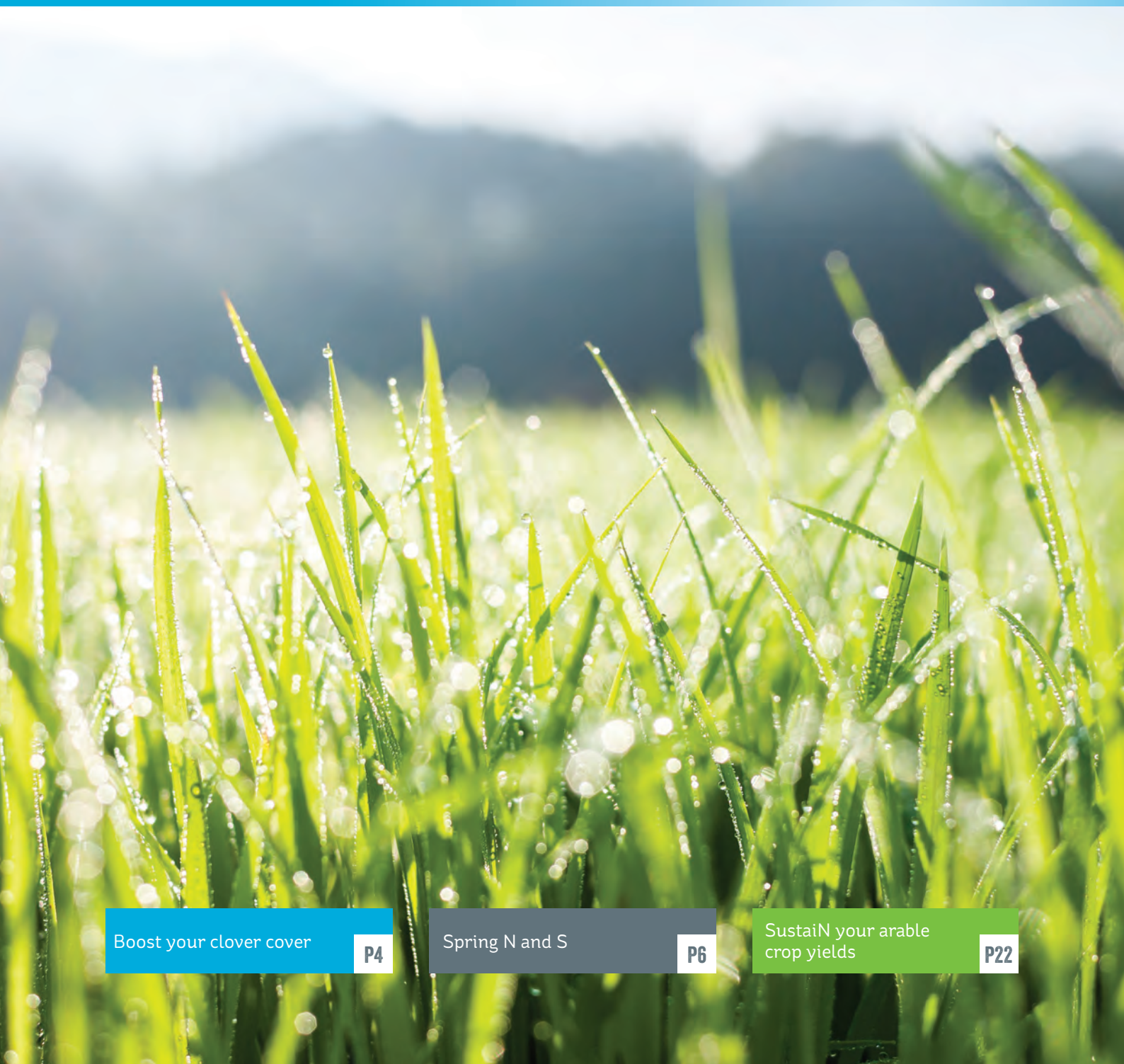
Ballance agri-nutrients

GROW

NORTH ISLAND
SPRING 2017



Boost your clover cover P4

Spring N and S P6

SustaiN your arable crop yields P22

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SPRING AND SELENIUM

Important for animal health, growth and performance, selenium is commonly deficient in New Zealand pasture. Luckily it's also a relatively easy issue to address.

The selenium content of pasture is influenced by:

Soil Se: In the North Island, Central Plateau rhyolitic pumice soils, Waikato and Hauraki Plains peat, sand soils in Manawatu and on the coast south of Wanganui and the light stony soils of Horowhenua, Hawke's Bay and Wairarapa are all prone to selenium deficiency.

Plant species: Browntop naturally contains more selenium than ryegrass, which in turn has higher concentrations than clover. Remember this when developing hill country, as ironically the improvement in pasture quality can induce selenium deficiency in stock.

Assessing Se deficiency

With most micronutrients, selenium included, there are no calibrated tests which can link soil levels with potential pasture deficiency and related animal health risks. However, clearly in areas where soil levels are low, plant levels are more likely to be low.

Herbage tests are the best way to confirm pasture deficiency. Blood and tissue tests will pinpoint selenium levels in stock. Table 1 shows the critical levels involved.

Selenium concentrations in pasture will vary throughout the year. Ideally you should take a benchmark herbage test in April and a confirmation test in October to estimate the adequacy of selenium in the diet.

Take blood samples from at least three animals in autumn. Take liver samples from at least three animals or collect the liver at the time of slaughter.

Addressing Se deficiency

If pasture levels are below 0.03 mg Se/kg DM (below 30 micrograms/g in your herbage test results) you will need to apply selenium to avoid deficiency in stock and/or realise performance and production benefits. Unlike some other micronutrients, selenium uptake by pasture is not commonly limited by levels of other macro or micronutrients. This makes it easier to incorporate into your fertiliser programme.

Two forms of selenium are commonly used: slow-release barium selenate and/or fast-release sodium selenate. Ballance Selenium combines both forms to give pasture an initial lift and then sustain selenium levels over time. This gives you more flexibility with application timing. Ballance Selenium can be applied in spring or autumn.

The recommended selenium intake for lactating cows and growing calves is significantly higher than the minimum: between 0.1 and 0.3 mg Se/kg DM. This may require direct-to-animal supplementation. Always consult your vet if considering this option.

Selenium deficient areas

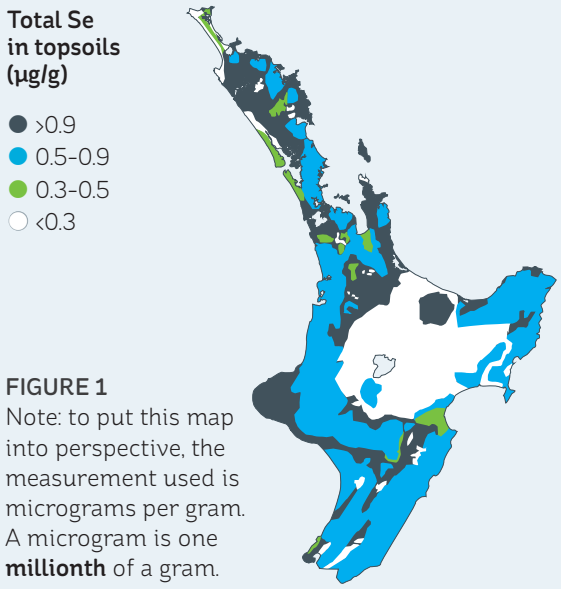


FIGURE 1
Note: to put this map into perspective, the measurement used is micrograms per gram. A microgram is one **millionth** of a gram.

		Low	Marginal	Adequate
Cattle	Pasture (mg/kg DM)	<0.03	–	>0.03
	Blood (mmol/L)	<130	130-250	>250
	Liver (mmol/kg fresh tissue)	<600	600-850	>850
Sheep	Pasture (mg/kg DM)	<0.03	–	>0.03
	Blood (mmol/L)	<130	130-250	>250
	Liver (mmol/kg fresh tissue)	<250	250-450	>450

TABLE 1
Critical levels for assessing selenium

GET YOUR FARM IN CLOVER

Addressing two common deficiencies may boost your pasture's clover content.

Ideally pasture should contain about 30% clover, which would fix roughly 200 kg N/ha/year and deliver significant animal productivity and DM yield benefits. "Importantly, the DM yield gains come mostly in summer when extra feed is really valuable," says Josh Verhoek, Ballance Science Extension Officer. "However, in many New Zealand pastures, clover content hovers around 10-15%. Figuring out what is limiting clover growth is a very worthwhile exercise."

Clover is known as the "canary in the mine" for pasture. It has a poor root structure relative to grasses, so is not as good at foraging for nutrients and will show signs of deficiency sooner. As grass outcompetes clover, it also shades it. Clover then has to compete for light to photosynthesise, compounding its struggle. "The law of the minimum applies to clover as to any other plant," continues Josh. "Growth is limited by the nutrients in shortest supply. The key is determining which ones they are."

Potassium and clover

Many are aware that sulphur is a common deficiency and important for clover growth. However, potassium can be overlooked. New Zealand's sedimentary soils contain varying degrees of reserve K, which is slowly released over time. With traditional farm systems, this was often sufficient but as farming has intensified, and these reserves have decreased over time, in some cases they cannot keep pace with demand. Where this has not been taken into account in maintenance fertiliser, soil K levels can fall.

K or OK?

