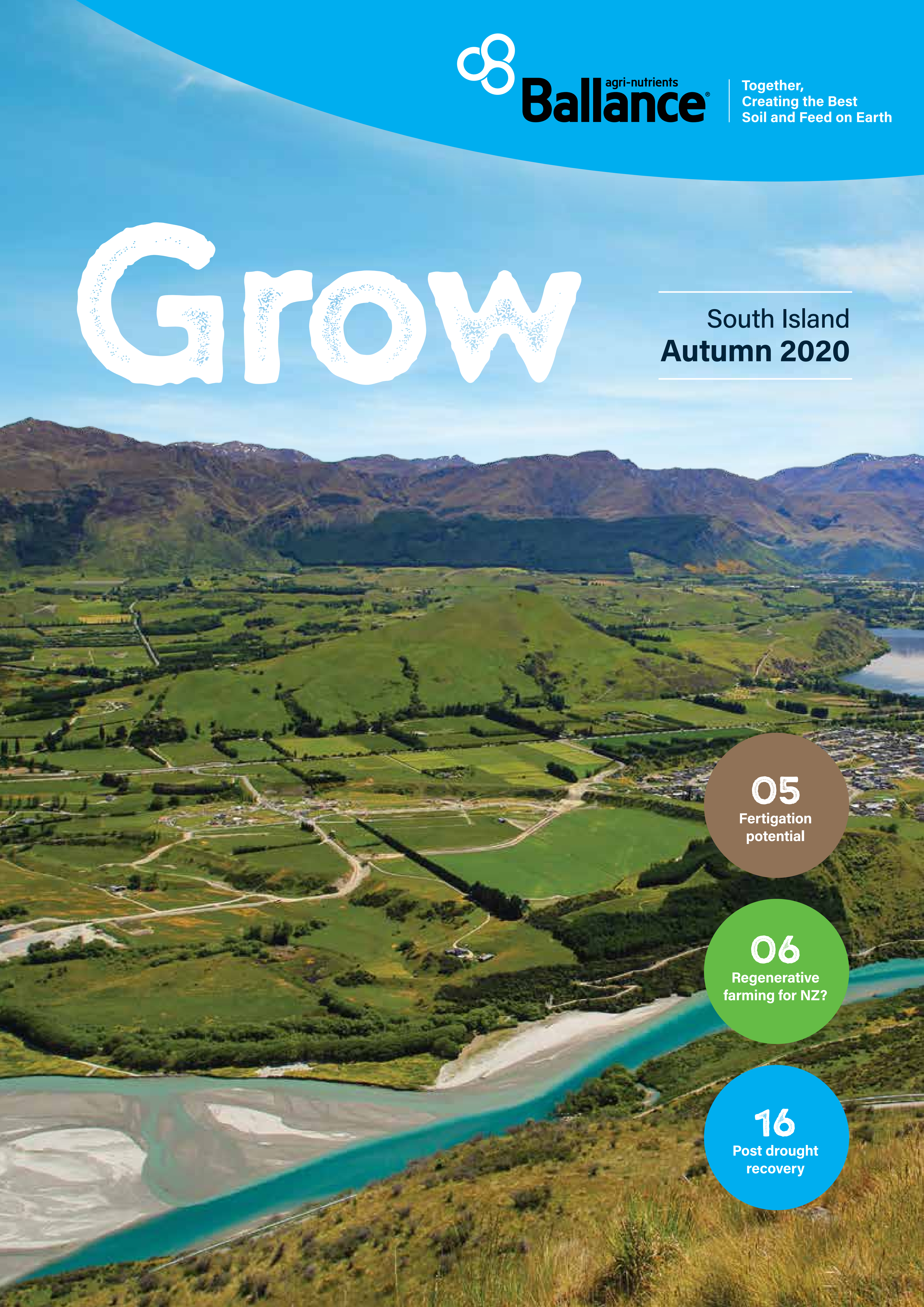
Ballance agri-nutrients

Together,
Creating the Best
Soil and Feed on Earth

Grow

South Island
Autumn 2020



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Ballance Agri-Nutrients is one of New Zealand's leading fertiliser manufacturers. A 100 percent farmer-owned co-operative, the company has over 19,000 shareholders and sells around 1.7 million tonnes of product each year, representing a turnover close to $900 million. Its products include imported and locally manufactured fertilisers, the majority of which attract a rebate for shareholders.

ballance.co.nz
0800 222 090

Since its inception in the 1980s, Super Air has evolved into one of New Zealand's leading agricultural aviation companies. In addition to aerial fertiliser application, Super Air has developed a world-class reputation for aircraft engineering and innovation. Wholly owned by Ballance, Super Air services most of the North Island.

superair.co.nz
0800 787 372

SealesWinslow is a recognised leader in the production of high-performance compound feeds and feed additives. A fully owned subsidiary of Ballance, SealesWinslow has manufacturing sites located in Morrinsville, Ashburton and Wanganui, and supplies custom-blended pelletised feed to farmers throughout New Zealand. It also provides molasses feed blocks, feed supplements and additives.

sealeswinslow.co.nz
0800 287 325

Detainment for good

Detainment bunds can help farmers in their quest for environmental sustainability and improved water quality.

Final results from three years of trials show detainments bunds' success at intercepting and treating storm water before it leaves the farm.

The recently completed three year Phosphorus Mitigation Project has a governance group made up entirely of farmers, who arranged a collaboration of nine industry co-funders to support this comprehensive applied science work.

Rotorua deer farmer and Bay of Plenty Regional Council sustainable farming advisor John Paterson, who kickstarted and managed the project says: "With an increasing spotlight on farmers and the impact farming has on waterways, this is a project developed and led by farmers."

Exciting results

Interim results (as reported in Grow Spring 2019) showed an average load reduction of 50 to 60 per cent, but the latest results are even higher, indicating detainment bunds capture around 60 per cent of the annual phosphorus load and 80 per cent of the annual suspended sediment load of storm water, depending on soil drainage conditions.

The project has demonstrated that well planned and built detainments bunds have a high success rate and their installation does not compromise pastoral productivity. Their size needs to be matched to the catchment size, so they can store at least 120 m^3 of storm water per hectare of contributing catchment. Over 20 detainment bunds have been built in recent years and the host farmers agree that storm water should only be stored for up to three days, so that pasture growth in the ponding area is not unduly compromised. Often the ponded water has largely soaked away before the three day limit is reached. This is important because often the prime places for creating the bunds and their large ponding areas are on some of the best pasture areas of the farm.

An interesting finding of the project was that a small number of large storm events were responsible for most runoff water, and thus sediment and phosphorus losses.

Multiple benefits

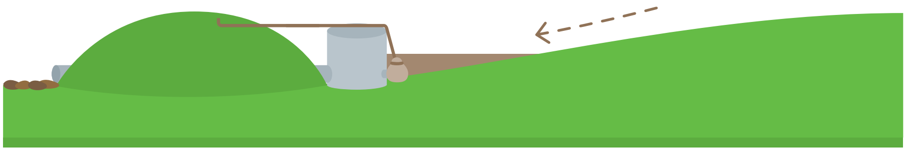
Detainment bunds are most effective for smaller flows from catchments less than 50 ha in size, where they have the potential to provide multiple benefits beyond phosphorus and sediment capture. The project also recorded nitrogen capture and further trials will focus on validating the capture of *E. coli* and nitrogen. Recharging of groundwater aquifers via soil infiltration from the ponding areas is another co-benefit of detainment bunds.

In addition, by capturing and slowing down the force of storm water, bunds can help to moderate floods and protect communities, and reduce stream bank erosion and damage to infrastructure such as fences, tracks and lanes.

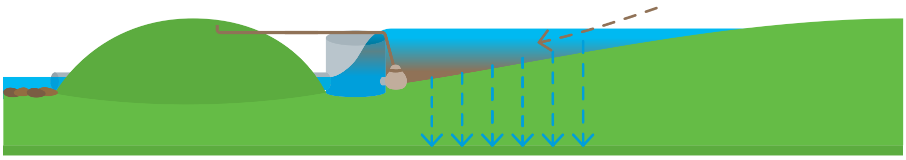
"Achieving the full potential of detainment bunds depends on the willingness of farmers, as they own the land that's suitable for them," says John.

The project was funded by the Ministry of Primary Industries Sustainable Farming Fund, and eight co-funders including regional councils, industry and Ballance Agri-Nutrients.

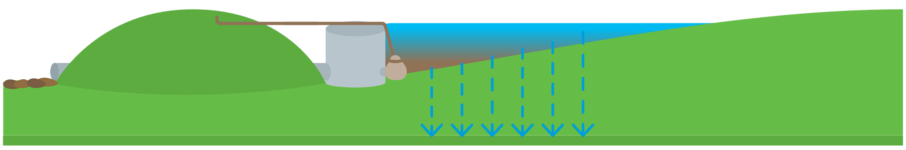
Detainment bunds, low earth embankments across valley floors where storm water flows, temporarily detain stormwater runoff in a large ponding area for up to three days, during which time its volume decreases due to infiltration into the soil. The suspended sediment particles, and attached phosphorus, cannot infiltrate and settle out before the water is released.



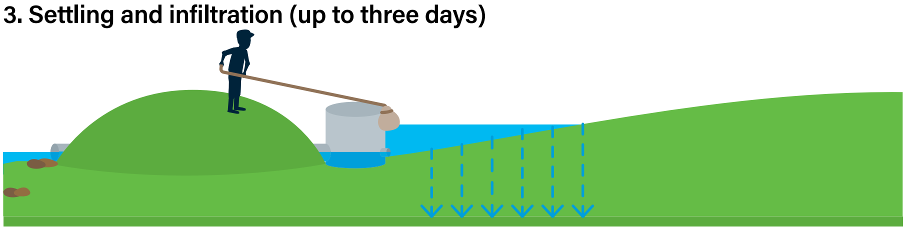
1. Stormwater runoff arrival and ponding



2. Pond full and overtopping riser



3. Settling and infiltration (up to three days)



4. Release of residual pond

5. Return to production

Retain or replace?

Crop residues can be a useful resource for returning plant nutrients and building organic matter into the soil.

Crop residue management determines whether the nutrients they contain are returned to the soil or removed and replaced via fertiliser.

Grain crop residues contain varying amounts of plant nutrients such as nitrogen, phosphorus, potassium, sulphur and magnesium (see Table 1).

Weighing up options

"The options for managing crop residues – removing, burning, leaving them or incorporating them back into the soil – all have their own pros and cons," says Ballance Science Extension Officer Aimee Dawson.

"Residue that's baled and removed has an economic value, but almost all of the nutrient content is lost. So it's wise to compare the value of the straw to the cost of replacing the nutrients via fertiliser." The economic cost of straw nutrient losses can be calculated using the Foundation for Arable Research (FAR) spreadsheet at www.far.org.nz/articles/247/economic-cost-nutrient-losses.

When residue is burnt most of the nitrogen and sulphur content is lost as gas, but about 80 per cent of the potassium, 60 per cent of the phosphorus and most of the magnesium and calcium content are retained and returned to the soil as ash.

"Residues left to decompose will slowly release nutrients and help retain organic matter. The rate of decomposition and release depends on the residue type, size, if and how it's incorporated back into the soil, and the nutrient itself," says Aimee.

"Barley straw decomposes faster than oat straw, which is faster than wheat straw. Smaller pieces of residue decompose faster than larger pieces. Using discs instead of ploughing to incorporate residues back into the soil mixes them more thoroughly into the soil, so they break down faster."

Residues can also be left on the surface and the next crop direct drilled into them.

