture and crop feed supply as well as supplement inventory buffers throughout the season.

A strategic feed budget can identify supply and demand variances so adjustments can be made to stocking levels, N use and supplementary feed ahead of committing to production targets and finding yourself short of feed or more exposed to unforeseen risk.

The new and improved Smart Maps seeks to simplify strategic feed budgeting by using prompting and prepopulating industry standard pasture growth patterns, animal feed intake by stock class, nutritional value of supplementary feed and N response rates. The result is a glimpse of the future, a strategic plan and a powerful tool that progress and implementation decisions can be measured against.

Trending and benchmarking, regionally and nationally

Volatility can undermine confidence; questions are asked about what is achievable, how am I performing against others, what did I do last year? Having no answer to these questions is often worse than tackling them head-on. Facing up to the reality and planning a way through armed with the right information sounds good, but putting it into practice can be daunting.

Recent advances in pasture growth modelling combined with the power of Ravensdown's online farm management tool, Smart Maps, has allowed retrospective calculation of grazing dates, where regular pasture measurements have occurred. In time, as we bring in more robust variables, we can begin to monetise these performance indicators and provide a picture of the value of paddocks, blocks or farms. These metrics can be summarised and viewed as part of a strategic review process, or individual paddocks can be singled out to visualise trends over time.

When combining the above technological aids, farm operational, tactical and strategic decisions can be made with a good deal more confidence. The sensitivity of decisions can be tested and risk assessments made in response to the influencing factors outside of our control, putting the farmer on a more level playing field.

SMART MAPS IS AN INTEGRATED SOFTWARE THAT USES FARM DATA TO SUPPORT STRATEGIC DECISIONS THROUGH PREDICTIVE MODELING.

SMART MAPS, YOUR NUTRIENT NERVE CENTRE

By Kimberley Bray, Ravensdown National Services Manager

The real power of information that you've recorded on-farm starts to pay dividends when it is combined with calculations and predictive modelling. This creates an environment where you are able to make strategic decisions about your farming operation and manage production, more closely aligned to your goals.

Ravensdown has been developing a software package that drives productivity through its ability to collect data from partner technology like those of C-Dax Pasture Meter, select groundspreading operators and Aeroworks aerial spreading that is managed through Smart Maps. Recording what has taken place on your farm is commonplace, but partnerships with providers like Farmax to build calculations into the system - taking into account weather forecasts, soil temperature data and other environmental conditions, means you can now predict pasture production, specific to your property, at a greater level of certainty.

Having the tools to understand your fertiliser, pasture and soil test results, what's achievable going forward and how this leads to productivity is where farming is headed and the capability to do that is now available at Ravensdown.

Ravensdown's online farm management tool will be coming to you soon. Contact your agri manager or phone 0800 100 123 to speak with a service representative if you'd like to know more.

Feature Story // Pilot perspective

Primary Growth Partnership

In its third year, Ravensdown's Primary Growth Partnership (PGP) programme 'Pioneering to Precision' is starting to gather momentum. With Ravensdown pilot Grant Lennox's unique perspective from above, he tells us just what he's seen out and about as part of the research team, spreading fertiliser on the research farms.

Researchers from Massey University put in the hard yards to check precision aerial application is not just pie in the sky. The buckets capture the fertiliser that's been released by the auto-adjusting hopper doors. The results are then compared with the unique ballistics model that predicted where the fertiliser was going to land.

IntelliSpread

FERTILISER BINS ON PICKWICK FARM FOR A PGP FIELD TRIAL.

EYES IN THE SKY, A PILOT'S PERSPECTIVE

PILOT GRANT LENNOX USING NEW SPREADING TECH IN HIS PLANE ON A PGP DEMO DAY

Grant Lennox, Ravensdown pilot, says timing is so important when it comes to aerial spreading. "You're travelling very quickly so you need lead-in time to open and shut the hopper doors. Before this programme we (pilots) have been anticipating when to do this, which means you're not always able to give your full attention to flying the plane safely."

"The programme has removed the guesswork for me with the GPS computer automating the hopper door, so now I can just focus on flying. It also is satisfying to see the consistency and how tidy every boundary can be because the doors are working with the scientists' ballistic modelling and shutting the doors more accurately than I ever could."

Because fertiliser travels so fast, and takes a while to slow down, the science behind the particle movement is being tested by placing bins across varying topography to catch what Ravensdown pilots like Grant are spreading.