A study of fertility trends in New Zealand pastoral soils examined soil test information from dairy and sheep and beef farms over a seven-year period. Results indicated that nearly 35% of farms had potassium levels that were below optimum for maximum production (less than QTK 7-10 on ash or pumice soils or QTK 5-8 on sedimentary soils). Around 8% had very low potassium levels. These findings were confirmed by analysis of clover tissue samples. On-farm observations also showed poor-performing young pastures, weak ryegrass and little clover.

Keeping potassium levels in good form will improve the clover content of pasture and increase overall pasture production.

Potassium can leach, so on some soils, particularly those with low cation exchange capacity (CEC) and/or under high rainfall (over 1500 mm/year) it may not be practical or economic to keep potassium levels within the optimum range. However, supplying enough potassium to meet plant needs is necessary to maintain plant K levels through the growing season. Split applications are recommended in high-loss situations.

Molybdenum and clover

Molybdenum (Mo) helps clover fix nitrogen from the atmosphere and recycle it to the wider pasture. This increases grass growth and the proportion of clover in the sward.

When this was discovered in the 1950s, farmers took notice and applied molybdenum a little too enthusiastically. "If animals consume herbage with high molybdenum levels it can affect copper absorption, causing issues such as ill thrift, scouring, bone fractures and loss co-ordination in hind legs. Some land has not had molybdenum applied since," says Ballance Nutrient Dynamics Specialist, Jim Risk.

MAF field trials in the 70s proved that the same improvement in pasture quality could be achieved with less than a third of the molybdenum recommended by

the original research. However, molybdenum still made people nervous.

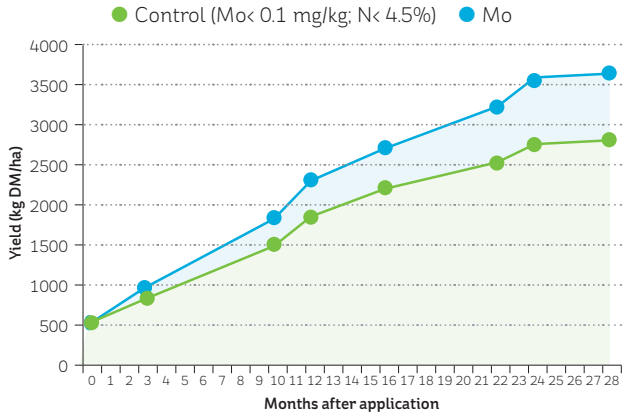
"The upside of this is that you can get a strong response when reintroducing molybdenum to land that has not seen it for a while," says Jim. "One study in Southland showed a 14% increase in pasture yield and 25% increase in clover production within 1.5 years after molybdenum application."

It is also extremely cheap: less than $1.00 per hectare. Applying 200 grams/hectare of 10% granular Mo supplies enough molybdenum for four to five years, making the cost/benefit ratio pretty impressive.

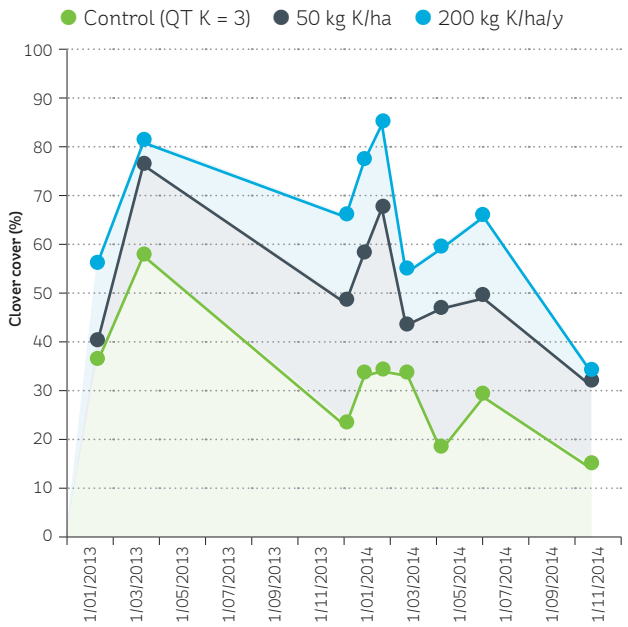
Mo or no?

Check by testing actively-growing clover. If this shows molybdenum at less than 0.1 ppm and nitrogen at less than 4.5%, applying molybdenum at the recommended rate is extremely unlikely to induce copper deficiency but will significantly increase pasture growth and clover content. Be aware that liming can increase molybdenum availability if sufficient background levels are present, particularly if your original pH < 5.5.

Impact of Mo on clover production



Impact of K on clover cover



Clover benefits

- Clover is more nutritious than grasses. It has lower levels of structural carbohydrate, higher digestible protein and is processed quickly by the rumen.
- Clover also 'feeds' other pasture species by fixing atmospheric nitrogen, reducing the need for N fertiliser.
- Clover will show nutrient deficiencies before grass, so a clover-only herbage test is a useful tool to fine-tune your fertiliser programme. Take samples during the spring flush.

Signs of K and Mo deficiency in clover

Potassium-deficient clovers are typically speckled, yellowed or 'scorched' around the leaf margins, with symptoms showing on older leaves first (see image above). Clover growth may be patchy – with clover looking lusher in old urine spots, which are potassium-rich.

Molybdenum-deficient clovers show similar symptoms to nitrogen deficiency. Stems may be slim and leaves small and pale or yellowed. Root nodules lose the distinctive pink colouring that indicates nitrogen fixation is in process.

Herbage testing can confirm a visual diagnosis and are the only way to examine levels of micronutrients that are important for pasture, crop and animal health. Herbage testing in addition to soil testing reveals a more complete picture of your farm's nutrient levels.

For herbage testing and advice on macro and micronutrient inputs to boost your pasture's clover content, talk to your Ballance Nutrient Specialist.

PLANT

SOIL

PUTTING THE N & S IN SPRING

Nitrogen and sulphur are both important for spring pasture quality and quantity. Understanding how this nutrient double-act works will help you use fertiliser inputs effectively and economically to make the most of the spring flush.

"Pasture plants contain around 4.0-5.0% nitrogen and 0.3-0.4% sulphur, roughly a 12:1 ratio," explains Ballance Forage Specialist Murray Lane. "This means they like to take up these nutrients in a similar ratio. If your soil's plant-available sulphur level is low, it may limit nitrogen uptake."

A sulphur-limited nitrogen response is much more likely to occur in spring than autumn. This is because soluble sulphate leaches from soil in wet winter conditions and cool soil temperatures slow down the microbes that convert organic sulphur into plant-available sulphate.

Pastures can become temporarily lacking in sulphur in early spring, as plant demand outstrips soil supply. If soil sulphur is deficient relative to crop or pasture needs, this may limit the response to fertiliser N.
"A lack of sulphur could also limit clover growth as temperatures rise," continues Murray. "Clover is a poor competitor for sulphur. If the proportion of clover in your sward drops so does its ability to supply nitrogen to other pasture species."

The right information

Sulphur needs, products and application rates should be considered in the context of your production and/or financial goals and overall nutrient management, based on sound data and advice.

Herbage testing complements soil testing to determine whether you need to use a straight nitrogen product or a nitrogen and sulphur combination (see Table 1).

The right product

If you need nitrogen alone, the common choices are urea or SustaiN. "Cool temperatures in early spring will not reduce your risk of nitrogen loss from ammonia volatilisation," says Murray. "Five to 10 mm of rain or irrigation within eight hours of application is still required or use SustaiN to reduce your volatilisation losses by up to 50%."

Sulphate of Ammonia (SOA) often comes to mind if both N and S are needed. SOA contains 19.5% N and 22% S. This is much more sulphur than necessary if you are applying maintenance superphosphate later in spring.

PhaSedN Quick Start combines SustaiN, SOA and fine-ground elemental sulphur, delivering 17.0% S (as both fast and slow-release S) plus 31.3% N. PhaSedN Quick Start is a good late-winter/early-spring option to address short and medium-to-long term sulphur needs, especially on soils prone to leaching.

SustaiN Ammo combines SustaiN with a little SOA to provide immediately available sulphur along with nitrogen as both ammonia and Agrotain™ coated urea. SustaiN Ammo 30N contains 13.7% S and 30.0% N and SustaiN Ammo 36N contains 9.0% S and 35.4% N.

S content	Impact on N response
Under 0.26% S	S is **likely** to limit an N response
0.26 - 0.3% S	S **may** limit an N response
At or above 0.3% S	S **will not** limit an N response

TABLE 1
S content of spring mixed pasture samples and impact on N response

MYTHBUSTING

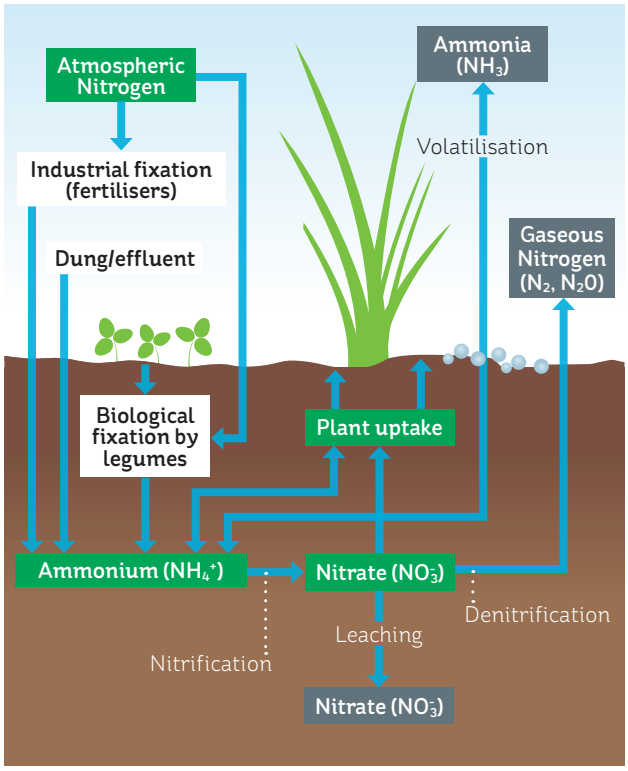
Everyone wants to make the most of spring, including the salespeople! Make sure you have sound information on your side.