Both incorporated and surface-retained crop residues have a high carbon to nitrogen ratio, which can affect the availability of soil nitrogen. As the soil organisms decompose residues they take nitrogen from the soil. Using fertiliser containing nitrogen to support decomposition is not always reliable, but drilling nitrogen fertiliser, such as DAP, with seed provides sufficient nitrogen (and phosphorus) to support early crop development.

"Nutrients are released at varying rates as residues decompose. Potassium's generally released pretty quickly; after five weeks about 50 to 90 per cent of the potassium content will be released. Nitrogen, phosphorus and sulphur are released more slowly."

FAR research has concluded different residue management systems are unlikely to result in major differences to total soil organic matter, but recent research suggests removing crop residues limits earthworm abundance and biomass.

"Whichever option you choose, consider the nutrient removal or retention when selecting the fertiliser for your next crop," says Aimee.

Table 1 **Nutrient content of crop residues**

	Approximate content (kg per tonne of residue)			
	Wheat straw	Barley straw	Oat straw	Ryegrass straw
Nitrogen	5.9	4.6	5.3	10.1
Phosphorus	0.7	0.4	0.5	1.0
Potassium	12.8	12.9	21.2	13.8
Sulphur	1.2	1.3	1.0	1.4
Magnesium	0.7	0.7	0.4	1.2

Source: FAR Arable Extra, Issue 103, December 2013

The Fertigation project group at Pāmu's Waimakariri Dairy Unit.

PHOTO: Irrigation NZ

Fertigation's potential

A new project is investigating fertigation's potential for irrigated pastoral farms.

Fertigation, essentially applying fertiliser together with irrigation water, could offer huge benefits for growing pasture, such as reducing nitrogen (N) application and loss, increasing N utilisation and improving clover content and pasture quality.

Since the 1970s fertigation has been used around the world, mainly in arable and horticultural cropping systems in countries such as Australia and America. Here in New Zealand, where it has mostly been used for horticulture and viticulture, and in few large scale irrigated pastoral or cropping farming operations, its impact on pastoral farming is not yet known.

To fill this information gap, the Sustainable Farming Fund Fertigation project started in 2019 to look at N application through fertigation and its potential to help New Zealand pastoral farmers reduce their environmental footprint while maintaining farm viability and sustainability. Ballance Key Accounts Nutrient Specialist for the upper South Island Raymond Williams is on the project team and says: "It's an exciting project, given the knowledge gap in using fertigation on pastoral farming in New Zealand, and in fact globally."

It is already known that fertigation can distribute N more uniformly than granular fertiliser application, especially at low application rates. Even with the best spreading applicator technology and compound fertiliser granules containing consistent amounts of nutrients, conditions during spreading, and granule size, weight and shape can still severely impact distribution uniformity (see page 10).

The project is investigating some of the other benefits fertigation could offer over conventional methods of solid N fertiliser application. By reducing N applications, fertigation may benefit the pasture clover content. When N applications are reduced, clovers face less competition and shading from ryegrass plants, which can lead to increased clover populations. In turn, more clover fixes more N, enabling further reduction of N inputs over time. However clover will still suffer if nutrients such as potassium, phosphorus and sulphur are deficient, as they typically need higher levels of these nutrients than ryegrass does, so not all nutrients inputs can be reduced.

Fertigation could allow farmers to apply N at the optimum time, when most needed by the pasture and when environmental risks are lowest. It allows smaller amounts of N to be applied more often, which may help to reduce losses and environmental impacts and, by matching N application to demand, improve the effectiveness to the pasture and profitability. This has significant implications for 'shoulder' season N management.

The project began with small plot trials at Lincoln University as well as on-farm monitoring at Pāmu's Waimakariri Dairy Unit. Pāmu Farm Innovation Specialist Tim Lissaman says: "Pāmu is striving to farm more efficiently with lower environmental impact. After very positive results in the first year of fertigation at Waimakariri Dairy, we are keen to quantify fertigation benefits through the project trials. We hope the trial will inform further investment in infrastructure at more of our farms and also help with learnings for the wider farming community."

Ballance Agri-Nutrients is collaborating with Irrigation NZ, the Ministry for Primary Industries, Pāmu Farms of New Zealand and others on the project.

This pivot irrigates and provides fertiliser for pasture through a fertigation system.

PHOTO: Irrigation NZ

Animal Effluent Plant Soil

A regenerative future?

Is regenerative agriculture the answer to the issues facing farmers?

Is regenerative agriculture a silver bullet that can improve soil health and biodiversity, and mitigate climate change, while still maintaining on-farm profits?

As a science-based organisation, Ballance Agri-Nutrients is interested in what regenerative agriculture can offer New Zealand farmers. Are its practices scientifically robust and relevant to New Zealand, and do they differ to 'business as usual'?

Originating in the USA and Australia, regenerative agriculture is still in its infancy, so has no clear, universal definition. It is best broadly understood by its goals, which we look at in more detail, asking how they relate to our context and what opportunities they may present.

Goal 1: Improve soil health

Regenerative farming aims to improve soil health by using compost and manures and reducing chemical fertiliser use.

This infers chemical fertilisers are bad for soil health, which is not backed by scientific research. Chemical fertilisers are just as effective as biological fertiliser at improving soil health, biological activity and organic matter. Research shows that nitrogen – whether from fertiliser, clover, or manures and compost – increases plant growth and production of dry matter, in turn resulting in more soil organic matter.

Where chemical fertilisers do differ to biological fertilisers is their superior cost-effectiveness and practicality. Relying solely on compost and manure for nutrients poses an array of major logistical challenges, such as the massive increase in stock and land use that would be needed to produce the required amount of manure.

New Zealand pastoral farmers already aim to maximise clover and its fixation of nitrogen, and to some degree, already use compost (plant residues) and manure (dung and urine) to improve soil health. Crop residues (see page 4), for example, are recognised as having an economic value for the nutrients they can provide.

Regenerative agriculture reinforces what we already know – soil health is important, so we need to continue investigating realistic and practical means of maintaining or improving it.

Goal 2: Sequester carbon

Regenerative farming aims to mitigate climate change by sequestering carbon into the soil as organic matter.

This approach is not currently backed by robust science and further research is needed to prove it can work in New Zealand. Evidence of regenerative agricultural practices increasing soil organic carbon (SOC) comes largely from the USA and outback Australia, both with very different farming systems to ours, and typically with low soil fertility and biological activity.

As our SOC levels are already relatively high, the same effect is not as readily seen here, despite pastoral farmers already using some of the regenerative agriculture practices promoted for achieving this goal, such as keeping ground in long term pasture, rotational grazing and cover crops.

Research in 1997 reported no net change in SOC, but more recent research has reported declines in SOC. The jury's still out as to why SOC levels may be declining in New Zealand, with further research currently underway. In the meantime, there is an opportunity for further research, with the New Zealand Pastoral Greenhouse Gas Consortium saying: "Despite a wealth of theories and ongoing research, there are not yet any robust general rules about how to reliably and sustainably increase soil carbon in New Zealand pasture soils."

Goal 3: Grow topsoil

Regenerative agriculture aims to grow topsoil by minimising soil disturbance and keeping the soil covered using practices such as no-till or minimum tillage, cover crops and rotational grazing. Ballance aims to create 'the best soil on earth,' and encourages the same practices employed by regenerative agriculture.

Ballance leads and/or supports a range of projects that are investigating soil conservation practices. These include the Sustainable Farming Fund projects Helicropping – protecting our soils (see Grow Spring 2019), which is finding the best tools to protect soil when cropping, and Catch crops to reduce N leaching (see Grow Autumn 2019), a practice which also stabilizes soil.

In New Zealand, rotational grazing is already practised, and our soils are relatively young, so soil organic matter levels are already very high. For us, growing pasture (perennial ryegrass and clover) using conventional farming methods is the most soil regenerative practice we can do.

As a company and country, we should continue to explore and adopt practical soil conservation practices.

"Regenerative agriculture reinforces what we already know – soil health is important, so we need to continue investigating realistic and practical means of maintaining or improving it."

Goal 4: Improve biodiversity

One way regenerative agriculture aims to improve biodiversity is by reducing nitrogen fertiliser use (by 100 kg/ha), which it claims can result in a sixteenfold increase in varieties found in pasture, while still maintaining productivity.

The scientific research behind this claim involved natural grassland with predominantly tropical grasses, very different to New Zealand pastures. The research also did not suggest that production could be maintained by reducing nitrogen fertiliser application, but instead that doing so over a 25 year period might result in a balance between biodiversity and productivity.

At a soil level in New Zealand, growing as much dry matter as possible feeds the worm and microbial population. Through their efforts to improve water quality or to sequester carbon, many farmers have been providing habitat and improving biodiversity by planting productive and unproductive areas, and restoring or creating wetlands.

Not encroaching on existing habitat by more efficient use of agricultural land already in production is vital for maintaining land with high biodiversity value.

Biodiversity varies across New Zealand, and is best addressed at a farm specific level. A reduction in applied nitrogen is unlikely to result in biodiversity gains. Instead, farmers should continue to work with councils and industry groups to identify the most effective and practical solutions to enhance biodiversity for their properties.

N for pre-tupping feed

Tactical nitrogen (N) use to provide feed before tupping can have a big impact on returns.

Good body condition for ewes before mating in autumn is important, and with a little help, pasture is the most cost-effective way to provide the feed required.

"The critical feeding period for increasing ewes to body condition score (BCS) 3-4 is typically when pasture cover is likely to be limited and after a long, dry summer, its content high in fibre and low in energy," says Ballance Science Extension Officer Josh Verhoek.

"But this can be overcome by using nitrogen tactically from late summer to early autumn to boost pasture. It's the cheapest way to provide good feed leading up to tupping, and can have a big impact on lambing returns."

Better body condition benefits

Increasing ewes' body condition for mating has a number of significant benefits, including increased conception rates, higher birth weights, increased chance of multiples, and increased lamb survival.

If ewes are on good leafy feed and gaining weight as the rams go out there will be an additional benefit of possibly 5-10 per cent in lamb drop. Ideally ewes should be rotated rapidly, going on to about 5-6 cm of pasture (2200 kg DM/ha) and not grazing below 3 cm (1500 kg DM/ha).

"All of the benefits from improving body condition lead to more lambs, and if well fed, heavier weights," says Josh. "Heavier lambs at birth are more likely to reach prime weights quicker, so there's more chance they'll be sold before Christmas when meat schedules are typically higher. Lambs sold before the period leading into and during mating also help reduce competition ewes face for feed."

Using N to improve body condition

Hill country is very responsive to N applications, as it has less clover content and low total N levels. In most summer-dry hill country conditions, a minimum response of 15 kg DM per kg N applied can be expected. If conditions, primarily soil temperature and moisture, are right greater responses are highly likely, reducing the cost of feed grown significantly. Factors such as aspect and altitude can also influence the level of response.

N should be applied to hill country at no more than a moderate rate – no more than 50 kg N/ha in a single application – and sensitive areas such as streams should be avoided. Timing of N should allow enough time to generate a valuable response before grazing off the pasture. "About six weeks is ideal and a good rule of thumb, but four weeks can suffice," says Josh.

Choosing the right N fertiliser for the job

Factors to consider include other nutrients required such as sulphur (as provided by PhaSedN) or phosphorus, as well as the need to reduce volatilisation, using a product such as SustaiN.