"It's a little bit like throwing a ball I suppose. I think it's great, the research is improving the accuracy substantially and is making my life a lot easier. The farmer is also getting a lot better result at the end of the day because we're not wasting any fertiliser, it's going where it's supposed to."

Grant says it's been great being a part of the research, "There's a great team working together from Massey, AgResearch and Ravensdown. I've learnt a lot about the GPS technology and fertiliser properties and how it is all connected through the Smart Maps system. It has given me more of a general overview and made my job a lot more enjoyable."

Grant believes there is definite improvement in the quality and accuracy of spreading due to the research.

"Without a doubt, in the field projects we are getting better results than before. There is a growing interest in the technology and I guess it's just a time thing until the science can be proven.

"On one of the trials there was a bit of time in-between flights, so I went to talk to the team who were unloading the catching trays and I could see the cover was quite even – it backs up what we're trying to achieve and it's great to see. Bearing in mind I'm not a scientist and I'm only looking at it from the naked eye, the scientists may be seeing something different when they measure the sample spread and rate."

The computer programme in the plane interacts with Ravensdown Smart Maps using the soil test results, along with other farm information, to generate an application map that is loaded into the plane's computer, dictating what is spread at what rate, instructing the GPS in the plane to spread just that and then showing where it landed with the Placement Verification Technology that is being developed. This is something that regional councils could be interested in as they become more and more interested in where the fertiliser is landing rather than where it is released.

"I've been aerial spreading for 11 years and this is the way things are going," Grant says. "If Ravensdown can make the whole PGP thing work then it really will be a game changer. From my perspective with the variable rate equipment it is going very well, knowing what I know now if I was a farmer I would insist on it."

THE SCIENCE BEHIND PLACEMENT VERIFICATION TECHNOLOGY

By Sue Chok, Massey University PhD student

Ravensdown's IntelliSpread technology developed from Ravensdown's PGP programme allows fertiliser to be applied at different rates depending on the aircraft's GPS position. We have found that our trials using automated hopper doors directed by a GPS system have showed a reduction in the variation (CV) of the fertiliser spread to around 45% from 70% previously reported for conventional aerial spreading (*).

What does this mean on the ground? It means that the system can tighten the fertiliser spreading range, for example for a spreading rate of 500kg/ha of superphosphate the variation can be minimised with two thirds of the particles lying within an application rate of 275-725kg/ha compared to 150-850kg/ha from conventional systems. The lower the variation in application the more targeted the application, supporting the case for an automated more precise application compared to a non-GPS manual operated hopper door providing a better impact. However, the influence of wind on aerial applications can still greatly affect where fertiliser lands.

The effect of wind on aerial topdressing has greater consequences along boundaries shared with neighbouring properties and waterways.

For the past decade, a research and development programme has been under way at Massey University's NZ Centre for Precision Agriculture, investigating fertiliser and lime flow from aircraft hoppers. A granular fertiliser ballistics model for fixed wing aircraft was first formulated by Professors Yule and Jones (Massey University), as part of Dr Murray's PhD, which in part lead to the Primary Growth Partnership programme. Sue Chok, a current PhD student at Massey University, has been validating this model using superphosphate, urea and di-ammonium phosphate (DAP).

The model can be used in a number of ways to optimise aerial topdressing, including placing boundaries around sensitive areas and minimising negative effects, such as fertiliser landing in the neighbour's farm. The model can also be used to understand how factors such as fertiliser physical quality and changes to spreading systems will affect the distribution of fertiliser on the ground. This would normally be achieved through expensive trials, but by using the model as an initial step, it can provide validation for new ideas before any major costs are incurred.

The model helps pilots like Grant Lennox apply fertiliser more effectively not having to worry so much about where the fertiliser might land.

The end goal? To apply fertiliser where it is intended.

ABOVE: GPS TECHNOLOGY THAT CONTROLS THE HOPPER DOOR RIGHT: DR MILES GRAFTON AND SUE CHOK FROM MASSEY UNIVERSITY AT A FIELD TRIAL ON PICKWICK FARM

(*) see page 42 Source Code

Feature Story // Superphosphate

THE SCIENCE BEHIND SPREADABLE SUPERPHOSPHATE IN NEW ZEALAND

Following on from the ballistic research in Edition 2 of Ground Effect (page 26) Mathew Ellen, Ravensdown Works Chemist, breaks down the science behind how Ravensdown improved its superphosphate spreading efficiency.