MYTH: AMMONIUM IS A SLOW-RELEASE FORM OF N COMPARED TO NITRATE.

TRUTH: No. Nitrate is a bit more mobile within the soil than ammonium, which gets attracted to soil particles. Plants may take up the more easily available source of N first but they are capable of taking up N in both forms. In any case, ammonium is converted to nitrate by soil bacteria within days to weeks (depending on soil temperature and moisture). Calling ammonium 'slow-release' is therefore a bit of a stretch.

MYTH: SULFATE OF AMMONIA (SOA) IS LONGER LASTING SOURCE OF N THAN UREA.

TRUTH: No. The N in SOA is ammonium. When urea is applied to soil it is converted to ammonium in a matter of hours. Field trials have shown no difference in the length of the N-response period between urea and SOA.



MYTH: I'M TOLD MY MIXED PASTURE TEST RESULTS SUGGEST I NEED TO APPLY BORON.

TRUTH: Very unlikely. New Zealand pastures seldom respond to boron input. If in doubt, test your clover. Ryegrass typically contains low B levels and due to its dominance in the pasture sward, a mixed pasture test can appear critically low in B. However, a clover-only test, will generally show B levels at or above the 13-15 ppm 'satisfactory' range.

Similarly it is rare for New Zealand soils to be deficient in iron, manganese or zinc. If you are being advised to apply these micronutrients on regular basis you need to ask why. The only exception is if you are in an area prone to facial eczema and are advised to supplement with zinc to guard against this serious condition.

MYTH: SULFATE OF AMMONIA IS MORE EFFICIENT THAN UREA.

TRUTH: It depends! Efficiency of any fertiliser depends on delivering what pasture requires and minimising losses. Cost is also a factor. With urea, minimising volatilisation losses is important in terms of nitrogen use efficiency. When you apply urea, soil pH rises temporarily around the urea granule, which drives the conversion of ammonium to ammonia gas. This pH change does not occur when you use SOA to apply N. However, SOA is an expensive way to apply N compared to urea. Using SustaiN is a more cost-effective way to manage ammonia loss.

If sulphur is a limiting factor, then you may get a better pasture response from SOA than urea. Applying SOA in autumn will not be efficient as soil sulphate levels are usually high at this time (due to mineralisation of organic sulphur) and excess will be vulnerable to winter leaching. Demand is also lower over winter as grass and clover growth slows. Applying SOA in spring will be more efficient but its high S content may prove excessive if applying super later in the season. Again a product like SustaiN Ammo, PhaSed N Quick Start may be a more cost-effective way to deliver S and N together.

PLANT

SOIL

INFORMATION INNOVATION

MyBallance will put your farm at your fingertips to make fertiliser management simpler than ever.

Launching later this year, MyBallance is an exciting, new online platform that will change the way your fertiliser strategy and orders are managed, with potential to improve your production, profit and environmental performance.

"MyBallance will allow you to access an online, interactive digital map of your farm from any smartphone, tablet or computer," says David Scullen, Ballance Chief Information Officer. "You'll be able to see on which paddocks you've applied nutrients and get proof of placement information...You'll be able to order directly from the map, see the status of your order and access your fertiliser plan for the year."

Your Ballance Nutrient Specialist will be able to view your MyBallance information and you can provide access to others in your team (e.g. farm managers, sharemilkers, agronomists, family members, accountants or bankers), so everyone is working from the same, quality data. "For our Nutrient Specialists, MyBallance will make it easier to shift the focus of on-farm conversations from simple order placement towards deeper, more strategic discussions about your farming system, your goals and a more tailored approach to nutrient management."

If you usually get your Ballance fertiliser through a rural merchant, you will still be able to reap the benefits of MyBallance. Rural supply companies will interface with the system so you can order fertiliser directly from your plan while making other purchases from the store, whether you're buying goods over the phone, on-line or in person.

MyBallance designers have worked with a group of farmers and Ballance staff from across the business to develop the best possible functionality. "The MyBallance prototype has been through rigorous user testing with farmers," says David.

MyBallance will support multiple goals for the future of New Zealand farming. "We're trying to innovate digitally with solutions that help farmers operate sustainably, while maximising production and profitability," says David. "Not only will MyBallance make it easier for farmers to do business with us, high quality data coming into our systems will allow for better and more accurate nutrient recommendations. That will result in improved productivity as well as better information about fertiliser placement and volume, which in turn can help farmers protect the environment."

THE SLOW N SLOW DOWN

While the concept is popular, price and performance are proving barriers to the success of slow-release N.

"The idea of slow release nitrogen fertiliser is very appealing," says Ballance Research Manager Danilo Guinto. "Urea and SustaiN create a peak of nitrate in the soil, whereas plants require a slow, steady source of nitrate over time. An effective slow or controlled release N product could better meet plant needs and minimise leaching losses – a win for pasture and the environment."

However, while new slow/controlled release N technologies are being developed all the time, research has yet to deliver a perfect match for New Zealand farming conditions. "Options to date have shown their limitations: they're very temperature dependent and ironically a bit too slow to provide the nitrogen our pastures need in spring. Plus the value proposition is questionable. Slow release N is more expensive than other N fertilisers and, using products currently available, the higher cost is not offset by significantly higher DM volumes. Slow release N is still available through Ballance for those who have decided the numbers still add up in their favour."

So until the right technology arrives at the right price, what is the best way forward for everyone else?

"Most farms still have room to improve their nitrogen use efficiency and through this, their bottom line," observes Danilo.

Some questions to ask are:

- Do you have a nitrogen plan to help you use nitrogen to deliver feed when you need it?
- Are you following best practice recommendations for applying nitrogen fertiliser (and using the best products) to improve plant uptake and minimise N losses?
- Have you considered whether your farm is suitable for variable rate nitrogen application?

For help with any of these strategies, talk to your Ballance Nutrient Specialist.

Use your N $s better with N-Guru

Most of the time, an industry average is used to estimate response to N fertiliser. Estimates are usually based on a moderate 10:1 response (i.e. every kg of N will generate 10 kgs of DM).

N-Guru uses soil Total N results from your farm to accurately model your farm's response rate, so you can better match your N inputs to your DM needs.

Using local pasture growth data, N-Guru models the variation in N response by month and calculates the cost of feed grown (in c/kg DM) to help you decide whether N-boosted pasture or supplementary feed is your best option.

Where N-Guru's analysis of soil Total N reveals significant variations between farm areas, you can consider applying less N to high-N areas and more to low-N areas to get better results from your N investment.

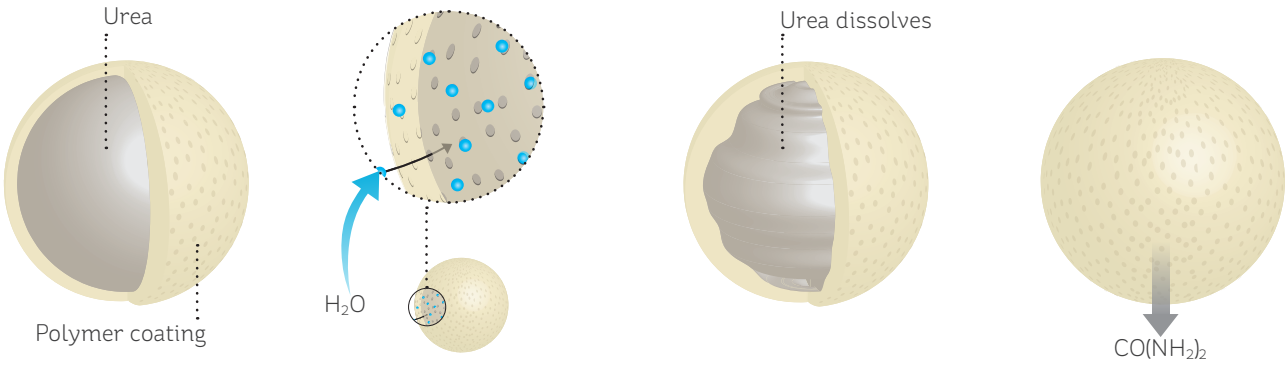


FIGURE 1
Polymer coatings may be used to slow down the release of nitrogen into the soil

BACKING THE FUTURE

By supporting doctoral research, Ballance helps sustain the future of New Zealand agriculture.

"Links between industry and research institutes are important to effectively target the challenges of modern agriculture," says Ballance Science Strategy Manager Warwick Catto. "A key requirement of a doctoral thesis is that it makes a new contribution to scientific knowledge, so this is a vital source of innovation. By helping to fund doctoral research, Ballance supports cutting-edge science, which can deliver practical benefits to New Zealand farming as well as supporting our next generation of experts."