My Pasture Planner

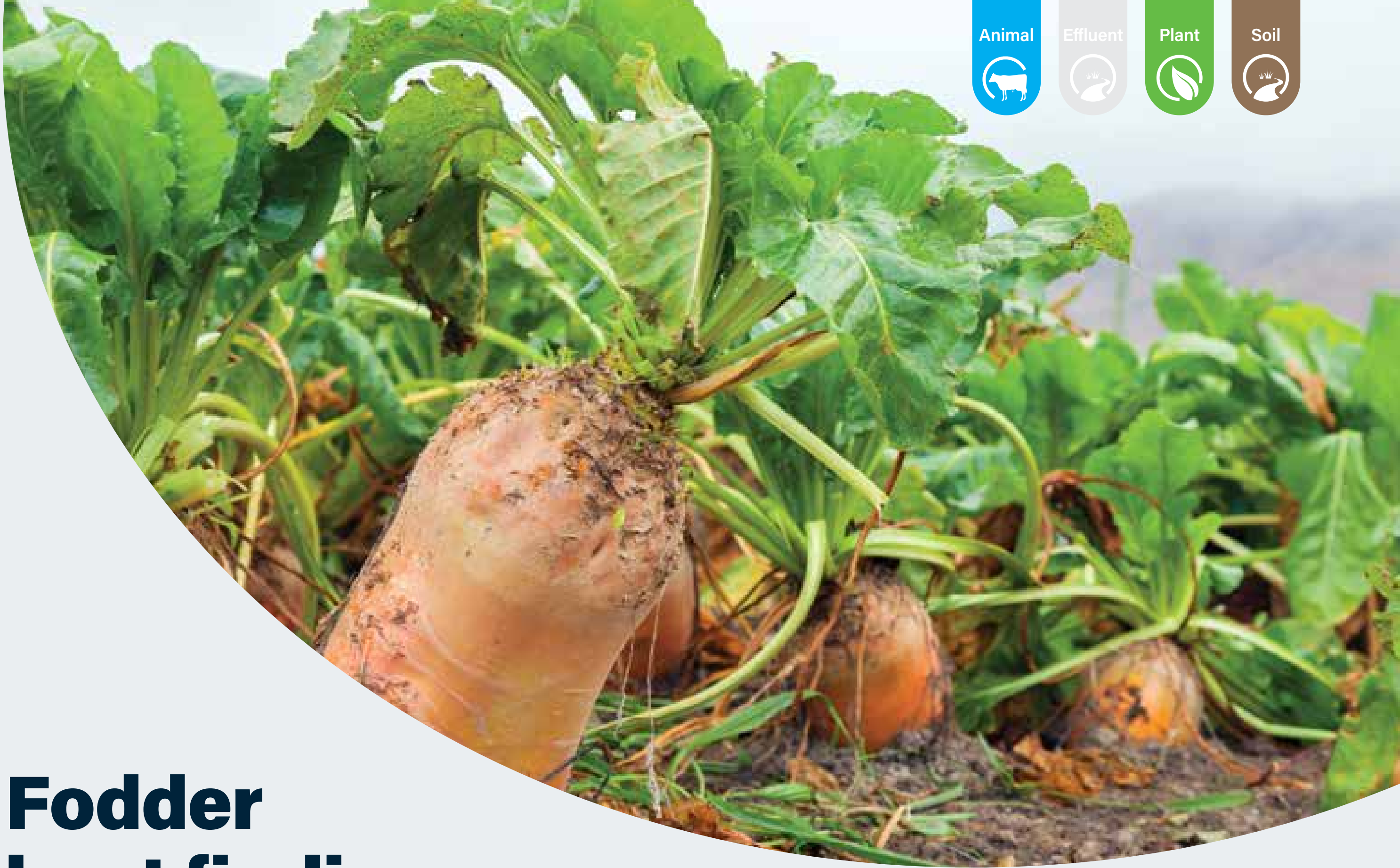
This decision support software tool uses soil total N test information to improve N use efficiency on pastoral farms. It can help improve feed budgeting and economical use of N fertiliser as a low cost supplementary feed. See ballance.co.nz/My-Pasture-Planner

Table 1 **Benefits of increasing body condition pre-tupping to BCS 3**

	Do nothing (15% ewes ≤ BCS 2.5)*	Increase condition (5% ewes ≤ BCS 2.5)	Gross margin difference ($/ha)
Scanning %	160%	171%	+ $42
Lamb survival	78.2%	80%	+ $36
Weaning weight	26.5 kg	27.5 kg	+ $50
Gross margin $/ha	$770	$898	+ $128

* Typical percentage of ewes below ≤BCS 2.5.

Source: Trevor Cook, 2017



Fodder beet findings

Farmers can benefit from results of local research into fodder beet.

A recently completed three-year Sustainable Farming Fund project, led by Plant & Food Research and involving Ballance Agri-Nutrients, has shed light on the role of fertiliser management and crop establishment in optimising fodder beet yields.

The impacts of different rates and timings of nitrogen (N), potassium (K) and boron (B) applications were trialled at sites (including dairying, arable cropping and sheep and beef, in both irrigated and rain-fed conditions) across five key fodder beet production regions.

According to results, as fodder beet is a luxury feeder of N, N should be applied prudently. While crop N uptake and N concentration increased as result of increased N application rates, yield did not consistently increase. In year 1 of the study, yield response to N fertiliser varied across sites, with responses from 100 to 200 kg/ha of added N. Three sites had no response to added N. Similar results were observed in year 2, with peak N response up to 100 kg/ha of added N.

On average adding up to 100 kg N/ha optimised yield. Applying N at sowing and again at canopy closure assists to optimise yields, but no notable increase in yield from a third application was apparent. Response to N fertiliser depended on the level of available N in the soil, demonstrating the benefit of soil testing to avoid unnecessary N applications and expenditure.

Fodder beet took up large amounts of K, depending on the soil K level and the amount applied. Across the trial sites K application rate and timing did not affect yields, even at low K soil test levels (as low as QTK of 3), suggesting fodder beet response to added K is minimal. However, as it is important to consider fodder beet in the full crop/pasture rotation, soil testing is still suggested. If QTK is less than 3, adding up to 100 kg K/ha is sufficient to supply K for the fodder beet and subsequent crops/pasture. If QTK is 3-5, 50 kg K/ha is sufficient and for QTK greater than 5, K can be withheld as its addition will not affect yield.

The essential micronutrient B did not affect yield in the trial, however B soil test levels across the sites were not in deficiency ranges. Due to its importance for crop health, B should still be supplied adequately at sowing, as deficiencies can result in brown heart rot. Unlike other nutrient deficiencies, B deficiency cannot be remediated after the crop has established.

The trial highlighted the value of soil tests such as Ballance's fodder beet profile test. Taken before sowing to a depth of 150 mm, the test identifies available N, K and B, as well as phosphorus, pH, sulphur, sodium and magnesium levels (see Table 1 for target levels). Testing well before the crop is sown can give you time to adjust soil test levels, especially soil pH.

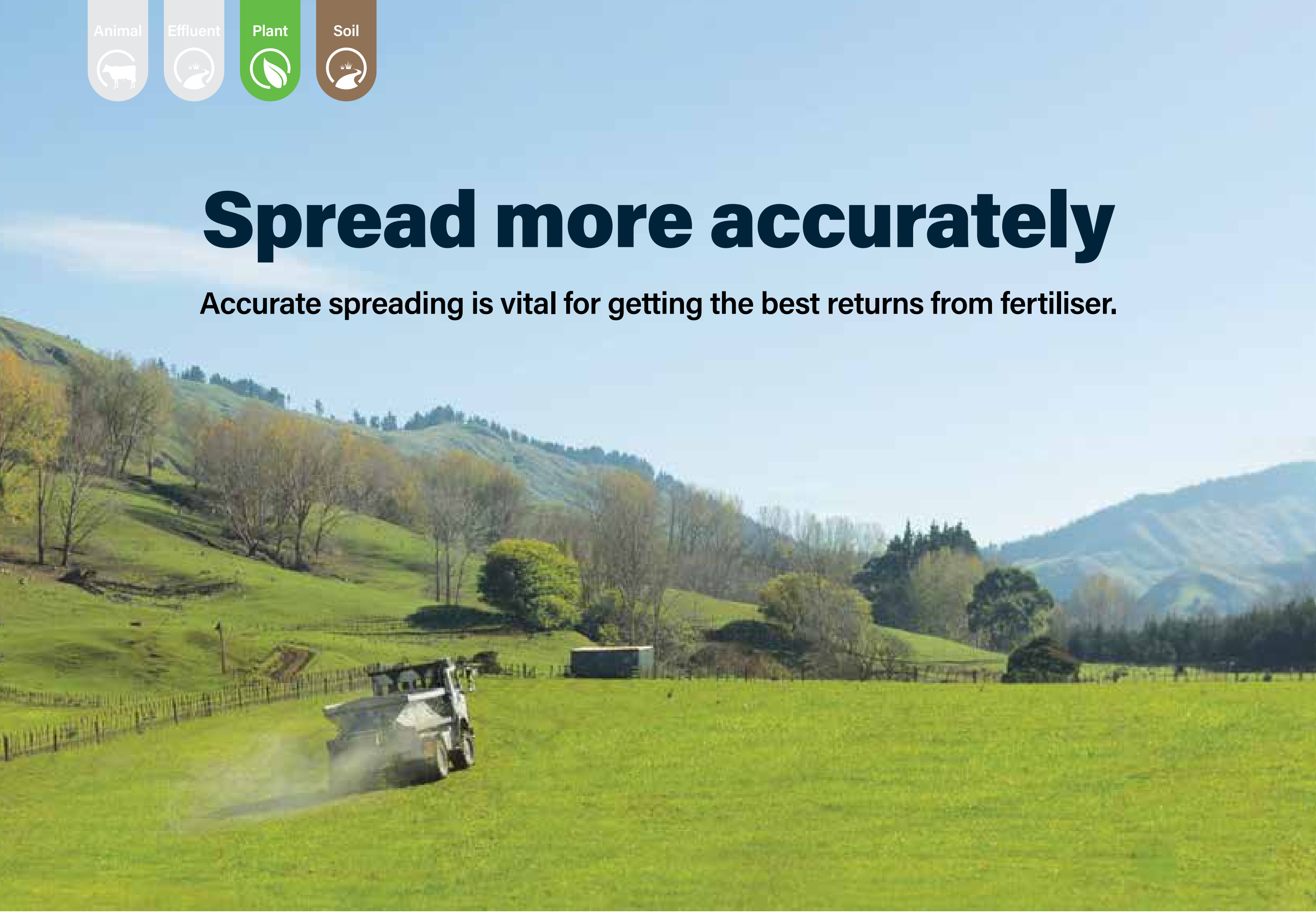
If nutrient deficiencies are suspected once the crop has established, a herbage test at canopy closure will confirm if further nutrient addition is required.

Test	Target level
pH	6.0-6.2
Phosphorus (Olsen P)	≥15
Potassium (QTK)	≥3
Sulphur (sulphate S)	Not determined
Magnesium (QTMg)	≥8
Sodium (QTNa)	≥4
Boron (mg/kg)	1.1

Table 1 **Target soil test results for growing fodder beet**

Spread more accurately

Accurate spreading is vital for getting the best returns from fertiliser.



"Fertiliser can be a significant investment for farmers, and if you've invested in a quality product you want to make sure you use it well," says Ballance Nutrient Dynamics Specialist Jim Risk.

"Fertilisers such as Superten and SustaiN supply plant nutrients in a very concentrated form, so to be most effective they must be spread evenly. Uneven spreading can result in striping in crops and pasture, reduced yields and variation in soil fertility."

Spreading accuracy depends on product quality, physical and chemical compatibility (if blending), and spreader calibration.

Product quality

The product quality of a fertiliser impacts how far it can be thrown (known as spread width or bout width). Product quality refers to a fertiliser's:

- mean particle size (represented by the size guide number - SGN)
- range of particle sizes (represented by the uniformity index - UI)
- bulk density (BD).

In New Zealand, most fertilisers range from SGN 95-475 (a higher value indicating a larger mean particle size) and UI 5-68 (a higher value indicating a more uniform range of particle sizes).

