Ballance agri-nutrients

Together, Creating the Best Soil and Food on Earth

Grow

Autumn 2022

Environmental regulations 1 year on: special edition

Contents

Welcome to this special edition

Much has changed in the year since Ballance Agri-Nutrients' last special edition of Grow, to support farmers and growers adapt to new environmental policies.

What remains unchanged, however, is Ballance's commitment to supporting farmers and growers to be environmentally and economically sustainable. Ballance is well placed to help with the challenges faced in what can be uncertain and testing times.

Following much positive feedback on the last special edition of Grow, we are pleased to provide another special edition, focusing on implementing and meeting the regulations in force, while keeping abreast of what could be coming in those not yet finalised.

Many farmers and growers are already making changes to meet, or in some cases exceed, the requirements of the Essential Freshwater package, the Zero Carbon Act and the upcoming National Policy Statement for Indigenous Biodiversity. Some of the regulations are already in force, while others have been delayed (see page 4 for more on this).

Ballance made submissions on all of the policies, and while some have improved as a result of submissions, others are proving, in practice, to be quite challenging. The rules on synthetic nitrogen fertiliser are one such example (see page 8 for more).

The COP26 climate summit late last year was a reminder that environmental issues are in the spotlight – here in New Zealand and globally – and although change is required, it could have significant consequences.

For years, many New Zealand farmers and growers have been looking at their environmental footprints, both on farm and at home, and are passionate caretakers and stewards of the land (kaitiaki) who want to leave their farms in a better state than they found them in. Investment in native planting, pest control and green technology are testament to this.

Despite the significant gains made by agriculture and horticulture, more remains to be done for New Zealand to continue as a global leader in producing efficient, low-emission produce to feed the world.

My optimism for the future also remains unchanged. The Future Ready Farms programme, announced in late 2020, is developing solutions for further reducing the primary sector's environmental footprint and boost economic growth, and one of its projects, a new soil health test, is coming soon (see page 5 for more).

If you've not already done so, I encourage you to delve into the regulations, so you can better understand what they mean for your own situation.

Working together, whether it be in catchment groups or farmers helping farmers with input from scientists, provides the best results, and Ballance is here to support you as needed.

Mark Wynne
Chief Executive Officer
Ballance Agri-Nutrients

Regulations, one year on

A year down the track, Ballance is returning its focus to three major environmental policies, and what they mean for farmers and growers at this point in time.

A year ago, the Autumn 2021 Grow: Environmental policies special edition focused on explaining key new rules introduced by the Essential Freshwater package and the Zero Carbon Act. Some of the policies in the proposed National Policy Statement for Indigenous Biodiversity (NPSIB) were also outlined.

Today, some of the rules that featured in that special edition are in effect, while other policies or regulations have been delayed. For example:

- The synthetic nitrogen (N) fertiliser cap is in effect, and dairy farms are required to provide their regional council with their N use report by 31 July this year.
- At the time of writing, the NPSIB (expected to be released in late 2021) is now set to have another draft released before it is finalised, with the Government making decisions on the draft by 30 June 2022.
- The intensive winter grazing rules (originally due to come into force in May 2021) are now expected to come into force later in 2022, with the Government having proposed a start date of 1 November 2022.
- The degree of slope to which the stock exclusion rules apply to non-intensively grazed beef cattle is yet to be finalised, with the Government having proposed a new approach (see page 13 for more).