Not surprisingly given our production and regulatory environment, a number of Ballance's recent PhD research investments have focused on using nutrients more efficiently to enhance growth while minimising potentially harmful losses to the environment.

Kritarth Seth is interested in how soil microorganisms can help pasture plants access and use nutrients. His PhD research identified bacteria colonies in clover that both fix nitrogen and improve phosphorus availability. His research could provide a direct economic benefit to farmers by helping them to use nitrogen and phosphorus more efficiently and could indirectly help preserve water quality.

Kamal Prasad Adhikari's research focus is on the use of inhibitors to reduce the loss of nitrogen through volatilisation. His PhD further explored the potential of urease inhibitors to reduce ammonia emissions from dairy-grazed pasture soils.

Doctoral research by **Jessica Roche** and **Qianqian Guo** explored how pastoral grasses use nitrogen, through two separate but complementary lines of enquiry.

Jessica's investigations revealed that ryegrass plants tend to have very little stored sugar soon after grazing. Plants need these sugars to take up nitrogen from the soil and convert it into amino acids and proteins.

Qianqian explored the impact of post-grazing carbon content on nitrogen uptake. Again, the conclusions were that the low carbon content of recently grazed plants inhibited the uptake of nitrogen.

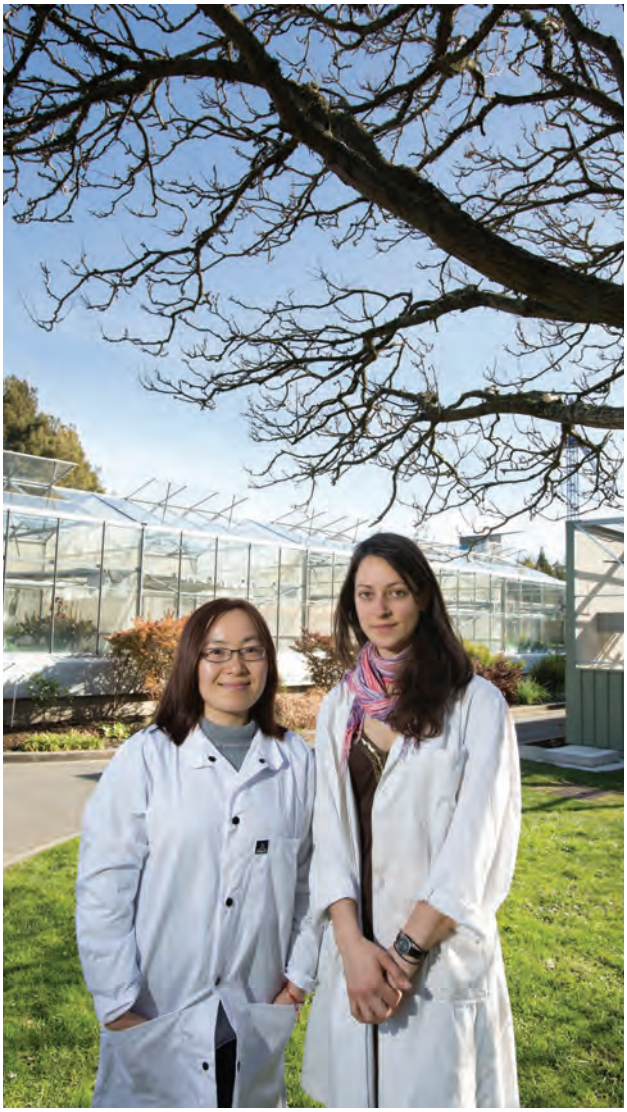
In combination, the researchers' results suggest that adding nitrogen fertiliser too soon after grazing may affect the growth response.

On a different tack, **Amy Whitley** hopes to improve the understanding of soil pH and aluminium toxicity for New Zealand soils. She is particularly interested in soil and environmental drivers, which could identify areas and/or soil types that may be more prone to toxicity. This will help farmers make strategic land use decisions and develop mitigation strategies.

All five are hoping to develop practical solutions to New Zealand agricultural challenges through continuing research or applying findings in a science extension

While some PhD graduates go on to post-doctoral research, others move into industry, advisory or education roles, maintaining the vigour (and rigour) of the agricultural sector as a whole.

"Many PhD students come to us from overseas universities and subsequently return to their home country. This opens up opportunities for mutually beneficial international collaborations and knowledge sharing," concludes Warwick.



Research by doctoral students like Qianqian Guo (left) and Jessica Roche supports New Zealand's agricultural future.

PHOTO: University of Canterbury.

TESTING, TESTING

PLANT

SOIL

In Autumn Grow we considered the value of grid testing versus traditional monitor paddock soil tests. Here we look at an increasingly requested mid-ground: all paddock/whole farm testing.

Monitor paddock testing is the typical way to gather information about your farm's nutrient trends over time. Done well, it's a reasonably easy and cost-effective way to get the information you need to develop an acceptable fertiliser strategy. Normally it's done annually but if you have reliable trend information and nothing has changed significantly management-wise, it's possible to test every two or three years.

With whole farm/all paddock testing, just as the name says, you test every paddock. The theory is that this gives you a more precise understanding of the variability in nutrient levels across the farm, which you can then use to apply fertiliser more strategically. Fertiliser savings (or other benefits) need to outweigh the cost of additional testing to make this approach worthwhile.

"You also need to be sure you are not just chasing natural soil test variability," observes Ballance Nutrient Dynamics Specialist Jim Risk. "For example, Olsen P levels could vary 15-20% either side of your test result. This reflects the erratic nature of biological systems and can be exacerbated by poor sampling protocols." This is why trend data is so important. "Without knowing a trend you can't rule atypical results in or out."

Situations where whole farm/all paddock testing might prove beneficial are during a conversion or amalgamation where there is a history of variable fertiliser application or where you are uncertain about the nutrient management history. With results in hand you then need to determine whether differences between paddocks are significant enough to warrant a differential fertiliser programme. "There are cases out there where whole farm testing has delivered extremely attractive cost savings but not everyone can expect to get these results."

If you do opt for this more intensive testing approach, Jim warns that repeating it year on year could be an over-investment. "Adjustments to your fertiliser programme may be improving the supply of nutrients to plants but take time to show in soil levels. To check the effectiveness of any differential application, it's more cost-effective to put extra transects into a monitor paddock testing programme instead."

Nutrients that aren't suitable for capital application – such as sulphur – are also better watched through monitor paddock transects rather than whole farm testing.

"There is always value to be gained from reviewing and refining your soil testing approach. You could also explore whether herbage testing could add value. Good information – not necessarily more – is the most helpful tool."

Jim Risk

For advice on soil testing and strategic nutrient management for your farm, talk to your Ballance Nutrient Specialist.

REWARDING AWARDS

The Ballance Farm Environment Awards are a great opportunity to strengthen your farm business through informed, independent feedback.

"Today's farming environment is a challenging one, with increased pressure from regulatory bodies, consumers and international markets but it's also an exciting one, with new science, technology and management practices rising to meet that pressure," says Ballance Science Strategy Manager, Warwick Catto, who is also a trustee of the NZ Farm Environment Awards Trust.

Stories showcased through the Ballance Farm Environment Awards (BFEA) are an important part of the picture. "Through the awards farmers can celebrate and recognise what they or their peers have achieved and also see what is possible, practical and profitable, when it comes to improving environmental management."

James Ryan, General Manager of the NZFEA Trust continues. "We find that our entrants feel strongly about the need to share positive stories about farming and growing in New Zealand... It is important for farmers to learn from other farmers. It is important so we can inspire our young people to work for New Zealand's most important sector. And it is also important so that people living in urban areas can better connect with the communities in which their food is produced." James observes that some entrants have gone on to important leadership roles in the primary sector.

For most, the value of award entry lies in the opportunity to gain insights from a team of highly respected and experienced farmers/ growers and agribusiness professionals. The judges take a holistic approach, evaluating every aspect of the business including environmental management, productivity and profitability, through to family and community involvement. The process is comfortably informal and yet thorough and visits are followed up by a report summarising observations, commendations and recommendations.

Entries for the awards are currently open, with closing dates varying from region to region. For more information and to read and listen to some inspiring farmer stories head to: nzfeatrust.org.nz.

The Gordon Stephenson Trophy

Supreme winners of the 11 regional BFEA awards are invited each year to a National Sustainability Showcase, to be considered for a trophy named in honour of Waikato farmer and noted conservationist, the late Gordon Stephenson. Trophy winners become ambassadors for the primary sector and get the opportunity to take an overseas study trip.

Peter and Nicola Carver were this year's trophy winners. Operating as Holmleigh Trust Partnership, the couple combine dairy and dry stock farming on their 515 ha family property east of Hawera. The Carvers felt the opportunity to get feedback and test their businesses against others was extremely valuable. "It has been a great opportunity for us to learn more about our business and the way forward...a great step in what is turning into an incredible learning journey," said Nicola.

Peter and Nicola Carver

KNOW YOUR TYPE

Exploring the differences between the most common fertiliser forms.

Fertiliser companies are continually developing new products to try and meet farming's changing needs. However, products generally fall into one of three types (see Table 1).