Heavier, larger granules (with a higher SGN) will throw further than lighter, smaller granules. Spread width also depends on spreader equipment and how it is calibrated to the product being spread. "Ideally spreaders should be calibrated for specific products, so using the information on the fertiliser's physical characteristics ensures the spreader is set up correctly for different products," says Jim.

The UI of the products being spread also impact the quality of the spread achieved. When a high proportion of the granules are within a narrow particle size range (have a higher UI) the spread will be more consistent than if the particle size varies largely.

Physical compatibility

If blending two fertiliser products, their compatibility affects their flow through a spreader, impacting the quality of the spreading and their performance once applied.

Products with a similar SGN and UI (a difference of less than 20) blend and spread better (see Table 1). "Blends will segregate, resulting in uneven spreading, if a low SGN product is mixed with a high SGN one, as smaller particles fall to bottom of spreader. Segregation and uneven spreading also occurs when a low UI product is mixed with a high UI product, as the small, medium and large particles separate out," says Jim.

Difference between SGN or UI values	Physical compatibility
Under 20	Compatible
20-40	Moderately compatible (some segregation likely)
Over 40	Incompatible

Table 1 **The effect of SGN and UI on physical compatibility**

Chemical compatibility

Mixing chemically incompatible fertilisers is most likely to pose a health and safety risk, but it can also impact spreading.

A product's tendency to attract moisture, which is usually associated with nitrogen-based fertilisers, is the most common chemical compatibility issue that can impact spreading.

"For example, avoid blending nitrogen products with superphosphate-based fertilisers, as the mix can turn into a wet sludge," says Jim. If used, the sludge clogs spinners in groundspread machines, and in top-dressing planes can get stuck in the hoppers and prevent the fertiliser from being discharged, as well as creating a health and safety risk. Even if a blend is only slightly affected by moisture issues, uneven spreading and striping can still occur.

Moisture from rain or humidity causes fertiliser to deteriorate and storing fertiliser products in cool dry conditions minimises the chance of any product degradation.

Spreader calibration and testing

Like any machinery, regularly maintaining, calibrating and testing a spreader are important for ensuring its accuracy.

On a well-calibrated spreader, the disc speed and drop point of the fertiliser onto the disc is right for the product or mix being spread (generally based on its bulk density), and the actual and set application rates are similar.

The coefficient of variation (CV) refers to how much the actual distribution of the fertiliser varies from the desired spread rate, as set on the spreader. A lower CV means a more even spread. "CV properties depend on the spreader's design; a poorly designed spreader can only operate effectively at lower spread widths. Testing a spreader with different fertiliser types determines the best spread width."

Spread testing helps to calibrate a spreader and ensure the settings are correct for a particular product or mix, and can also help determine how far a product or mix can be thrown. "Spreaders usually have their own settings and ability to throw products to specific spread widths," says Jim.

Spread testing determines the CV at certain spread widths. For nitrogen the maximum CV is 15 per cent, whereas for phosphorus it is 25 per cent. When looking at spread testing graphs you determine the maximum spread width for that product from that spreader by looking at where the line intercepts the CV.

"Spread testing has shown that by using uniform products (well granulated with even particle size), spreaders can optimise spread widths, resulting in more even application and fewer passes. Spread testing can demonstrate product quality, but it is ultimately the spreader calibration and settings that determine maximum spread width," says Jim.

FOR MORE INFORMATION

For more information on Ballance products and their compatibility, contact the Ballance Customer Service team on 0800 222 090.

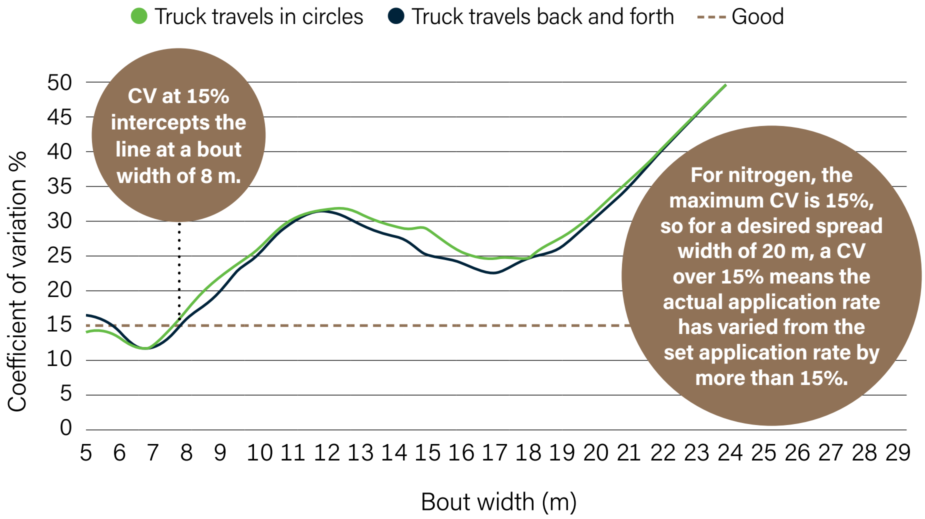


Figure 1 **Example spread testing graph, showing a poor spread pattern. On this spreader with the current settings a nitrogen product (CV 15%) will spread to 8 m.**

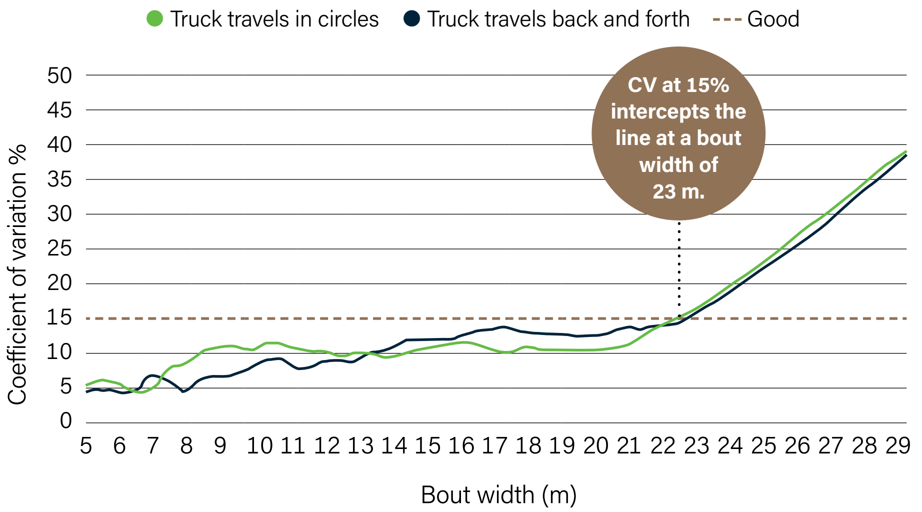


Figure 2 **Example of a spread testing graph showing a good spread pattern. On this spreader with the current settings a nitrogen product (CV 15%) will spread to 23 m.**

S products: side-by-side

What's the difference between sulphur products, and what are their best uses?

"PhaSedN, PhaSedN Quick Start and Nrich SOA are related fertiliser products, all with sulphur (S) and nitrogen (N), but they're best used at slightly different times of the year for different purposes," says Ballance Science Extension Officer Josh Verhoek.

The key difference in these products is the S they contain – sulphate S (plant available and can leach), elemental S (not available to plants and does not leach), or both. We look at them in more detail below to better understand them.

	PhaSedN	PhaSedN Quick Start	Nrich SOA
What's in it	N (SustaiN), S, calcium (small amount, as lime)		N, S
S content (and type)	**28.5%** (100% elemental S)	**17%** (32% sulphate S, 68% elemental S)	**22%** (100% sulphate S)
N content (and type)	**25.3%** (100% urea)	**31.3%** (85% urea, 15% ammonium)	**19.5%** (100% ammonium)
When best used	autumn (March to May) and early winter in areas with milder conditions	late autumn to end of winter (May to August) to cover winter and early spring S and N needs*	spring (August to November) to cover high S demand and typically low supply from soil
What it does	N gives pasture an immediate boost	Sulphate S and N give pasture an immediate boost	
	Fine elemental S particles sit in the soil over winter and are increasingly converted to sulphate S as soil temperatures rise, supporting early spring growth		-
	SustaiN helps minimise N volatilisation losses		-
Best for	▪ low S soils ▪ high rainfall areas at risk of S leaching over winter ▪ areas high in phosphate but low in S and N ▪ effluent blocks requiring tactical S and N		▪ strategic N application to pastures in early spring ▪ where soil S supply is low enough to limit pasture response to N applications
Dairy farm uses	▪ where phosphate isn't needed, but S availability needs to be increased/ maintained ▪ on effluent blocks with a tactical requirement for S and N, but no need for potassium		▪ in place of straight N products in late winter/ early spring when pasture demand is high, ▪ on effluent blocks that haven't had effluent since autumn
Sheep and beef farm uses	▪ on hill country where cost of applying phosphate is uneconomic, but applying S and N (which are constraining pasture production) is economic ▪ on hill country with low organic S levels (< 8) and with soils with low-medium anion storage capacity (ASC < 60)		▪ on hill country as a pre-lamb N application, swap straight N for N and S for further growth in spring ▪ include with/instead of (if budget constraints) phosphate application
	-	on finishing areas on fertile sheep and beef farms to boost pasture growth, helping to provide sufficient quality feed to rapidly finish stock	

*assuming suitable conditions (mild, no heavy rainfall, not waterlogged, actively growing pasture)

Grazing winter crops

Simple strategies could better protect the soil during winter forage crop grazing.

Winter forage crops are essential to get grazing animals through the winter, and allocating stored feed is important to ensure maintenance or growth targets are achieved. But managing stock grazing on these crops involves juggling the need to optimise crop utilisation while keeping animals well fed and looking after the soil.

"A lot of information's already available on planning and managing grazing stock for best outcomes for the animal and for the soil. But despite this, farmers continue to get variable results depending on the severity or kindness of the winter weather, and receive criticism for animal welfare outcomes and soil damage from grazing winter forage crops. So the following ideas may be food for thought," says Ballance Forage Specialist Murray Lane.

Leave it uncultivated

"Disruption of soil structure from cultivation leads to a greater risk of soil pugging during forage crop grazing, as well as affecting grass grub predators, often leading to poor future pasture persistence. So leaving the soil undisturbed is a big positive," says Murray.

"No-tillage techniques have been successfully used to grow crops for nearly 40 years, so if you're still cultivating, maybe it's time to change. No-till drills handle the soil as it is; it's only the more primitive drills that require tillage to create a seed bed.

"Leaving the soil structure intact is the first line of defence to protect the soil, the next being having a low growing plant and roots (such as plantain) in the swede or fodder beet crop, to provide greater resistance to pugging."

Grow more

"There's always wastage when forage crops are grazed. The current recommendation to minimise wastage is to graze stock on a long grazing front behind an electric wire, moving the fence daily. This approach aims to efficiently allocate the crop so it lasts right through the winter period, until spring grass growth takes over.

"The reality is that yield varies across the paddock. That, combined with not knowing the length and severity of winter conditions, means that allocating the crop is a moving target. While the current recommendation focuses on optimising crop consumption, often leading to greater soil damage, it may be that minimising soil damage will become the major focus. Potentially growing more feed than planned, without disturbing soil structure and growing (for example) plantain as a companion crop, not only means there'll be enough to meet the moving target, it may also help to minimise soil damage."

Block grazing vs strip grazing

"A number of farmers I've been working with, being pushed for time, have moved away from strip grazing to block grazing. Recognising that the efficiency of utilisation will decline, they deliberately grow more crop than essential, and are prepared to have some wastage. The concept is to, after transition, offer four days grazing, and move them at three, returning at a later date to pick up the extra day, along with regrowth from the companion crop of plantain, essentially reducing pressure on soil.