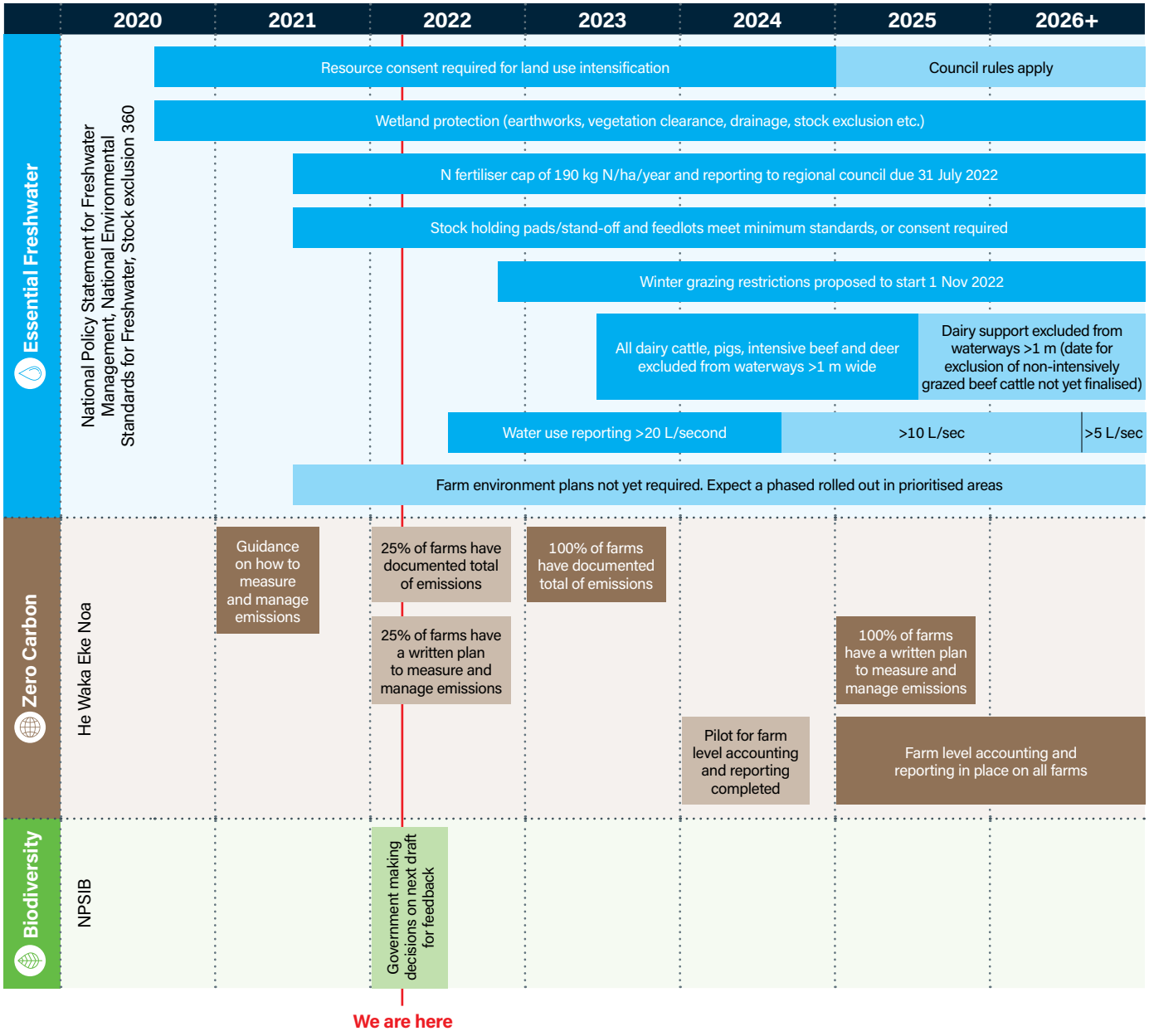
The timeline below provides a snapshot summary of 'where things are at' in early 2022.

FOR MORE INFORMATION

environment.govt.nz

ballance.co.nz/essential-freshwater-policy

Autumn 2021 Grow: Environmental policies special edition (and other previous editions of Grow) at ballance.co.nz



Future farming solutions

New technologies will help reduce environmental footprints and help meet environmental targets.

Creating products and services to enable farmers and growers to be kaitiaki of their land, whilst being productive, is core to the Ballance ambition – Together, creating the best soil and food on earth.