While we know phosphorus is essential for the survival of all living cells and no plant or animal can live without it, how it is produced is just as important. Phosphorus is a naturally occurring element, but superphosphate is a manufactured product. The truth is, not all superphosphates are created equal.

Traditionally, one or two sources of phosphate rock were used to make superphosphate by many manufacturers. Each rock brings its own qualities to the mix, so Ravensdown now utilises four or five phosphate rocks in a blend to deliver a higher quality and more affordable product.

Our procurement team scours the world to bring us the best quality and most affordable rock that specifically enhances granule quality and consistency, so we can make the best quality superphosphate we can.

The rocks' chemical properties are tested extensively at ARL, which informs our technical specialists who create and adjust the superphosphate recipe. Creating the consistent standard that pastoral farmers and spreaders need from their staple fertiliser is just like creating a recipe for a cake.

> **"Our procurement team scours the world to bring us the best quality and most affordable rock."**

A by-product of sulphuric acid manufacture is heat and lots of it! All our processing plants convert the excess heat to electricity that can be used on site or exported. In winter we routinely support the national grid during periods of high demand, to the tune of 5400 households.

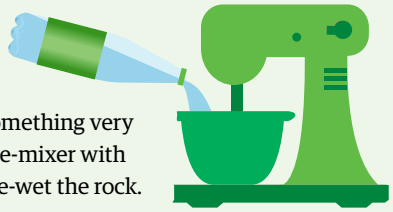
Superphosphate recipe

Ingredients

38-40 tonnes of phosphate rock
23 tonnes sulphuric acid
10.5 tonnes water

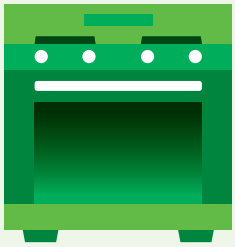
Method

1 Crush the rock to less than 75 microns (just like flour)



2 Put this into something very similar to a cake-mixer with the water to pre-wet the rock.

3 Add the acid to make approximately 65 tonnes of super.



4 Allow to cure for 10 days

The chemistry

$Ca_3(PO_4)_2$ (rock) + $2H_2SO_4$ (sulphuric acid) $\longrightarrow$ $Ca(H_2PO_4)_2$ (Superphosphate) + $2CaSO_4$ (Calcium sulphate)

Phosphate Rock + Sulphuric Acid $\longrightarrow$ Superphosphate (mono Calcium Phosphate) + Gypsum

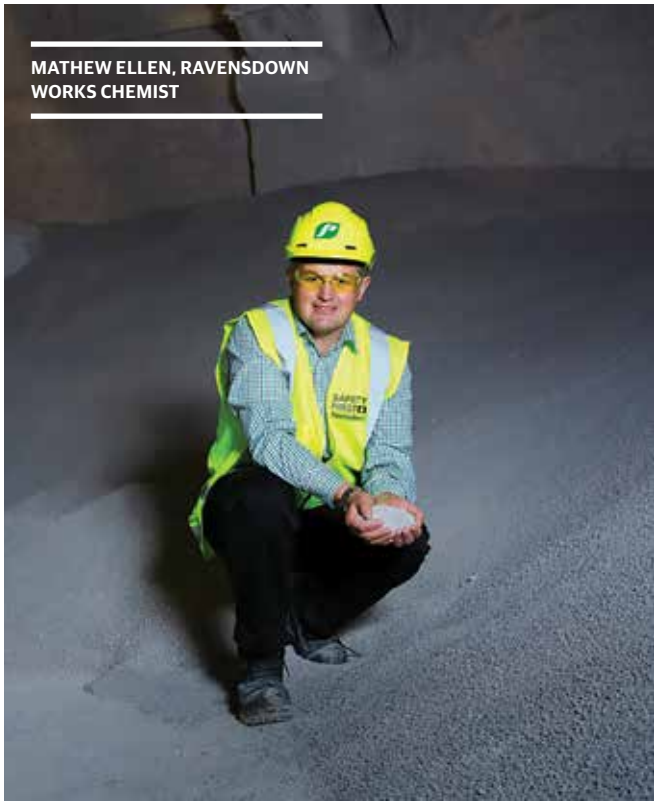
What's changed?