"It may be that we need to rethink not only how we establish the crops, prioritising retention of soil structure plus a suitable companion crop, but also how we graze the crops, prioritising minimising soil damage," says Murray.

FOR MORE INFORMATION

dairynz.co.nz/feed/crops/wintering-cows-on-crops/

beeflambnz.com/wintergrazing

Plantain sown with swedes. Good plantain recovery after appropriate grazing (left), compared to plantain recovery damaged by overgrazing (right).

Valuable but variable

Testing soil from the same place, and in similar conditions each year means better results.

Soil testing provides valuable information to help determine what nutrients are required, but variability can impact the reliability and accuracy of results.

"Soil testing is about optimising production and profits. Knowing the level of nutrients in the soil means you can apply the fertiliser needed to optimise pasture or crop growth," says Ballance Science Extension Officer Aimee Dawson.

Even though soil testing is important, trials have indicated that there is variability in soil test results (see Table 1). "So an Olsen P result of 20 could mean, with a potential variability of 20 per cent as seen in the trials, that the soil's Olsen P levels could be anywhere between 16 and 24," she says. "This doesn't mean that soil tests aren't to be trusted, but that you should ensure that you look at results over multiple years to determine trends in soil fertility."

But what causes this variability? Laboratory environments and methods are strictly controlled, so are only likely to play a small part. "The conditions under which a soil test sample's taken and the exact location it's taken from are far more likely to be behind the variability. Soil's a biological system, so it's highly variable from location to location. Furthermore, soil conditions such as temperature and moisture levels are known to affect soil test results."

Timing (and conditions) are everything

"Taking samples at the same time of year as previous samples, ideally in similar conditions and not in extreme dry or wet, minimises variability in soil test results due to seasonal and climatic factors, such as moisture and temperature," says Aimee (see Figure 1).

"Recent application of fertiliser and grazing by stock can also affect soil test results. Ensuring you don't soil test within three months of fertiliser application and avoid dung and urine patches will reduce test variability."

If you test during very dry or wet conditions there are a few 'watchouts' for nutrient levels. Compared to other times of the year, during drought or summer dry soil conditions sulphate sulphur and potassium soil test results can be much higher, and Olsen P slightly elevated. In dry conditions, microbial activity is much higher and plant available nutrients such as sulphate sulphur and phosphorus are released into the soil at a rate faster than plants can use, elevating levels in the soil. Also during this time soil moisture tends to be low so leaching and plant uptake of nitrate nitrogen reduces, which can cause it to accumulate in the soil and push up mineral nitrogen levels.

Soil test	Variability (%)
pH	2 - 5
Calcium	10 - 15
Potassium	20 - 30
Magnesium	10 - 15
Olsen P	15 - 20
Sulphate sulphur	20 - 40

Table 1 **Typical variability in laboratory soil tests**[1]

Temperature can affect soil pH, with pH dropping by up to 0.2 units in warm soil conditions due to microbes releasing organic acid and plant roots growing.

Wet winter conditions can also affect test results, with pH increasing slightly due to reduced microbial activity and plant growth. In soils that leach easily, significant rain events can lower sulphate sulphur. In soils with low cation exchange capacity such as coarse or sandy soils, potassium can also leach, reducing its soil test value. Phosphorus, however, is not affected as it does not readily leach in most soils.

In the spring and autumn flush, rapid nutrient uptake by plants can cause phosphorus, potassium and sulphate sulphur levels to be temporarily depleted.

"The best timing for testing is spring or autumn, when soil's not too wet or dry. Also this is when pasture and crops are actively growing so results will better reflect the nutrient levels available to growing plants."

Location, location, location

Setting up soil testing transects (lines along which samples are collected) and taking samples from the same transects in subsequent years also helps to tackle variability in test results.

"When you initially set up the transects, make sure you mark them on a map or with painted pegs, or take GPS coordinates so you can use them again," says Aimee.

"One-off soil tests can be useful but they can also be misleading; the full value comes from soil testing over several years, so you can identify trends in the soil's nutrient status over time, and then adjust fertiliser inputs accordingly."

FOR MORE INFORMATION

See Hill Laboratories Technical Notes *Seasonal and environmental effects on soil tests and Soil test variability* or talk to your Ballance Nutrient Specialist.

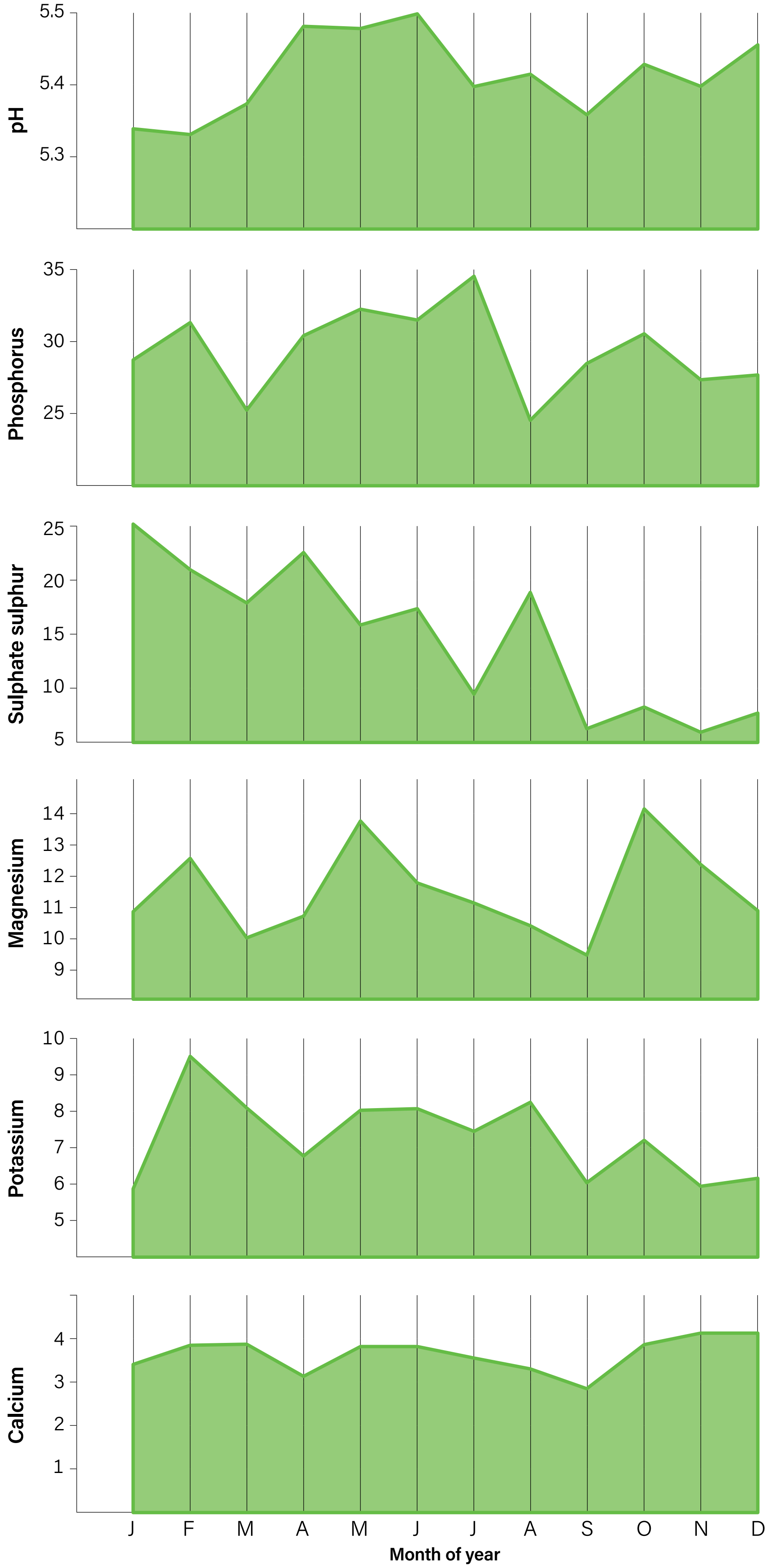


Figure 1 **Soil test variability by month in a single paddock of a high producing dairy farm from a MAF study on a Taupō soil[2]**

[1] Edmeades, DC, Cornforth IS, Wheeler DM 1985. NZ Fertiliser Journal.

[2] Edmeades DC, Cornforth IS, Wheeler DM. Occasional article: Getting maximum benefit from soil testing. Ruakura Soil & Plant Research Station, Hamilton

Recovering from drought

Nitrogen (N) helps pasture bounce back after a drought.

Getting pasture back on track after drought is crucial for animal production and profit, as well as ongoing pasture persistence.

Drought causes many spring tillers to die or become stressed, and summer tillers do not emerge. "Supporting autumn tillering is important to prevent pastures thinning out over winter and becoming vulnerable to weed invasion. This could reduce production and start a cycle of decline," says Ballance Science Extension Officer Joshua Verhoek.

"Drought doesn't affect all pastures equally, so they'll need to be treated differently when the drought breaks." Pastures dominated by productive species, with plants still alive or the crown of the plant at ground level, recover well with support. Those with weeds and large bare patches need regrassing.

"While it's traditionally been advised to wait until pasture begins to recover from drought before applying N fertiliser, more recent research suggests that N applied after the first significant rains produces a similar pasture response to deferring it until further rain has fallen," says Josh.

The research, commissioned by Ballance and independently performed and reported on, was on drought-affected land in the Bay of Plenty and Hawke's Bay, and indicated that any N not immediately used is not lost, and produces a pasture response when more rain arrives.

"So the current recommendation is to apply N fertiliser to any live pasture as soon as the first drought-breaking rains fall, so you're not missing any opportunity for growth in this critical period." SustaiN, which does not need 5 to 10 mm of rain within eight hours of application to reduce volatilisation losses, is an ideal N option for such conditions, or PhasedN, containing SustaiN and sulphur.

Drought followed by rain (or moist overcast days) is when the risk of nitrate poisoning is greatest, but certain practices can reduce the risk. "Avoid grazing within three weeks of applying N, or minimise intake one to two weeks after drought-breaking rain. If stock must be put on high risk pastures, the risks of nitrate poisoning can be reduced by limiting access overnight and in the morning, when nitrate levels are highest, feeding well on low nitrate feeds such as straw hay or silage before grazing, and stocking lightly to avoid hard grazing, as the lower parts of stems have the highest nitrate levels. These measures will protect recovering pastures as well as stock."

"While applying N to dry ground is not ideal, if it's your only opportunity, it will not leach but a small percentage could still be lost through volatilisation, and using SustaiN minimises this loss."

"Regrassing will be needed for pasture that's beyond recovery. Assuming your base fertility is fine, you'll need DAP or a similar starter product to drill with seed, followed by post-emergence N, provided growing conditions are good."

Sustainability snaphot

We talk to Ballance National Farm Sustainability Services Manager Claire Bekhuis about her team's work.

What has the Farm Sustainability Services team been working on recently?

There's been a flurry of interest in our new MitAgator services (see page 19) which started in 2019. We've produced risk maps for a number of farmers, bringing their critical source areas for nitrogen, phosphorus, sediment and *E. coli* to life and deepening their understanding of their farming systems, ultimately supporting better decision making. The team have also been using MitAgator to run mitigation scenarios and complete farm environment plans. Helping land hold on to nutrients is vital for keeping it healthy and productive for the long haul, and MitAgator removes the guesswork and gives sound insights into a farm's strengths and weaknesses, identifying which soil is well equipped to do the job, and how other areas can be helped to perform better.

The team have also been working alongside farmers and growers to support them to farm within limits while maintaining profitability. We provide sound advice and use expert tools to inform decision making. We're expert users of tools such as OverseerFM and MitAgator, and come with strong farm systems knowledge and a practical attitude to farming within limits.