Ballance is leading the Future Ready Farms programme, to provide New Zealand food and fibre producers with solutions for further reducing their environmental footprints, while boosting the primary sector's economic growth and sustainability.

The Future Ready Farms programme, which began in late 2020, is developing 12 farm nutrient technologies to reduce emissions from multiple sectors within the primary industry, and help meet national environmental targets for:

- greenhouse gas emissions
- agricultural chemical use
- nutrient loss to waterways (see diagram on page 6).

One of the technologies, to promote soil health, is coming soon, while another – MitAgator 2 – is under development (see page 6).

The outcomes of the programme will support New Zealand farmers and growers to continue leading sustainable production on the world stage. Our farmers are the most efficient in the world – per unit of production, they produce the most from the lowest resource footprint. The programme will also increase public confidence in the primary sector.

After completing a successful Primary Growth Partnership programme (see page 7) in 2018, Ballance has continued to anticipate the challenges farmers and growers may encounter over the next 5 to 10 years and focus our innovation efforts with the future in mind.

"Ballance recognises the value in investing in products, tools and services, providing NZ farmers with the latest science and technology, available at their fingertips, and helping them meet the aspirations of local communities and global consumers," says Ballance Sustainable Food and Fibre Futures Programme Manager, Suzanne Young.

The $25 million Future Ready Farms programme is led by Ballance with co-investment of more than $10 million from the Ministry for Primary Industries' Sustainable Food and Fibre Futures fund as part of its Fit for a Better World programme.

FOR MORE INFORMATION

mpi.govt.nz/funding-rural-support/sustainable-food-fibre-futures/current-sff-futures-projects/sff-futures-projects-dairy/

The Future Ready Farms programme is developing nutrient technologies to reduce the primary sector's environmental footprint.

FUTURE READY FARMS
Creating a lower emissions future
Brought to you by Ballance in partnership with MPI

	Impact					Sector				
	Greenhouse gases			Water quality	Agrichemicals	Sheep and beef	Hort and arable	Dairy	Forestry	Manufacturing
Project	Nitrous oxide	Carbon dioxide	Methane							
1	▼			▲		●	●	●		
2 - Soil Health	▼	▼		▲		●	●	●		
3	▼			▲				●		
4	▼			▲	▼		●			
5		▼		▲	▼				●	
6		▼								●
7		▼				●	●	●		●
8	▼		▼	▲				●		
9	▼		▼	▲	▼	●		●		
10			▼		▼	●				
11 - MitAgator 2	▼	▼	▼	▲		●	●	●		
12	▼	▼	▼	▲		●	●	●	●	

New soil health test coming

A new soil health test developed by the Future Ready Farms programme – Soil Health Check – will provide additional valuable information for farmers and growers, for no extra effort and minimal additional cost.

"The Soil Health Check test is an easy way to get information on your soil's biological properties, as well as the chemical properties you already measure," says Ballance Nutrient Science Manager Sheree Balvert.

"The test's been designed to align with standard soil fertility sampling protocols, so no change to your current soil testing programme, or additional samples are required.

"Just a single set of samples is needed, taken in the same way and to the same depth as soil fertility samples. The only difference is that it's recommended to do the Soil Health Check every three to five years, compared to annually or biennially for soil fertility testing."

In addition to pH and Olsen P, which indicate the soil's chemical health, Soil Health Check measures the following biological health parameters:

- Total N (%) - all soil N (organic and inorganic)
- Total C (%) - all soil C (organic and inorganic)
- Anaerobically mineralisable N - shows soil's ability to store N that can be supplied to plants as organic matter decomposes. Also correlates with the soil microbial biomass (bacteria, fungi etc) and is a proxy for measuring the health of the soil biological community.
- Organic matter (%) - a very important component that influences all chemical, biological and physical systems of soil

"While the Soil Health Check cannot assess soil physical health, it can provide a picture of the impact of land use on soil health by monitoring changes in biological and chemical parameters over time. If the general trend is a decrease in soil health, then a comprehensive test and remediation efforts are advised."