Several years ago we set some goals to improve our superphosphate's physical quality to deliver farmers a better product that spreads evenly.

First up, we improved the manufacturing process by investing in plant automation and maintenance programmes. All three plants are now fully computer-controlled for reduced variances and allowing precise adjustments so that each and every tonne is the same.

The value of the experienced plant operators cannot be over-stated in this process.

In addition to our own testing, all of our manufactured products are audited as part of the Fertmark programme to give shareholders further assurance in what they are being supplied.



MATHEW ELLEN, RAVENSDOWN WORKS CHEMIST

The importance of superphosphate

Plants depend on phosphorus (P) drawn from the soil and consequently stock depend almost entirely on P provided by pasture.

Superphosphate has shown itself to be ideal for New Zealand farming systems, affordably providing both phosphorus and sulphur (S) in plant-available forms.

Early history of superphosphate

1840

German Chemist Justus Von Liebig found that phosphate in bones was more quickly available in soils if they had been pre-treated with sulphuric acid.

1843

English entrepreneur John Lawes manufactured the first commercial batch of superphosphate by reacting sulphuric acid with phosphate rock.

1880

First import of superphosphate to New Zealand by W.E. Ivey to demonstrate its value to local soils at Lincoln University.

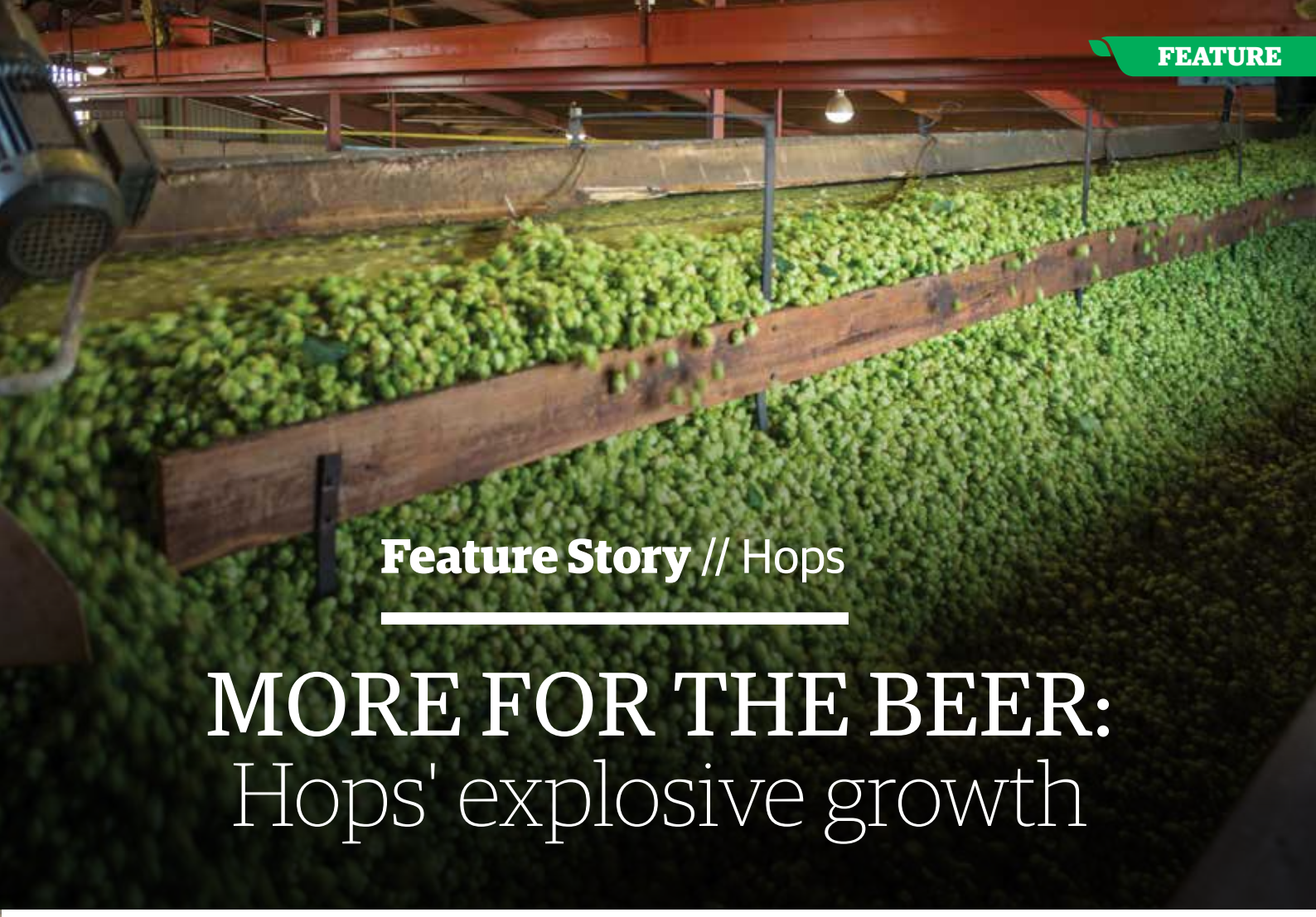
1881

The first commercially manufactured superphosphate in New Zealand was produced at Burnside, Dunedin.

1922

The third superphosphate plant opened in Hornby, Christchurch, which is still operated by Ravensdown today along with plants in Dunedin and Napier.

"I learnt very quickly the importance of water and fertiliser, everything I know about fert I learnt from other growers and Chris our Ravensdown rep."



Feature Story // Hops

MORE FOR THE BEER: Hops' explosive growth

Nestled in the top of the South Island you'll find an agricultural industry that's punching well above its weight.

Completely unique to the Nelson area, hops are a highly sought-after product both here and overseas thanks to the craft beer industry boom, says local hop grower Dean Palmer.

The 18 hop farms in the Nelson area contribute an impressive $17 million to New Zealand's economy annually from exporting 90% of their hops, which makes up 1% of the world's supply (*). With a myriad of prizes and innovations, the New Zealand hop industry is well established on the international beer scene, but what happens behind the farm gate to attract such prestige?

"The hop-growing fraternity is very progressive," says Chris Wratt, Ravensdown Agri Manager, "They have to be really, because of the way the crop is harvested. The whole plant needs to be chopped down and so the growers essentially need to start from scratch each season to replace the soil nutrients."