What does your team do to ensure farmers get the best possible advice?

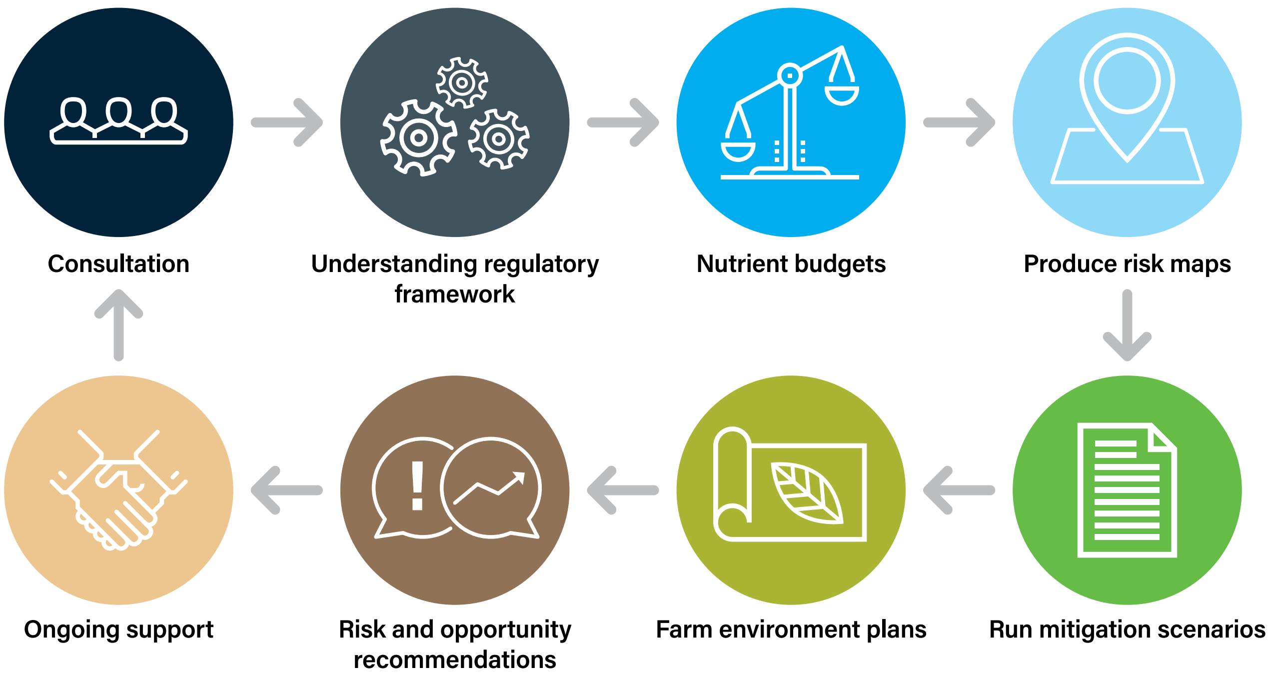
We collaborate across a wide range of industries, working with stakeholders such as milk companies, industry bodies and working groups, regional councils, consultants, real estate agents, irrigation schemes, catchment groups and banks throughout New Zealand, so we can provide the best advice to farmers in the regions.

I'm exceptionally proud of the team's passion and drive that have led them to be heavily involved in the Ballance Farm Environment Awards judging process, and their wide range of voluntary work to support good management practices within the industry.

With a continuously changing policy environment, the team are focused on being ahead of the change, upskilling with the latest science to ensure they can remove a lot of the stress from farmers in this space and support them to farm into the future. Some of the team have completed the latest Massey GHG course to support farmers with queries on the Zero Carbon Bill.

How many people are in the Farm Sustainability team and where are they based?

The team's nationally based, with 18 staff. In the last four years we've grown to meet demand from the regions, and now have a presence in Otago, Canterbury, Hawke's Bay/Manawatu, Bay of Plenty and Waikato. We plan to extend our team into Southland to support our shareholders with the Land and Water plan.



FOR MORE INFORMATION

Contact the Ballance Farm Sustainability Services team to discuss how they can help support your farming business on 0800 222 090 or farm.sustainability@ballance.co.nz

Farm Sustainability Services

A vehicle for action

Farm environment plans are a useful tool for making moves in the right direction on farm.

Farm environment plans are good business practice and a way of demonstrating and guiding increasing sustainability on farm.

Farm plans could also become compulsory across New Zealand as part of the Government's proposed freshwater management reforms.

"In some parts of the country, farms meeting certain criteria (for example, over a set size) are already required by regulation to have a farm plan, or may need to do so in the near future," says Ballance Nutrient Dynamics Specialist Jim Risk.

"The beauty of farm plans is their recognition of the uniqueness of each farming system and farm landscape, giving farmers the freedom to implement management practices and mitigations that best suit their farm. They also identify key actions already in place to address risks, such as riparian management, and prioritise future actions."

"A farm plan's purpose will be guided by issues within the farm and as well as any catchment-wide issues, such as sediment management. So while they're specific to each property, all farms within a catchment can address a common risk in their farm environment plans," says Jim.

Creating a farm plan involves an individualised risk assessment followed by the development of an action plan to reduce the risk. "It's possible to develop your own farm plan or you can use a certified farm planner, but in some places if you make your own plan it must be signed off by a certified planner."

"MitAgator (see page 19) is an excellent first step in getting your farm plan underway," says Jim. The risks and mitigations identified by MitAgator can be used to produce a list of prioritised, time bound actions, displayed spatially on a map of the farm (see Figure 1).

"A farm plan's a living document that can be reviewed annually to see what's been achieved, what needs to be done in the future and if anything's changed that may impact future planning. The plan can be added to and changed over time as actions are implemented or new risks and challenges emerge. They become a vehicle to show environmental improvements over time, and can be provided to milk or meat companies you supply, as well as environmental regulators," he says.

FOR MORE INFORMATION

- **Find out how the Ballance Farm Sustainability Services team can help you to create a farm environment plan on 0800 222 090 or farm.sustainability@ballance.co.nz**
- **See page 23 for Ballance's submission on the proposed freshwater management reforms.**

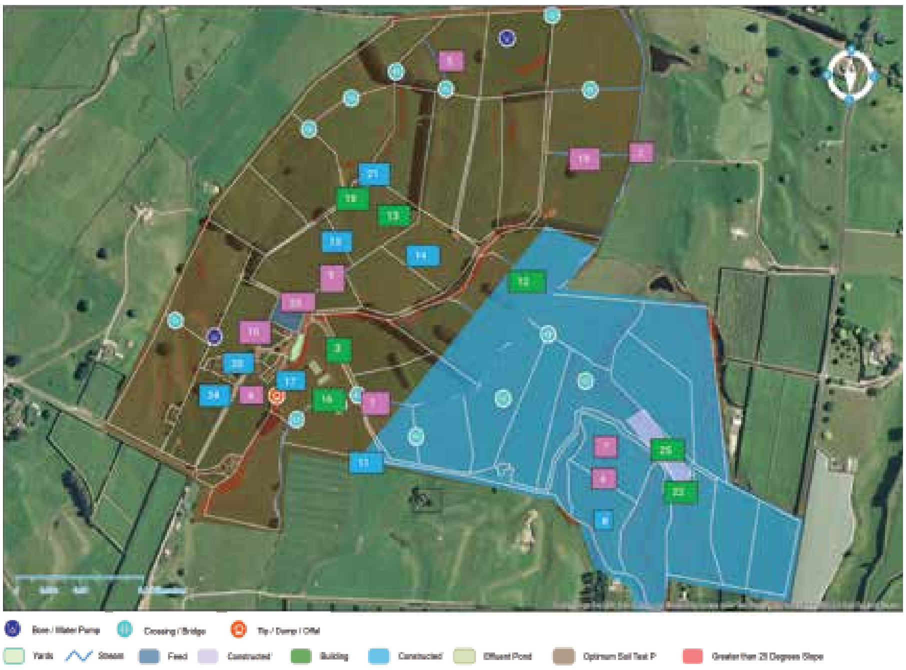


Figure 1 **MitAgator action map for Why-One Farms. Actions are numbered and their colour indicates the level of risk being addressed (pink=high risk, green=medium risk, blue=low risk).**

A farm environment plan reflects the environmental risks and opportunities a farm faces and sets out how soil, water and nutrients will be sustainably managed. They can also be multi-purpose, integrating other areas such as biodiversity, biosecurity, winter grazing, waste and greenhouse gases. They always include:

- **Risks on farm** – current and potential losses of the four key contaminants to water (nitrogen, phosphorus, sediment and *E. coli*)
- **Actions** – current mitigations and prioritised planned mitigations to reduce the risks
- **Timelines** – when good management practices and mitigations will be implemented

MitAgator at work

A powerful new tool has helped a Mackenzie basin farming couple choose the best mitigations for contaminant losses.

Richard and Annabelle Subtil have benefited from using Ballance's MitAgator service on their 12,000 ha high country sheep and beef farm, Omarama Station.

"We wanted to learn as much as possible about the outcomes on our property so that we can target the areas where we can make the biggest difference," says Richard. This led them to Ballance's MitAgator service, a further step on their journey towards a more sustainable and profitable farming operation.

MitAgator, cutting-edge software, spatially identifies critical source areas of nitrogen (N), phosphorus (P), sediment and *E. coli* losses on farm and then finds the best mitigation options to reduce losses.

The Subtils teamed up with Ballance Farm Sustainability Services Senior Specialist Julie Lambie and Nutrient Specialist Kerry Galvin, and used MitAgator to produce risk maps, identifying critical source areas for N, P and sediment losses on the farm, showing the relative risk of loss within the property and prioritising areas for mitigations.

The couple already had a nutrient budget, showing N and P loss and movement, but it was not easy to relate this information spatially to the property. Identifying the less obvious areas of high risk for contaminant loss, such as N leaching or how P loss varies across the property was also a challenge.

MitAgator's ability to visually and spatially display the critical source areas for N loss (see Figure 1) allowed the nutrient loss to be more easily relatable to the property. Showing the location of loss helped with understanding the relativity and quantity of loss, as well as the background drivers of loss, such as soils vulnerable to leaching. This led to development of a winter management plan, involving strategic use of crops to reduce N losses.

MitAgator's identification of the critical source areas for P loss (see Figure 2) has led to strategic application of P fertiliser. This involves reviewing Olsen P tests on high risk areas where higher P loss is more likely if soil test levels are above optimum, as well as working with Ballance Nutrient Specialist Kerry on maintaining a sustainable fertiliser plan and soil testing regime.

A sediment risk map (not shown here) identified high risk areas, supporting thinking on how to manage such areas to further reduce losses.

"We now have a much better understanding of the interaction between the nutrients and the different soil types. It's great to be able to see it all visually. It can surprise you, or confirm your thinking," says Richard.

The Subtils are continuing to work with Julie and Kerry to utilise the full richness of their risk maps by testing mitigations. MitAgator can test the outcome achieved by different combinations of mitigation options, as well as provide mitigation options to reach a set target, such as reducing P loss to meet a target.

FOR MORE INFORMATION

Visit ballance.co.nz/mitAgator. To find out more about the MitAgator service phone 0800 222 080 or email farm.sustainability@ballance.co.nz.