FOR MORE INFORMATION

Visit ballance.co.nz or contact your Ballance Nutrient Specialist.

MitAgator 2 to include greenhouse gases

MitAgator, Ballance's digital tool already helping farmers meet water quality regulations (see page 7), is being further developed to include a greenhouse gas layer.

The greenhouse gas layer will enable and empower farmers to recognise, manage, and mitigate sources of carbon dioxide, methane and nitrous oxide on their farms.

Farmers will be able to make informed decisions that produce net positive results rather than swapping one detrimental consequence for another. For example, efforts to increase water quality may be inadvertently prioritised at the expense of increased greenhouse gases.

Already in the toolbox

Ballance has already developed a number of solutions for increasing nitrogen (N) and phosphorus (P) use efficiency, and reducing environmental impacts.

The following products, tools and services have been developed as part of the Clearview Innovations programme, co-funded by the Ministry for Primary Industries through the Primary Growth Partnership.

My Pasture Planner

Make the most of your nitrogen

My Pasture Planner is a decision support tool to optimise the timing, rate and placement of N applications. It incorporates the scientific expertise of AgResearch, and is used by Ballance nutrient specialists to guide N fertiliser plans to optimise pasture production while farming within limits.

ballance.co.nz/my-pasture-planner

SPREADSMART®

Super Air's SpreadSmart system enables more precise aerial topdressing. It combines GPS, hydraulic gate control and digital farm mapping to apply fertiliser where required, taking into account slope, aspect and soil fertility status. The system automates the aircraft's gate control to take the guesswork out of topdressing and allows for smaller exclusion zones down to 30 m, eliminating application on unproductive and/or environmentally sensitive areas.

ballance.co.nz/About-Super-Air/SpreadSmart

MitAgator®

MitAgator spatially identifies critical source areas of contaminant losses and finds the best mitigations. Developed by Ballance and AgResearch, and incorporating around 30 years of independent research, MitAgator is the first tool that singlehandedly deals with N, P, sediment and *E. coli* losses.

MitAgator produces detailed risk maps and compares the cost and effect of different mitigation strategies, allowing alternatives to be weighed up and the best option chosen.

ballance.co.nz/Farm-Sustainability-Services

ballance.co.nz/mitAgator

SurePhos

SurePhos is an effective and sustainable phosphate that reduces phosphate loss by up to 75 per cent (relative to superphosphate products)[1].

A slow release P fertiliser, it gradually releases into the soil so more P is retained in the soil and less is lost to the environment.

SurePhos is currently available in the North Island only.

ballance.co.nz/surephos

Also in the toolbox

Ballance self-funded development of the N fertiliser SustaiN (urea coated with the urease inhibitor AGROTAIN®).

SustaiN cuts N losses from ammonia volatilisation by up to 50 per cent (compared to standard urea)[2], keeping it in the ground for plant use and increased pasture production.

SustaiN® Powered by AGROTAIN®

ballance.co.nz/SustaiN

1 McDowell RW, Smith C, Balvert S 2011. The environmental impact and agronomic effectiveness of four phosphorus fertilisers: Report for Ballance Agri-Nutrients, October 2011

2 Zaman M, Saggar S, Stafford AD 2013. Mitigation of ammonia losses from urea applied to a pastoral system: The effect of nBTPT and timing and amount of irrigation. Proceedings of the New Zealand Grassland Association 75: 209-214

Meeting the N cap

A Canterbury farming couple share their experiences under the first year of the nitrogen (N) cap.

Norm and Lee-Anne Stewart, who farm 800 Jersey cows on 200 ha in Greenstreet, mid-Canterbury, have reduced their annual N fertiliser applications from 250 kg N/ha/year to 190 kg N/ha/year.

This reduction was made to meet the Essential Freshwater N cap rules that came into force in July 2021 for the 2021/22 season.

"We got our Ballance Nutrient Specialist to write up our annual plan, and we've followed the plan, and that gave us total N for the season. We used to put on 70-80 kg N/ha/year in the shoulder seasons, and now put on 40 kg N/ha/year," Norm explains.