Hop grower Dean Palmer considers himself new to the industry after eight years and says it has been a steep learning curve.

"I learnt very quickly the importance of water and fertiliser, everything I know about fert I learnt from other growers and Chris our Ravensdown rep.

"Hops are quite a latitude-sensitive crop, if you look at all the hop growing areas in the world they're all within the 40-48° latitude because of the long growing days, which is why Nelson is so good."

DEAN PALMER PLANNING NUTRIENT REQUIREMENTS WITH HIS AGRI MANAGER CHRIS WRATT

With the temperate climate, sheltered from the wind, hops start growing in late September and hit their growth spurt by December, where they shoot to the top of the five-metre canopy and are ready to harvest late February and March.

Dean says the bine training process in October is a delicate balancing act. "There are sometimes hundreds of bines produced

(*) see page 42 Source Code

by each plant and you've got to select six to eight of the best bines to grow up the wires. You want ones that are aggressive enough to get right to the top and produce a good crop but won't be so big they block the light and are too difficult to harvest."

Of significance to the hop industry, is how they manage their way around the mineral transfer process.

"Cutting down the plant means you take away the organic return of nutrients to the soil through the mulching process," Chris says.

"With a plant that needs to grow five metres high, the plant needs all the nutrients it can get. That's why hop farmers need so much fertiliser."

Dean applies fertiliser every two weeks in the spring and up to nine times a year on some blocks. He uses different brews of fertiliser specific to the farm determined from the extensive soil tests, and historical and current analysis.

"We use tailored NPK fertiliser mixes and soil test on all our blocks annually, sometimes more if we think we've got a problem. In the winter we sit down with Chris and put together a plan, we tailor it every year tweaking and adjusting to get it as accurate as we can."

Dean also farms four hectares organically and says Ravensdown does a lot of soil testing and comparison between the two plots. "When we've had problems, Chris has been really good, suggesting extra tests and doing analysis work."

Dean says analysis and tests from ARL are crucial to such a high-input system."Ravensdown have been helping with leaf tissue analysis for the past four years to determine whether the plant has got enough nutrients to reach its potential. They're also helping the industry by analysing the whole plant after harvest, to measure the amount of nutrients the plant has removed from the ground, which will help us determine our fertiliser plans."

"The industry is mindful of the environment, so this kind of data is being collected with a view to the future."