Fertiliser type		Examples
Single component	ONE macro or micronutrient.	SustaiN Nrich urea Muriate of Potash (K) Durasul (S)
Blended (sometimes called bulk blends)	TWO or more macro and/or micronutrients, physically combined as an 'off-the-shelf' product. Similar sized particles are chosen so they don't separate into heavier and lighter layers.	Cropzeal Pasturezeal Pasturemag PhaSed N and PhaSed N Quick Start
Compound	TWO or more macro and/or micronutrients **chemically** combined so the proportions in each granule are the same.	Superten Cropzeal Boron Boost Yaramila Complex Yaramila 12-10-10 Actyva S

TABLE 1
The three key fertiliser types. Note: Special mixes are a form of blended fertiliser with more macro and/or micronutrients physically combined to meet specific requirements for a crop or paddock.

Product pros and cons

ACCURACY

With a single-component or special mix you can determine the amount of each nutrient you apply, whereas with a bulk blend or compound the proportions are determined for you. Usually, bulk blends and compounds come in a range of formulations and one will be close to what your soil requires.

Compounds or blends will usually have a breakdown of their nutrient content on either their packaging, in product brochures or price lists. The figures in the nutrient columns show the amount of each nutrient in the product as a percentage. To calculate the quantity of fertiliser needed to apply a given rate of nutrient, use this formula:

$$\text{Rate of application (kg/ha)} = \frac{\text{rate desired for nutrient (kg/ha)} \times 100}{\text{Nutrient in fertiliser (\%)}}$$

HANDLING

Compounds are usually processed into a stable granule, which makes them less dusty. This makes them more pleasant to handle and they perform better in spreaders and particularly in drilling equipment, saving time and hassle in application.

Compatibility issues can also affect blends. Certain nutrient combinations can attract moisture and/or generate heat or gas, which affect handling and performance and can be hazardous. These issues should not affect commercially produced blends but should be kept in mind when mixing your own blends.

SPREAD

Compound fertilisers deliver their nutrient content very evenly, whereas blends sometimes segregate during transport, storage and application resulting in uneven nutrient distribution. This is not a major issue in a pastoral situation where nutrients are shifted around by stock moving, eating and excreting. It's more significant in an arable or cropping context where it can result in striping and impact on yields.

COST/BENEFIT

The production methods and performance advantages of compounds usually add to their cost. This is why they are usually targeted at horticulture or arable farming and best suited to high-value crops.

At the end of the day, the best option will be the one that delivers the right nutrients at the right rate and the right time, while minimising losses to the environment. Your Ballance Nutrient Specialist can help you choose the best option for your production goals and budget.

LAB IN THE LIMELIGHT

Backing good products with good science: our in-house laboratory teams have your back when it comes to what's in the bag.

Ensuring your super is 'super' and your ready-mades right.

At its Mt Maunganui plant, Ballance makes sulfuric acid and then reacts it with finely ground phosphate rock to produce three superphosphate-based products: Superten, Serpentine super and Sulphurgain 30S. Laboratory Team Leader Frances Palmer heads a tight team of three technicians working hard to keep product quality on track.

The team checks the quality of sulphur going into the acid plant and tests the resulting sulfuric acid on a daily basis, particularly its iron levels, which must be low to satisfy discerning customers.

Monitoring of phosphate rock involves taking a sample off the trucks every hour as each 30-50,000 tonne shipment is unloaded. The team analyses individual and composite samples to fully understand each shipment's quality and variation.

Inside the plant an auto-sampler snatches some finished product off the belt every 30 minutes. "We run a daily report on our materials during manufacturing and strive to help the guys in the plant continuously improve the product, both chemically and in granule quality," says Frances.

A final sample is taken as product is loaded onto trucks for delivery – a minimum of once every 1,000 tonnes dispatched. "So we measure the quality of raw materials going in, check throughout manufacturing and then, because of the reaction that continues in the shed after processing, we test again at dispatch," summarises Frances.

The lab also closely monitors the quality of HFA (hydrofluorosilicic acid - a marketable byproduct of superphosphate production). Other products monitored include coated urea and PhasedN from our Morrinsville and Te Poi plants, plus a wide range of imported, high-spec, ready-made products like DAP and SOA. "Ready-mades tend to be chemically and physically consistent and we have good benchmark data which has allowed us to confidently streamline our QA process. However, sometimes they have a different colour or look. We keep a rotating library of samples – at least three shipments' worth – so we can make a physical comparison, pick up any differences and flag any variations that may confuse customers."

Developing methodologies that deliver statistically valid test results is vital. "Our numbers have to be meaningful or it's a waste of time," observes Frances. "The first step is having a valid, representative sample... We know our low and high range on a daily basis and have a substantial amount of historical data which is really helpful for spotting trends and anomalies. As an industry we have well-tested methods and we also take part in the Interlab program, which ranks lab and technician performance against other labs throughout the country and in Australia. We perform consistently well in those tests, which is really significant in the context of our workload and capacity...People don't always like our results but they know they are right!"

Fertmark audits are another cross check. "All of our three manufactured products are Fertmark standard as are many of our ready-mades...Twice a year a Fertmark auditor checks all our lab data is within spec for the

Above: The Mt Maunganui Lab team in the fertiliser library (L to R): Karen Thurston, Shona Russell, Frances Palmer, Midhun Augustine.

period. Random samples are taken during audits and tested externally and internally for comparison."

Keeping an eye on urea

Ballance also owns New Zealand's only ammonia-urea manufacturing site, located at Kapuni, in Taranaki (below right). This high-tech plant breaks down natural gas into its component hydrogen and carbon dioxide. The hydrogen is combined with nitrogen extracted from compressed air to create ammonia, which is then recombined with CO_2 gleaned from the previous processes to form urea.

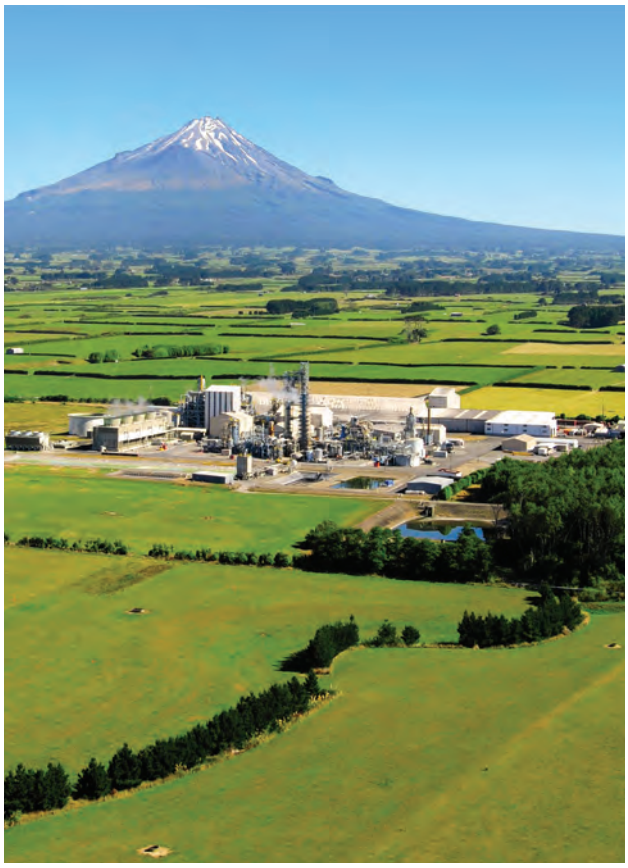
Production runs 24-7 and every two hours samples are taken and tested for biuret. "Biuret is a byproduct of the process and a plant toxin, so it's vitally important that levels are kept within specification," explains Plant Chemist Michael Taylor. "Composite samples are tested every 24 hours so we know the average of the product that's gone into the store."

The chemical composition of the end product is checked to ensure its total nitrogen content is up-to-scratch. Particle size is also examined. "This is crucial to allow spreaders to be calibrated to apply the product evenly and avoid striping. 90% of particles must be between 2 and 4 mm.

Kapuni's lab has been ISO 17025 accredited for urea testing since 1987 to meet expectations of its industrial clients. "It means that we are checked for technical validity and peer reviewed against labs around the world," explains Plant Chemist Michael Taylor who is part of the nine-person lab team. "Our procedural compliance is checked annually and every three years we are subject to a full technical audit. We use IANZ as our certifier." Total N and biuret are also audited by Fertmark.

A 'Think Big' project, Kapuni was built to meet all of New Zealand's urea needs as well as a significant export market. Now Kapuni produces 260-270,000 tonnes per year for Ballance customers alone and more is imported to meet demand. "All imported urea is tested here to meet the same standards as manufactured product. Samples are sent to us as the urea is loaded on the ship at source and again before dispatch," says Michael.

The lab's work also serves Ballance shareholders by maintaining the quality of industrial products made at Kapuni, including the 3-4 million litres of GoClear manufactured each year. An additive and scrubbing agent that reduces harmful nitrogen oxide emissions from diesel engines, GoClear uses around 1% of the plant's annual urea make.



The Mt Maunganui lab also undertakes all of the site's environmental resource consent testing, ensuring that Ballance is doing right by the environment as well as by customers.

Once a month, a technician scales the towering acid stack chimney to verify results from the continuous monitoring units tracking sulphur dioxide emissions (see right). Every week the manufacturing chimney is checked for acidity and fluoride levels. Wastewater is also tested weekly and a minimum of six sets of stormwater samples and collected and analysed per year.

A CATCH UP ON CADMIUM

This year the National Cadmium Strategy comes up for review, so it's timely to consider how we currently manage cadmium in our food production system.

Cadmium (Cd) is a metal, present naturally in small amounts in the earth's crust, air and water. Plants do not need cadmium to grow but will take it up if it is present in the soil and from there it enters the food chain. Humans don't need cadmium either but our kidneys and liver retain traces of quantities we ingest. Over time, it accumulates. In extreme cases, this accumulation has been linked with kidney dysfunction and bone density issues.