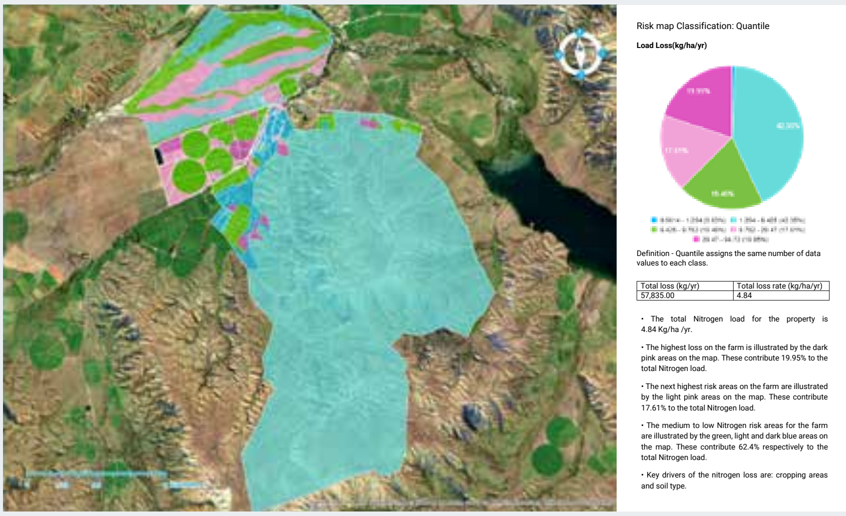


Figure 1
MitAgator nitrogen risk map for Omarama Station.

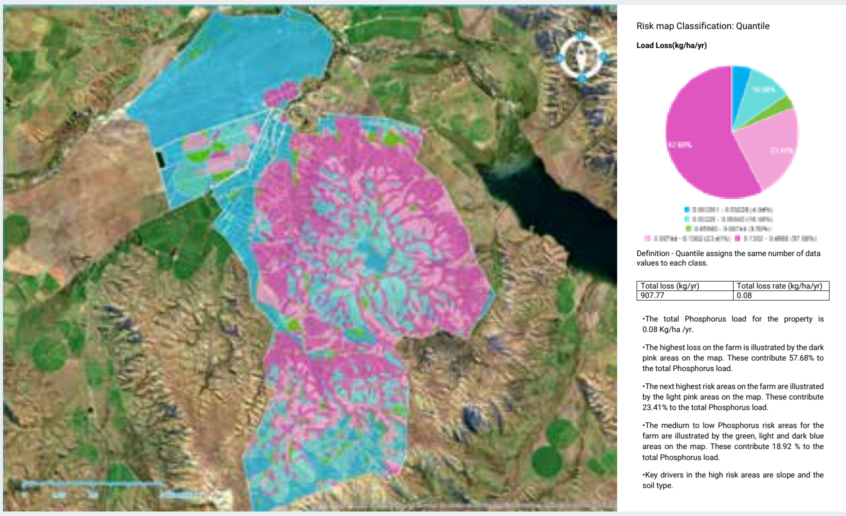


Figure 2
MitAgator phosphorus risk map for Omarama Station.

Mo gets its mojo back

Molybdenum (Mo) offers huge potential to improve production.

After animal health issues arose from overapplication of Mo in the 1950s, this cost-effective micronutrient fell a little out of favour, but nowadays it can be used with confidence.

"Current recommendations for applying Mo are the result of many years of trials (and some error)," says Ballance Nutrient Dynamics Specialist Jim Risk.

"When Mo deficiencies were first identified in New Zealand, the recommended rate was chosen somewhat arbitrarily, before rate trials were carried out. But the frequency of application was the main issue, resulting in high levels of Mo affecting copper absorption in stock," says Ballance Nutrient Dynamics Specialist Jim Risk.

"So understandably there was some uncertainty about using it. But research has long since confirmed the recommendations. Applying Mo to deficient pasture at the right rate and frequency is an incredibly cost-effective way of significantly improving production. It improves nitrogen (N) fixation efficiency and N cycling, driving clover and pasture growth."

Identifying and overcoming Mo deficiency

To determine if Mo levels are adequate, the sampling strategy and type of analysis depend on the problem, but clover only herbage analysis, not soil tests, should be used.

When both Mo and N are deficient in pasture (below 0.1 ppm and 4.5 per cent respectively), Mo deficiencies can be overcome by applying NutriMax molybdenum (1%) at 2 kg/ha (20 g Mo/ha) every four to five years. To check the application has raised Mo levels adequately, resample the same paddocks the following late summer or early autumn. Testing should continue every one to two years.

Mo deficiencies can be prevented in soils vulnerable to such deficiencies with maintenance applications of Mo with fertiliser, using NutriMax molybdenum (1%) at 2 kg/ha (20 g Mo/ha). If new pasture is being established, or existing pasture oversown, seed can be coated with Mo before being sown.

"Copper deficiency issues in stock are easily avoided by good management via herbage testing, and by applying Mo at the right rate when needed," says Jim.

[1] Davies EB 1952. Proceedings of the New Zealand Grassland Association 14:182-191

[2] Scott RS 1963 New Zealand Journal of Agricultural Research 6:567-577

[3] Sherrell CG, Metherell AK 1986. Diagnosis and treatment of molybdenum deficiency in pastures. In: Proceedings of the New Zealand Grassland Association 47:203-209

[4] Morton JD, Morrison JD, 1997. Molybdenum requirements of pasture. In: Proceedings of the Fertiliser Research Conference

Table 1 **The benefit of applying Mo to responsive sites, with a statistically significant increase in pasture and clover production at all sites by year 2[4].**

Rate of sodium molybdate (g/ha)	Total pasture production (kg DM/ha)				Clover production (kg DM/ha)			
	Central Plateau	Wairarapa	Inland Otago	Eastern Southland	Central Plateau	Wairarapa	Inland Otago	Eastern Southland
Year 1								
0	6087	3696	3699	6812	859	560	383	705
150	6489	3980	4960	7647	961	630	1221	1058
Year 2								
0	11024	5330	6212	14444	1369	697	1136	2121
150	11719	6003	9658	16419	1748	938	3716	2928

FOR MORE INFORMATION

For herbage testing and advice on incorporating Mo into your fertiliser budget, talk to your Ballance Nutrient Specialist.

Evolution of Mo research

Early 1950s

Mo deficiency first identified in New Zealand[1]. Application rate of 140-175 g/ha sodium molybdate recommended.

1963

Scott[2] shows maximum response occurs below 175 g/ha, with response to sodium molybdate levelling off at 70 g/ha.

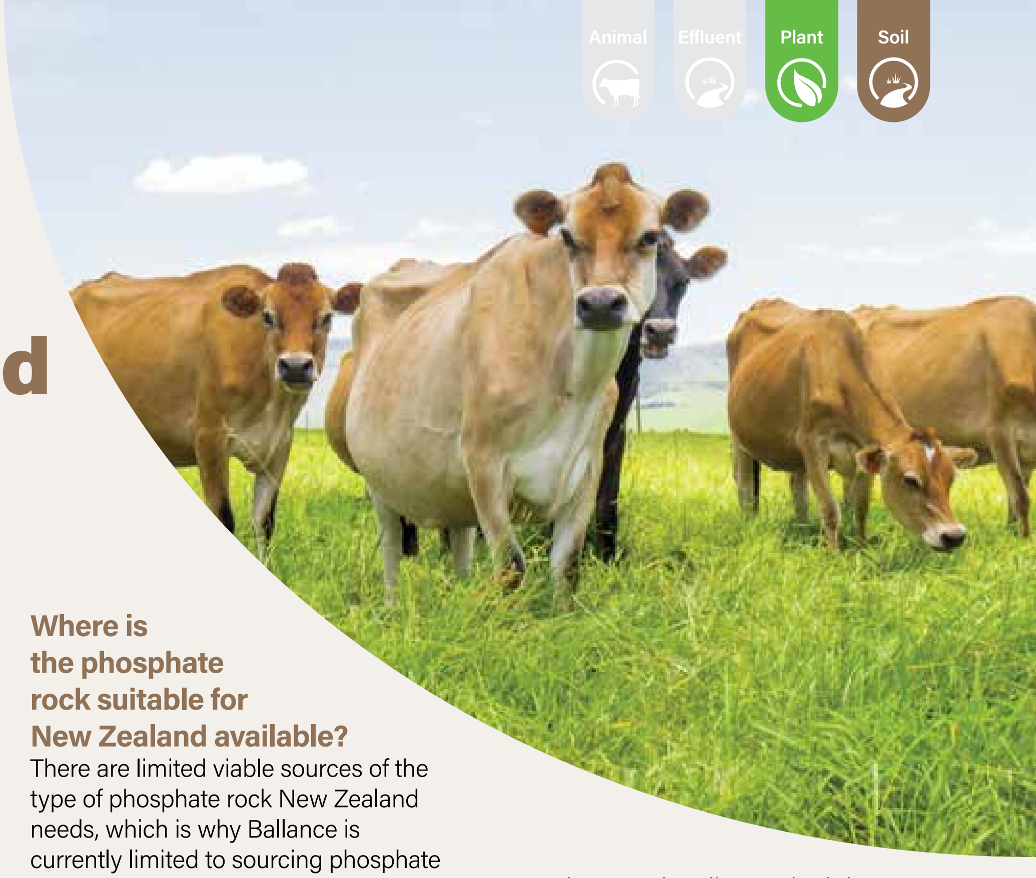
1985

Sherrell and Metherell[3] conclude optimum rate is 35-70 g/ha sodium molybdate every four years. Recommended rate set at 50 g/ha of sodium molybdate (20 g Mo/ha)*.

1997

Morton and Morrison[4] show benefit of applying Mo in a deficient situation for increased clover and pasture production (see Table 1).

* Equivalent to 2 kg/ha of NutriMax molybdenum (1%)



Rock for New Zealand

Fertiliser made from Western Saharan phosphate rock provides our agricultural sector with the best blend of nutrients to optimise production and manage its environmental footprint.

We speak to Ballance Science Extension Manager Ian Tarbotton about the phosphate rock required to produce the superphosphate New Zealand needs.

Why are superphosphate (and phosphate rock) important for New Zealand?

As New Zealand soils are naturally deficient in phosphorus and sulphur, our predominantly pasture-based farming systems require these two nutrients to be added as superphosphate, made from phosphate rock.

Can any sort of phosphate rock be used to make superphosphate?

To meet New Zealand requirements, the phosphate rock used to make superphosphate must be high in phosphorus, as well as low in the heavy metal cadmium.

Why is phosphate rock with low levels of cadmium needed?

The low cadmium levels are to protect human health. Cadmium occurs naturally in air, water and soil, but it's toxic to humans if it builds up in soil and enters the food chain via consumption of plants and farmed animals.

In the 1990s, Ballance, along with the rest of the New Zealand fertiliser industry, voluntarily adopted a limit for cadmium in fertiliser of 280 mg Cd/kg P. This has kept cadmium soil concentrations relatively low and within World Health Organization guidelines. New Zealanders do not need to worry about cadmium levels in their food, and we want to keep it that way.

Where is the phosphate rock suitable for New Zealand available?

There are limited viable sources of the type of phosphate rock New Zealand needs, which is why Ballance is currently limited to sourcing phosphate rock from the Western Sahara. It is low in cadmium and high in phosphorus. Alternative sources present significant environmental impacts and supply risks.

Can another phosphate fertiliser such as DAP be used instead of superphosphate?

DAP (diammonium phosphate), which is manufactured overseas and imported into New Zealand, is suitable for cropping but not for most pastoral situations. DAP contains just 1 per cent plant available sulphur, compared to Ballance's locally manufactured superphosphate fertiliser Superten, which has 10.5 per cent plant available sulphur.

DAP also contains 17.6 per cent nitrogen, while Superten does not contain any nitrogen. So using DAP instead of superphosphate would result in unnecessary nitrogen applications, and significant environmental implications.

The manufacture of DAP also emits more greenhouse gasses than the manufacture of Superten or stabilised phosphate fertilisers such as SurePhos do, as well as producing an unwanted environmentally damaging by-product called phosphogypsum.