The Stewarts also started to apply small amounts of sulphur (S), to overcome early spring S deficiencies and ensure spring pasture can take up applied N and flourish. If soil sulphur levels are too low when N fertiliser is applied, this may limit the efficiency at which the pasture responds to applied N fertiliser. They had also changed from using standard urea to SustaiN (urea coated with a urease inhibitor) which is designed to minimise N losses as ammonia gas, keeping more N in the ground for plants to uptake.

Despite making these changes to compensate for reduced N use, they have noticed they are not growing as much grass as before. Their adjoining 40 ha runoff, where they grow fodder beet and maize, and winter a few cows, has been used to grow some extra feed for the dairy platform.

"We've tried to hold our stock numbers and have grown another 4 ha of maize to cover the shortfall because of the cap." Fortunately, the N applied to ungrazed, arable crops such as summer maize silage is not counted toward the N cap.

Thinking about the future, Norm says: "It's not fixed yet, and I think we're going to have to drop stock numbers."

Norm's advice to other farmers is: "If you're going to hold your stock numbers you're going to have to carry more supplement. We're in that situation now, and how sustainable is that? I can tell you in 12 months' time – then do we start dropping our stock numbers?"

Ever since they moved to the farm in 2002, the Stewarts have regrassed 10 per cent of the farm each year, and have found the pastures they are using are very reliant on N.

They hold hope in technology developing a vigorous ryegrass that is less N dependent than their current pasture.

FOR MORE INFORMATION

'Understanding the synthetic nitrogen fertiliser cap: A quick guide to implementing the cap on dairy farms' at environment.govt.nz/publications/ncap-quick-guide-dairy-farms/

For more on making the most of every kilogram of N applied, see 'Using less N fertiliser' on page 8 of Grow Autumn 2021 Environmental policies special edition, at ballance.co.nz

Over the years, Ballance has been involved in many Ministry for Primary Industries Sustainable Farming Fund projects, helping farmers to improve their efficiency, including these three projects, which also add to knowledge on what is, and isn't, helpful for meeting the nitrogen cap and intensive winter grazing rules.

Fertigation – a new tool for nutrient management? this page

Optical sensors for N-fertilising dairy pastures page 10

Catch crops to reduce nitrate leaching page 11

Fertigation findings

Does applying liquid nitrogen (N) with irrigation water help farmers meet the nitrogen (N) cap?

For farmers needing to meet the N cap, recently completed research into fertigation – application of liquid N with irrigation water – suggests it enables reduced N application and produces more clover, but otherwise does not offer significant benefits over granular N[1].

Overall, the results from the 'Fertigation – a new tool for nutrient management?' project's two years of trials suggest fertigation results in similar N use efficiency, and pasture production and quality as granular N. These results are in line with a 2018 review, which found liquid N had no significant pasture response efficiency gains compared to granular N[1].

The project trialled a variety of granular and liquid N treatments in the 2019/20 and 2020/21 seasons – various application frequencies and fertigation application rates, as well as shoulder month only application.

In terms of N application rate, results indicate that when fertigation is used to apply N, a lower rate of N can achieve similar results to higher rates of N. One of the project's trials looked at fertigation application rates and compared the pasture production and quality and clover content produced by fertigation at 16 kg N/ha, 20 kg N/ha and 24 kg N/ha. The three different rates of fertigation produced similar pasture quality, and pasture N content and dry matter (DM).

Another trial yielded a similarly promising result. Fertigation produced more clover than granular urea when applied at an identical rate. This could be due to fertigation's reduced N applications benefitting the pasture clover content, as clovers face less competition and shading from ryegrass plants. In turn, more clover fixes more N, enabling further reduction of N inputs over time. Not all nutrient inputs can be reduced, as clover typically needs higher levels of nutrients such as potassium, phosphorus and sulphur than ryegrass does, and will suffer if they are deficient.