Traces of cadmium are also found in phosphate fertiliser and regular application can increase soil cadmium levels. "Surveys indicate our soil cadmium levels are comparable to agricultural soils internationally and levels in our diet are less than half the tolerable monthly intake defined by the World Health Organisation[1]," says Ballance Science Strategy Manager Warwick Catto. "Nevertheless it's an issue that the fertiliser industry and government watchdogs take very seriously."

The National Cadmium Strategy was launched in 2011 to "...ensure that cadmium in rural production poses minimal risks to health, trade, land use flexibility and the environment over the next 100 years." The Strategy directs food, soil and fertiliser monitoring, communications/education and research as well as implementation of the Tiered Fertiliser Management System (TFMS).

Tier	Soil Cd concentration (mg/kg)	Management action
0	<0.6	Retest in 5 years
1	≥0.6- <1.0	Retest in 5 years and restrict fertiliser product choice based on application rate
2	≥1.0- <1.4	Restrict fertiliser product choice based on application rate. Limit rates of application
3	≥1.4- <1.8	Restrict fertiliser product choice based on application rate. Further limit rates of application
4	≥1.8	No further cadmium accumulation permitted. Site-specific investigation required

TABLE 1
A summary of the TFMS. The majority of farms in New Zealand will fall into Tier 0 or Tier 1

Any farmer applying 30 kg P/ha/year or more should be following the TFMS's soil testing programme and associated recommendations to manage cadmium accumulation. The system classifies phosphate fertilisers into three groups based on potential cadmium content and supplies advice on their use relative to soil cadmium status.

[1] The NZ Total Diet Study 2009 estimated that monthly dietary exposures to cadmium ranged from a low 1/5 of the provisional tolerable monthly intake (PTMI) for 19-24 year young males to less than half of the PTMI for 5-6 year children and 1-3 year toddlers.

Research update

Some crops take up more cadmium from the soil than others and research under the National Cadmium Strategy is exploring this further. Jo Cavanagh from Landcare Research is leading the current project, which seeks to understand the influence of soil properties (such as pH and organic matter content) on cadmium uptake in potatoes and wheat. The research involves field surveys in key commercial growing areas and trials in Manawatu and Canterbury. Other projects have examined cadmium uptake in different cultivars of wheat, potatoes, onions and leafy greens as well as different pasture and forage crops; the impact of cadmium on soil rhizobia and nitrogen fixation in clover; and the effect on lambs of 'high-cadmium' feeds such as chicory.

Why is there cadmium in superphosphate?

Cadmium from sea water forms insoluble complexes with phosphates in the teeth and bones of marine creatures. When they die, their skeletons settle and eventually fossilise on the sea floor. Earth movement shifts these underwater graveyards to the surface, allowing the phosphate-rich deposits to be mined. Removing traces of cadmium from phosphate rock is difficult and expensive. Instead, fertiliser manufacturers select rocks that will make high-quality superphosphate with acceptably low levels of cadmium.

TURN LIMITS INTO PROFITS

By 2025, 75% of New Zealand farmers will be farming within limits. Act now for a sustainable future.

Ballance has established its Farm Sustainability Services team to help you get the best from your land, and meet compliance requirements. "It's much more than ticking boxes," says Ballance Farm Sustainability Services Manager, Alastair Taylor. "It's about enhancing your farm business. It's the same story we see again and again through the Ballance Farm Environment Awards –what's good for the environment usually has benefits for your bottom line."

The challenge for many farmers in new regulatory environments is grappling with the rules and the tools or systems required to comply. "This is where our team can help," continues Alastair. "We work with the regulatory and industry good bodies such as Regional Councils and Levy Boards to help shape compliance and consent requirements. Ensuring rules are implemented in a way that produces sustainable outcomes – socially, economically and environmentally is at the heart of what we do. We also keep on top of developments in associated tools and technology – like Overseer®."

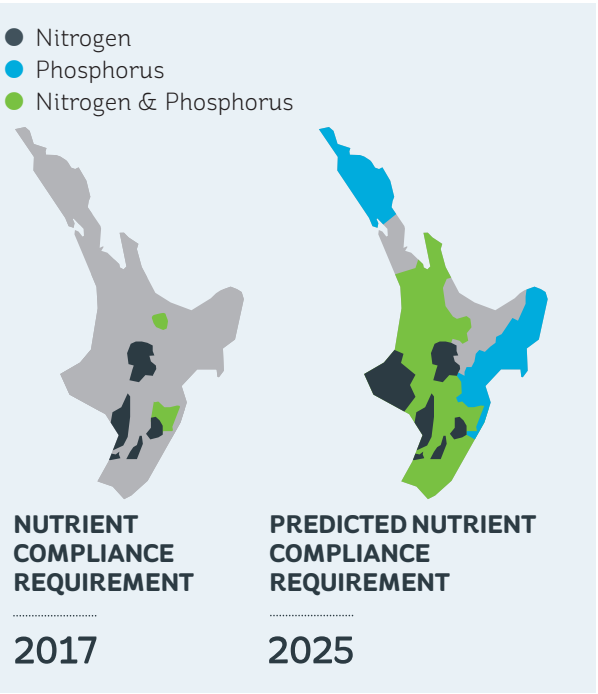
Overseer® supports farm business goals

Because its outputs can be used for compliance monitoring, Overseer® has often been viewed as a regulatory tool. However, it was originally developed to support cost-effective fertiliser recommendations and can be hugely valuable as a decision support tool for your farm business. "Agricultural consultant and economist Phil Journeaux has valued the benefits of Overseer® to the New Zealand farming sector at $271 million per year through its ability to save cost and time on-farm, improve fertiliser application and nutrient management and support research," says Alastair.

Overseer® also works well with other farm systems tools, like Farmax and now MitAgator™ (see page 20). "Overseer® is powerful but complex," admits Alastair. "You need to be a proficient user to get the best out of it and not everyone has the time or inclination for that. Again, that's where we come in."

The Farm Sustainability Services team can help you use Overseer® to develop Year End Nutrient Budgets (which support benchmarking for those preparing to farm within limits), test scenarios to improve nutrient use efficiency and/or obtain data to feed into other decision support tools.

With a solid understanding of relevant limits and your farm's nutrient flows, the team can work with you to build a robust Farm Environmental Plan which will help your farm business thrive now and into the future. "It's about identifying opportunities as much as constraints and provides peace of mind, allowing you to get on with the business of farming."



OUR PROCESS

SOIL FERTILITY TRENDS

A study of soil fertility trends over a recent seven-year period shows there is still scope to improve nutrient management for productivity, profitability and better environmental outcomes.

Managing nutrient levels at or close to the optimum ranges is economically and environmentally desirable. It means that you're getting the ideal pasture growth from the nutrients you apply. If soil test levels are below the optimum, a lack of nutrient(s) limits productivity. Conversely, if levels are above the optimum, you are spending more on nutrient(s) than you need and increase your risk of losses to the environment.

Your farm soil-testing programme is the best way to assess your position in relation to these optimum ranges. However, large-scale studies of soil test data also provide interesting insights into the way New Zealand agriculturalists are managing soil fertility levels.

A 2004 study by AgrResearch looked at soil test information from New Zealand pastoral farms over a 14-year period (1988-2001). Among other points, this review indicated that sheep and beef farms tended to operate with below optimum phosphorus levels, while dairy farms could potentially reduce their phosphate inputs without reducing production.

In late 2016 and early 2017, Ballance presented a new retrospective, based on customer soil test information from nearly 17,000 dairy farm samples and over 9,000 sheep and beef farm samples taken over the period 2009 to 2015.

The data sets were further grouped according to soil type (sedimentary, ash, pumice and peat) and trends examined for potassium (QTK), phosphorus (Olsen P) and sulphate levels, as well as pH.

Information on the change in the percentage of farms testing within the optimum range for the three nutrients examined is presented in the graphs on page 19.

"These graphs demonstrate some interesting points," says Ballance Research Manager Danilo Guinto. "It is encouraging to see that, with a few exceptions, soil fertility is generally being maintained. However, if you look at the y-axis of each graph, the maximum is 42% with many of the bars sitting at 30% or less. This means that 58-70% or more are applying either too much or too little of a given nutrient. There are various factors to consider here including statistical significance and the difficulty of achieving optimum ranges for some nutrients on some soil types. However, the overall message in terms of room for optimisation prevails."

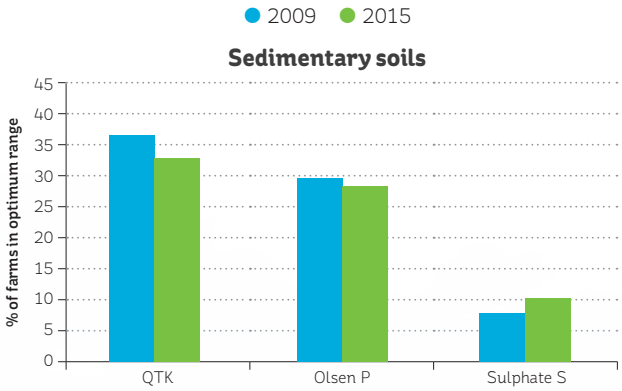
This research reconfirmed the conclusions drawn by the 2004 study regarding phosphorus levels on dairy and sheep and beef farms. It also identified opportunity to optimise sulphate levels in both dairy and sheep and beef farms.