What about ethical issues of sourcing Western Sahara phosphate rock?

Western Sahara is a non-self-governing territory and subject of a complex, ongoing dispute that's been going on for over 40 years. We are very clear and open about the fact that we are operating within United Nations expectations and are therefore comfortable both legally and ethically sourcing Phosboucraa phosphate rock from Western Sahara.

Economic development of the region, boosted by trade, is positively impacting the local population. Ballance has been purchasing phosphate rock from Boucraa in the Western Sahara for over 30 years, and 100 per cent of profits from sales are reinvested by PhosBoucraa (owned by mining company OCP) into improving the local people's wellbeing, supporting health, education and housing.

We're meeting (as well as validating) United Nations expectations, which include promoting economic advancement, benefiting the locals, non-discriminatory working conditions and sustainability. Ballance board members and executive staff regularly visit the Western Sahara to check everything is in order. We also ask the mining company OCP for regular updates on employment practices, health and safety, benefits to local people and investment in health, education and social programmes.

FOR MORE INFORMATION

ballance.co.nz/ethical-sourcing

bit.ly/2v79lPK for FAQs from the Fertiliser Association

Tough, but treat it well

Plantain may be tough, but treating it well gets the most from this useful forage crop.

Plantain's fibrous root system helps it to respond quickly after summer-dry conditions, so it can provide feed when pasture quality is poor.

"To get the best from a sward of pure plantain, treat it like high value pasture," says Ballance Science Extension Officer Aimee Dawson.

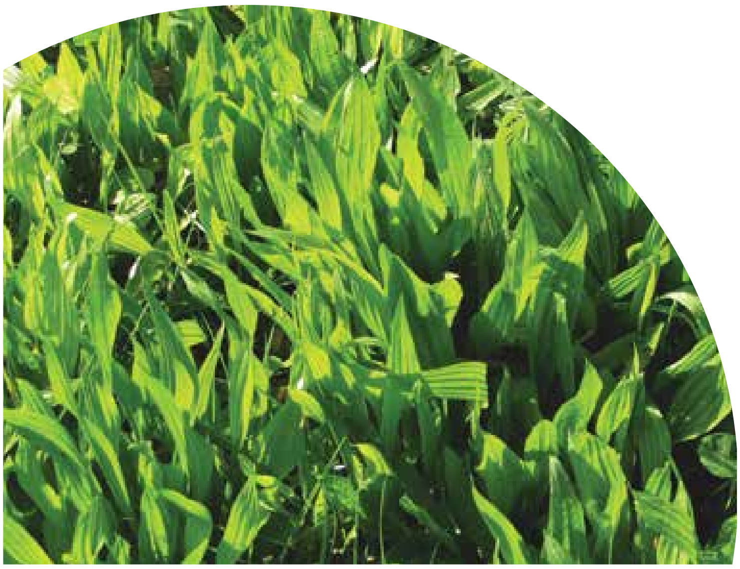
This involves soil testing to determine nutrient requirements, sowing fertiliser and driving growth with nitrogen (N). Plantain generally does not need potassium or magnesium once established.

"Test soil to a depth of 75 mm, 6 to 12 months before establishing plantain in spring. Use a base fertiliser to correct soil test levels if required (see Table 1 for target levels). Phosphorus is important for all plant establishment, so if Olsen P is under 15, consider drilling fertiliser with seed, using DAP or the Cropzeal range." Similar principles apply if stitching plantain into an existing pasture sward.

A small plot trial, looking at a plantain and clover sward, found that after a season a good amount of clover fixes adequate N for plantain, but during early establishment N needs to be applied. This is because it can take 12 to 18 months for clover to cycle N. Applying 30 kg N/ha (65 kg/ha of SustaiN) after each grazing optimised dry matter yield in the trial, but for the sake of practicality, applying 50-60 kg N/ha (120 kg/ha of SustaiN) after every second grazing is also recommended.

Table 1
Target soil test results for growing plantain on sedimentary soil

Test	Target levels
pH	5.8-6.0
Phosphorus (Olsen P)	20-30
Potassium	QTK 5-8
Sulphur (sulphate-S)	10-12
Magnesium	QTMg 8-10



Kiwifruit forever

Ballance and Zespri are on a joint mission to help kiwifruit growers become more sustainable.

The two organisations are in discussions on working together to help growers reduce nutrient losses on kiwifruit orchards, ensuring the longevity of the kiwifruit industry.

"Together with Zespri's Innovation and Research team, we're looking at improving kiwifruit growers' understanding of the science behind nutrient cycles, as well as management options to improve nitrogen (N) use efficiency," says Ballance Science Extension Manager Ian Tarbotton.

Growers' desire for improved sustainability, coupled with limited availability of robust N data for kiwifruit orchards, has already led to a long term study that is measuring N (as well as water) use and loss on seven Bay of Plenty kiwifruit orchards.

Modelling of data from this study has indicated a long term average leaching range of 26-46 kg N/ha per year (at 2 m) when N fertiliser is applied at 120 kg N/ha per year. Losses vary so greatly between orchards as they depend on management (especially nutrient and irrigation practices), soil type (particularly how free draining the soil is) and rainfall and other climatic variations.

"We look forward to this opportunity to share our expertise to benefit the kiwifruit industry," says Ian.

Science-based submission

Ballance has made a science-based submission on proposed freshwater management reforms.

Like many individuals and organisations around the country, Ballance Agri-Nutrients made a submission on the Government's proposed freshwater management reforms in October 2019.

"Ballance supports the proposal's intent to improve freshwater quality and ecosystem health, but the proposed timing and targets are impossible, and don't acknowledge the great work already done. Our submission pushed for science-based policy and identified areas where more work and review are in order, so that resulting policies are as efficient, practical and effective as possible," says Ballance Science Extension Manager Ian Tarbotton.

"A key example is the unworkability of the proposed national water quality levels, with some waterways being naturally high in certain elements such as phosphorus due to the geology of the area."

The Government is considering the huge number of submissions it received, and will decide what changes to make in the first half of 2020.

The main points Ballance made in its submission include:

National bottom lines for dissolved inorganic nitrogen and dissolved reactive phosphorus

Lack of science used to underpin the appropriateness of the values for these national bottom lines.

- A five year work programme to identify values relevant on a site-specific regional basis.
- Hold the line until 2025, using existing values established by regional councils.

Reduction of nitrogen loss

Focusing on nitrogen overlooks regions where, for example, sediment and phosphorus may be a greater risk to ecosystem health.

- Allocate resources for developing robust 2025 Regional Plans and Farm Environment Plans.
- Consider opportunity to allow aggregation or trading of nutrients within catchments.
- Establish catchment values and nutrient reduction requirements at a local level.
- Develop further permitted activity conditions, to maximize outcome efficiency.

Freshwater modules of farm plans

A well-designed farm plan is an effective tool to implement 'on the ground' changes to achieve the desired outcomes and drive good environmental practices.

- Review timeframes for farm plans, considering available capable certifying resources.
- Develop 'bare minimum' farm plans to maximize results for minimal cost and labour.
- Use existing certification programme for farm plan assessors.
- Expedite Overseer enhancements.
- Align freshwater and climate change policy, goals and timeframes.

Monitoring of water quality and ecosystem health

Expand national monitoring to improve data accuracy, consistency and benchmark knowledge of current conditions and trends.

Consider nationwide resourcing of monitoring activities.

Socioeconomic impacts to farming communities

It is vitally important to have a freshwater policy that has been developed with good economic consideration.

The Government undertake socioeconomic analysis of the proposals, with input from farmers to gain clear understanding of the real costs and community impacts.

Riparian setback requirements

The science and reasoning behind the benefits of the 5 m setback requirement instead of, for example, a 3 m setback is currently unclear. Acknowledge huge progress made on riparian fencing in the last decade.

- A risk-based setback requirement, assessed at farm level.
- Provide guidance on planting and other watercourse protection options.
- Contribute to costs of developing and maintaining riparian strips.

Key Ballance's comment Ballance's recommendation

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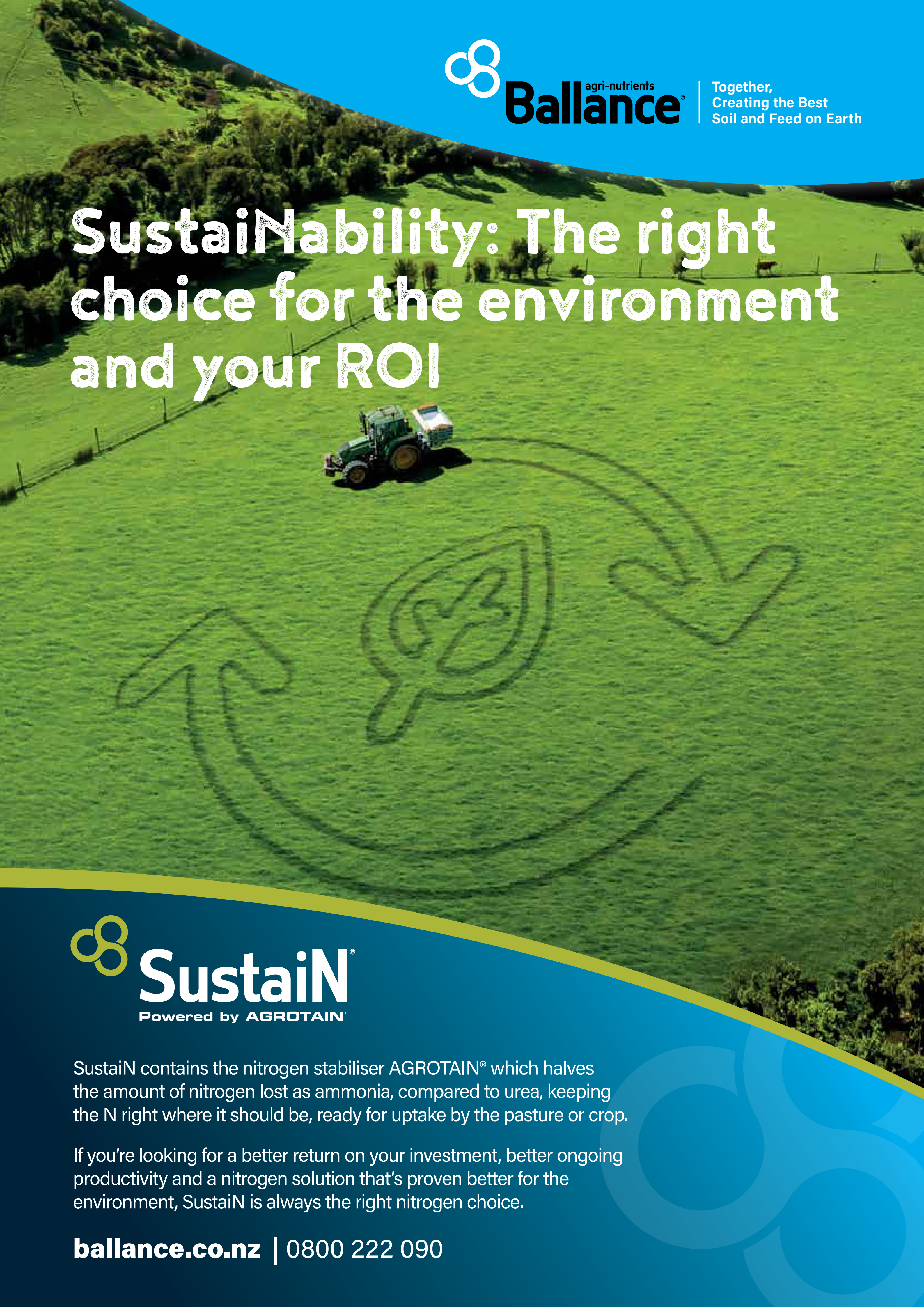

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