Ballance collaborated with IrrigationNZ, the Ministry for Primary Industries, Pamū Farms of New Zealand and others on this Sustainable Farming Fund project.

FOR MORE INFORMATION

The project's year 1 and 2 summary results reports are available at irrigationnz.co.nz/PracticalResources/COP/Fertigation

As part of this project, the Fertigation resource book has been updated, and is available on the above page to IrrigationNZ members.

The fertigation project team being shown the Pamū Waimakariri fertigation system

[1] Morton J, Tillman R, Morton A 2019. Review of research on pasture yield response to fine particle application of fertiliser in New Zealand, New Zealand Journal of Agricultural Research, 62:2, 210-223

Same yield for less N?

Optical sensor technology could help farmers meet the nitrogen (N) cap.

Applying N fertiliser using optical sensor technology holds promise for reducing N inputs and leaching, without reducing pasture yield.

A recently completed three year research project investigated using optical sensor technology to apply N fertiliser at a variable rate – only where needed and at the amount needed – and what the resulting economic and environmental benefits may be.

Prior to this project, traditional plot experiments had shown sensor-based variable rate application can achieve the same pasture yield as uniform application of N, but with 23 per cent less N and 13 per cent less N leaching.

But could these benefits be achieved under practical conditions of pastoral farming, in particular on dairy pastures?

Individual farms paddocks were used to compare sensor-based variable rate and uniform application of N. A cab-mounted unit called CropSpec, developed by TopCon, which had sensors angled to minimise the impact of shadows and plant movement, was used. Due to the unavailability, the technology could only be trialled on one farm in the project's first two years, but in the last year, trials on six farms were conducted.

The trial on the farm that operated sensor-based variable rate application for three years had higher pasture yields than the uniform control in two of the three years. In the third year, for example, pasture yield was 1370 kg/ha or 14 per cent more than the uniform control.

Sensor-based variable rate application on the other five farms conducted for one year showed a trend of 500 kg DM/ha to 1200 kg DM/ha more pasture biomass, but these differences did not prove statistically significant and at least another year of trials is required on these sites.

This Sustainable Farming Fund project was managed by Lincoln Agritech with guidance from farmers and co-funding from Ballance as part of its work in developing new technologies for improved fertiliser management.

FOR MORE INFORMATION

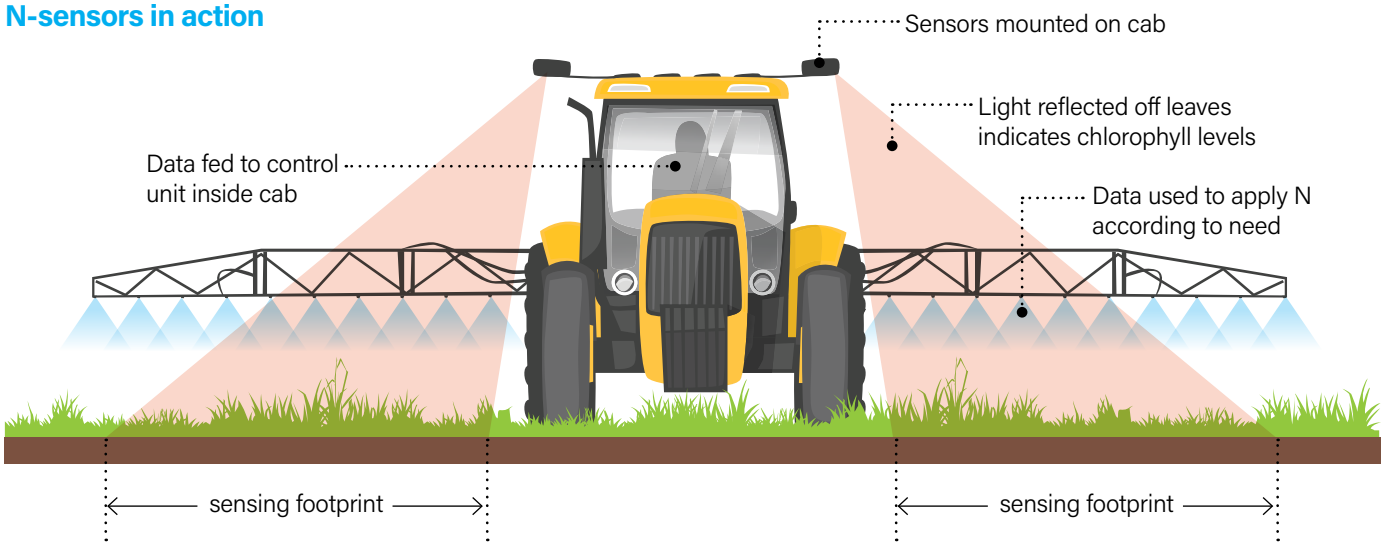
lincolnagritech.co.nz/assets/Uploads/RC185-FM19-28-29.pdf