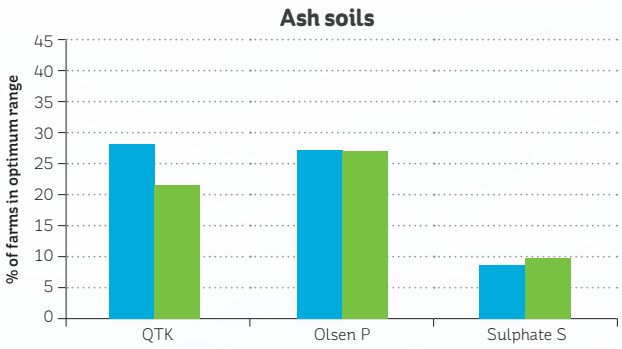
Test	Ash	Sedimentary	Pumice	Peat
Olsen P	25-40	25-40	35-50	35-50
QTK	7-10	5-8	7-10	5-7
Sulphate S	10-12	10-12	10-12	10-12

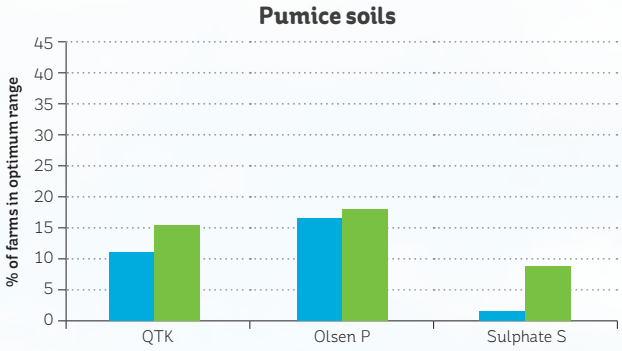
TABLE 1
Nutrient levels for near maximum production

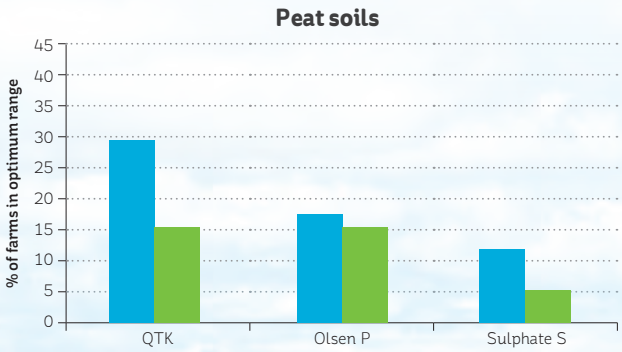
Note: These ranges reflect those used in the data analysis. The Olsen P ranges differ from standard agronomic target ranges for maximum production. Using near maximum ranges avoids the need for economic or risk calculations.

Sheep and beef farm fertility changes: 2009 compared with 2015

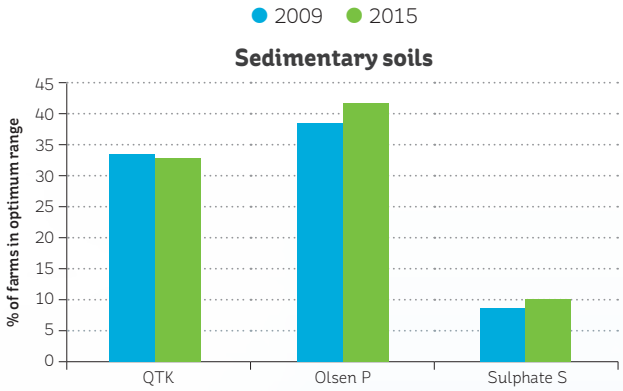


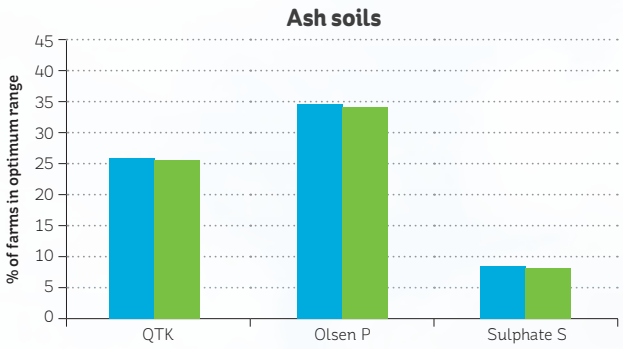


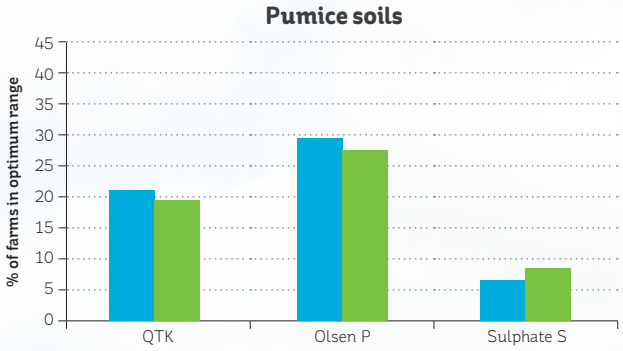


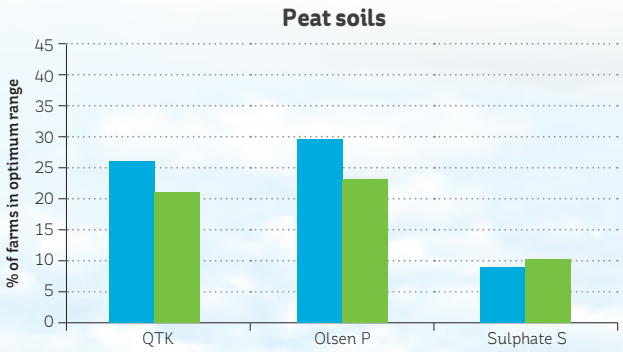


Dairy farm fertility changes: 2009 compared with 2015









MITAGATOR™ MAGIC

This innovative decision support tool will help you pinpoint and address hotspots of nitrogen, phosphorus, sediment and E. coli loss to boost profitability and farm within limits.

"The beauty of MitAgator™ is that it not only identifies critical source areas for these losses but also helps find the best way to address the issue," says Ballance Nutrient Dynamics Specialist Jim Risk. For every problem there can be a number of potential solutions, such as installing or improving infrastructure like feed pads or effluent storage, creating natural filters by planting riparian buffers or wetlands or managing stock and nutrient inputs in different ways.

Selecting the most effective solution for your budget usually involves a lot of time, number crunching and probably head scratching. "MitAgator™ takes the hard work away. Currently MitAgator™ is loaded with 23 science-backed and ranked solutions and can automatically select and compare the best ones for your chosen objective, allowing you to make well-informed, strategic decisions almost at the click of a button," says Jim.

As well as the fully-automated approach, MitAgator™ also allows you to target a specific critical source area, a particular paddock or block, or define an area manually.

To make the process even easier, Ballance has teamed up with a preferred supplier who can create the geo-referenced farm map that underpins MitAgator™.

"Obviously the 'garbage-in, garbage-out' principle applies and if you want to use MitAgator™, you need a robust Overseer® file. If you are not using Overseer® to best effect, your Ballance Nutrient Specialist or our Farm Sustainability Services team can help."

You can incorporate risk maps and mitigations into your farm plan so you can prepare and budget for implementation accordingly.

MitAgator™ becomes available to Ballance customers later this financial year, so there's still time to get prepared for the arrival of this powerful helping hand.

FIGURE 1
An example MitAgator™ risk map

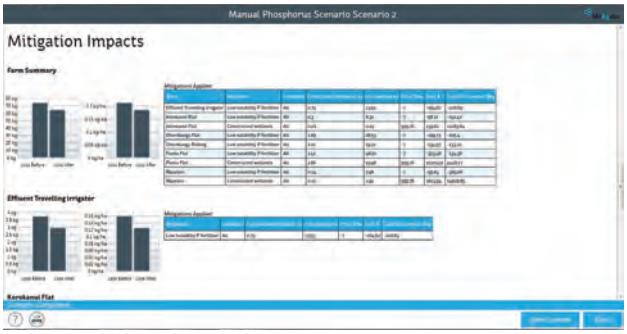
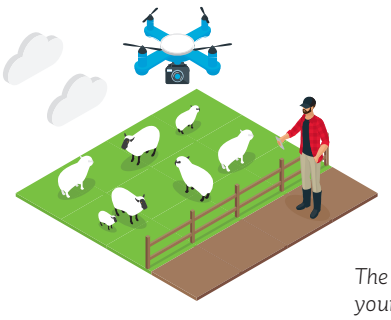
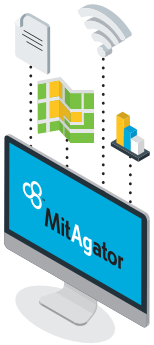


FIGURE 2
An example MitAgator™ scenario report

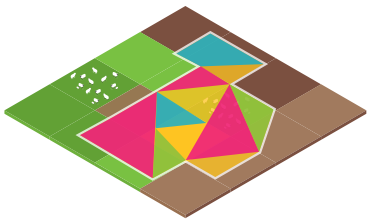
How does MitAgator™ work?



GPS and/or drone technology is used to create a geo-referenced aerial map of your farm.



The map is combined with your Overseer® file, along with soil and elevation data from national databases (or more specific datasets if these are available.



MitAgator™ generates risk maps, highlighting critical source areas for N, P, sediment and E. coli loss.