KILN DRIED HOPS ARE LOADED INTO A HOPPER IN PREPARATION FOR PRESSING INTO 130KG BALES

HOP CONES AFTER HARVEST

Focus On // Fertiliser

FOUR THINGS you need to know about lime

By Dr Hendrik Venter, ARL Technical Director

It is commonly known that lime should be applied to create conditions conducive to crop production at the most economic levels. What is less understood is the impact that lime has beneath the surface to generate the ideal growing conditions, when sufficient lime is applied. Let's look at how lime can help you get the best results in pasture and crop production.

1. Going back to the roots

Aluminium (AI) limits root development, while manganese (Mn) adversely affects leaf and shoot development (*). At low soil pH, Al and Mn become more soluble, releasing into the soil solution at varying amounts depending on the type of soil. However, in most New Zealand soils, once soil pH is raised above pH 5.5, Al in soil solution decreases to the point where there is little or no effect on crop and pasture production (Figure 1) and excessive levels of Mn start to reduce.

Roots exposed to excessive Al concentrations typically become thick and stubby with little development of fine roots, and root hairs, as illustrated in Figure 2 with maize. Eliminating the detrimental effect of Al on root development with the optimum pH levels enables the plant to explore a greater soil volume in search of water and nutrients (*).

Figure 1. Typical relationship between exchangeable aluminum and pH

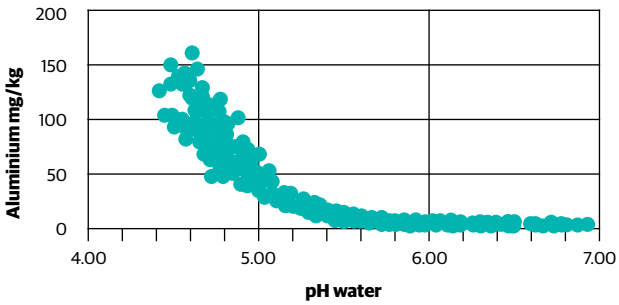


Figure 2: Maize roots exhibiting severe aluminum-toxicity symptoms (**)

At pH 5.8 – 6.0, the recommended minimum optimum pH for pastoral soils in New Zealand, the adverse effects of Al and Mn toxicities associated with acidic soils are eliminated (*). Nutrient availability and cycling is also improved, all of which are conducive to improving pasture production economically.

2. Nailing your nutrient needs

Lime is the most economic source of calcium which is essential to the cell elongation process and plant structural strength. With some liming materials being rich in magnesium – the powerhouse behind photosynthesis - such as dolomite (11% Mg), the Mg becomes plant-available as the dolomite slowly dissolves.

Thankfully, calcium deficiencies in New Zealand soils are largely unknown because of the geological age of our soils. Our young soils are also less weathered so Ca and Mg are not so easily leached. The widespread use of calcium phosphate fertilisers and lime means our soils maintained at pH 5.8 provide ample Ca for crop and pasture production.

In the opposite effect to Al and Mn, molybdenum (Mo) is a trace element that is essential in the fixation of nitrogen by plants. The importance of lime here is that Mo increases as the soil pH increases above pH 5.5, provided the soil contains Mo in the first place.

3. Worms and soil 'bugs' love lime

Acid soil conditions impact negatively on soil biological activity, slowing the breakdown of organic matter. Liming acid soils stimulates this increase in soil biological activity, and frequently results in faster organic matter breakdown and release of nutrients, such as nitrogen (N), which then stimulates pasture growth.

4. Conjuring N out of thin air

Although white clover is relatively tolerant to Al toxicity, the Rhizobium bacteria is sensitive to soil acidity. Liming acidic soils results in improved nodulation of most temperate legumes (*).

(*, **) see page 42 Source Code

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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** Figure 2: Courtesy, Dr Mart Farina.

RAVENSDOWN BREAKING NEW GROUND IN HORNBY WITH THE OPENING OF AUSTRALASIA'S FIRST PRECISION BLENDING TOWER (18 MAY, 2016).

The Last Word

We hope you enjoyed the third 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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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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Our Ravensdown contributors who go to considerable efforts to make sure their advice and information is not only timely and relevant to farmers but easily understood. Special mention to Marty O'Connor who managed to photograph himself on his iPhone for the publication.

Finally, our new design team Libby & Ben, with Ashleigh, who have designed and laid out Ground Effect to such a high standard.

Ground Effect

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