You can then use MitAgator™ to run scenarios comparing the effectiveness and cost of different solutions for a specific target. (e.g. a 10% reduction in P loss)

AVOID FODDER BEET BLUES

...or should that be yellows? More tips to manage this tricky but high-yielding forage crop.

As more fodder beet is grown, more issues and questions naturally surface. "Some farmers had problems with leaves yellowing towards the end of last season," reflects Ballance Science Extension Officer Aimee Dawson. "Many assumed this was a nutrient issue – possibly a deficiency of nitrogen, potassium or magnesium – but in fact it was caused by disease."

Beet Western Yellow Virus (BYVW) is frequently responsible for yellowing fodder beet. Transmitted by an aphid, it is hard to tackle. It only takes five minutes for an aphid feeding on the plant to transmit the disease, with symptoms appearing six weeks later. With BYVW, the leaf veins turn yellow. With magnesium or potassium deficiency colour changes occur between the veins, which stay green.

Leaf yellowing also occurs in the final stages of some fungal diseases. Circospora leaf spot starts out as 3-5 mm spots, with light brown centres and darker brown to reddish-purple borders.

Another case of mistaken diagnosis is where bulb rot from rain sitting in the crown or Rhizoctonia root rot in fodder beet is attributed to a lack of boron. Bulb rot and Rhizoctonia are more common in humid, high-rainfall environments, such as the Waikato.

Rusts are another common affliction, although not usually mistaken for nutrient deficiency. Severe rust infection increases susceptibility to other diseases.

Yellowing on this fodder beet leaf is due to Beet Western Yellow Virus, not nutrient deficiency. It is also infected with Alternaria leaf spot which is commonly associated with BWYV infection.

PHOTO: Mark Braithwaite, Plant Diagnostics Limited, Templeton Christchurch

Leaf viruses and rusts affect the palatability of the leaves and sometimes reduce photosynthesis, influencing the yield or quality of the bulb. "Treatments are available for some issues but the key to minimising losses is managing the crop well early on, so that you maximise the dry matter in the bulb," says Aimee.

Fodder beet checklist

- ☐ Avoid planting aphid/disease host cover crops (e.g. beet, radish, peas, potatoes, mustard) between drillings. Planting brassicas prior to fodder beet is a good strategy as the two crops don't tend to get the same diseases.
- ☐ Avoid crop spray residues BUT ensure that weeds have been well-controlled as seedlings are slow to establish, so vulnerable to weed invasion. Rotate with pasture if uncertain about spray history.
- ☐ Don't plant in same paddock two years running.
- ☐ Soil needs to have good water holding capacity during early development but not prone to pugging/compaction during grazing/harvest.
- ☐ Consider access for machinery and/or stock.
- ☐ Needs a fine firm seedbed.
- ☐ pH needs to be between 6.0 and 6.2 – fodder beet is very sensitive to acid soils.
- ☐ Seed coated with fungicide and insecticide provides best disease defence.
- ☐ Aphids hatch in spring and fly to summer host plants - drilling later may help avoid infestation.
- ☐ Fodder beet has a low requirement for phosphorus but still needs starter fertiliser containing P and B for strong establishment.
- ☐ Potassium and sodium are needed if QT K and QT Na are less than 4
- ☐ One or two early side-dressings of N will grow leaf area quickly and keep it green to drive bulb yield.

Research progress

Ballance is part of a Sustainable Farming Fund research project into fodder beet. Early investigations focused on N, K and B rates with final conclusions to be released at the end of the year. The next phase will examine crop diseases.

BEST DRESSED

Independent research is showing how SustaiN can boost yield and profit for arable farmers.

Wheat, maize and ryegrass seed crops require nitrogen at key growth stages to maximise yield. Consequently, there is less flexibility around application timing than in a pastoral context and a greater risk that nitrogen is applied in less than ideal conditions.

If 5-10 mm of rain or irrigation does not arrive within eight hours of application, some of the applied nitrogen will be lost due to volatilisation. In an arable context, where high rates of nitrogen are applied, these losses can be significant.

SustaiN reduces nitrogen volatilisation losses by up to 50%. Trials are showing that, with some strategies, the marginal cost difference between SustaiN and urea is more than offset by the gains in crop yield.

Ryegrass seed

The Foundation for Arable Research (FAR) has released results of a ten-year investigation into nitrogen application on ryegrass seed crops, involving 26 field trials on sites throughout Canterbury[1]. Nitrogen is generally applied pre-closing (to increase dry matter for grazing), at closing and again about three weeks after closing.

Information from 11 trials revealed that using SustaiN delivered a 6% increase in yield compared to urea, even when applying the urea using good management practices.

Maize

FAR and Plant & Food Research compared the impact of SustaiN with urea on maize crops in 2008[2]. The two-year trial involved three sites in the Bay of Plenty, two in Gisborne, two in Waikato and one in Canterbury.

The main nitrogen application happens eight weeks after sowing. On the Gisborne and Bay of Plenty sites where it was broadcast in dry conditions, yields were on average 5% higher using SustaiN compared to urea (for full grower rates of nitrogen). SustaiN had less of an advantage where fertiliser was knifed in or where the required amount of rain followed application.

Wheat

SustaiN's performance on wheat has been examined in a Cropmark/NZ Arable study reported on in 2009[3] and more recently in a Ballance-commissioned trial completed in 2013.

The 2013 trial compared grain yields from winter wheat crops grown with urea and SustaiN (against a no-N control) on irrigated sites in Wakanui and Temuka. A lower and higher rate of N was compared at both sites. Nitrogen was applied at GS32 and GS39.

Both nitrogen fertilisers produced significantly higher yields than the control. On the Temuka site, at the lower application rate (110 kg/ha) SustaiN increased yield by an average of 0.5 tonnes grain/ha, compared to urea. SustaiN also delivered a net economic benefit.

At the higher application rate (220 kg N/ha), SustaiN increased yield by 0.18 tonnes/ha more than urea. SustaiN still delivered a net economic benefit, albeit a much smaller one than achieved using the lower application rate.

Summing up SustaiN

Product choices need to be made in the context of the specific site, its soil test results, climate, irrigation and using current prices for fertiliser products and crop outputs.

However, independent research is showing SustaiN is a useful and financially beneficial tool for arable farmers, particularly if conditions are dry during the ideal application window.

[1] Foundation for Arable Research, (2016) Nitrogen Application on Ryegrass. From the Ground Up, Issue 86, Winter 2016. 10-11.

[2] FAR Arable Update No 61, November 2008. 'Comparing Urea and Sustain for broadcasting over maize'.

[3] FAR Arable Update No 193, June 2009. 'Comparing urea, SustaiN and DCn for broadcasting over wheat'.

FIRING UP FARM WIFI

Spark has partnered with NIWA, Farmlands, and Ballance Agri-Nutrients on 'Connecting Farms', a pilot project to explore the power of on-farm WiFi connectivity to deliver information that can improve decision-making and farm performance. NIWA's high-resolution, local forecasts are an example of the kind of live data the service will deliver via Spark's mobile WiFi network. This can help determine when to irrigate, fertilise, spray or harvest to best meet environmental consent requirements and mitigate risks. Ballance will test the power of WiFi (using Spark's LPWA* network) to gather and analyse data in real time from high-tech sensors measuring soil moisture, fertiliser spread, stock movement and pasture response.

Connecting Farms involves 60 pilot farms across New Zealand, starting with about 40 in the Matamata-Piako region. See more at: connectingfarms.co.nz. **Low Power Wide Area*

STAMP OF APPROVAL FOR SUSTAIN

As a result of Ballance-funded research, nBTPT-amended urea (such as SustaiN) has been recognised as an indirect way to reduce nitrous oxide emissions.

When soil microbes convert ammonia or ammonium into nitrate, they are never 100% successful. Some of the N is lost as nitrous oxide. Also known as laughing gas, nitrous oxide (N_2O) is a potent greenhouse gas and a very serious matter. One molecule of N_2O released into the atmosphere contributes almost 300 times more to climate change than a single molecule of carbon dioxide. If ammonia escapes into the atmosphere (e.g. by volatilisation) it can be re-deposited on land, becoming an indirect source of N_2O. Fractional ammonia gas emissions from fertiliser (or $Frac_{GASF}$) are therefore important factors within national greenhouse gas inventories.

"Our research on the impact of nBTPT-treated urea in reducing $Frac_{GASF}$ has been included in New Zealand's Greenhouse Gas Inventory since 2016," says original research leader and Landcare Research scientist Professor Surinder Saggar. "Now the Board of the Intergovernmental Panel on Climate Change has recognised the findings in its Emissions Factor Database. This further endorses the research and also acknowledges that it has potential to be applied internationally."

For users of SustaiN, it provides confidence that they are making a more environmentally sustainable nitrogen choice as well as an effective one.

FERT-TO-GO

First it was ATMs, then pay-at-the-pump options for petrol and now you can load your own fertiliser.

Ballance's convenient, self-service silos allow you to place your SustaiN order as usual and then load it into your own truck, at your leisure. An electronic key tag system provides 24-7 access, so you can collect your SustaiN whenever it suits you without assistance from the store.

Weather permitting, the North Island's first self-service silo will be up and running at the Whakamaru Service Centre, Mangakino by September. There are plans to construct more (and make other fertilisers available) as and when their popularity grows.

Whakamaru's self-service silo will be similar to this one at Ballance's Anama Service Centre in the South Island.

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