How optical sensor technology works

Special lights emit short pulses of light onto plant leaves, measure the light reflectance and determine chlorophyll content, which is closely related to the N concentration in the leaves, and the potential biomass of the pasture.

Using the chlorophyll data, a map of the varying N levels in the paddock is produced, which is used to apply varying rates of N to areas where fertiliser is needed the most. Some 'on the go' devices are able to send the measured leaf N content directly to a control unit which adjusts the N flowing through a sprayer or a spreader (see illustration below).

N-sensors in action



Wins for winter grazers

Lincoln Agritech's Dr Peter Carey and Plant & Food Research's Dr Brendon Malcolm explain the benefits of catch crops in wintering systems.

Using catch crops as part of winter forage crop rotations can help reduce the risk of nitrogen (N) loss and improve farmers' bottom line through increased forage production, according to a recently completed three year Sustainable Farming Fund catch crop project, run by Lincoln Agritech and Plant & Food Research.

The project's aim was to show that catch crops, mainly forage oats, could be successfully established following winter forage crop grazing on commercial farms in both Canterbury and Southland. These trials built on promising results shown in earlier small scale plot and lysimeter research undertaken at Lincoln University and Plant & Food Research.

Key to the success of catch crops is that they need to be sown as soon as possible after winter forage grazing finishes (e.g. July/August). This presents quite different challenges in terms of catch crop establishment in Canterbury and Southland, primarily due to the wetter, colder, and often heavier, soil conditions of Southland.

Catch crop cereals such as oats are used because they are winter-active and grow rapidly as spring soil temperatures warm, meaning they can capture a significant amount of soil N before it can be lost, through either drainage or denitrification (gaseous losses).

Timing is key, but despite it being winter, sowing a catch crop was not found to be much more difficult to establish than at other times. Six Canterbury catch crops trials were sown over three winters, either by minimum till/drill or direct drilling. Direct drilling is the preferred method of establishment if the soil surface is not badly pugged. This is because there is less chance of stimulating soil N release from organic matter through soil warming by mechanical aeration. That said, the key objective at all times is to provide good soil-seed contact to help get the crop underway quickly.

While sowing catch crops in Southland presented more challenges around establishment, some very good catch crops were still achieved in wet, heavy soils using innovative tillage technology – a single-pass spader-drill combination. It does, however, remain challenging in regions such as Southland to deal with soils that are simply too heavy/wet, stony or hilly to achieve early sowing. It is hoped that other options for farmers will be explored in the near future.

Figure 1 shows some results for dry matter (DM) and N uptake from two catch crop trials sown mid-July and early August in Canterbury (12.1 t DM/ha) and Southland (8.4 t DM/ha), respectively, over the winter of 2018. More importantly, they captured 120-200+ kg N/ha.

FOR MORE INFORMATION

The project, in conjunction with other research conducted by Plant & Food Research, has produced a set of comprehensive catch crop guidelines to assist farmers with introducing catch crops into their winter forage rotations, available at:

dairynz.co.nz/feed/crops/catch-crops/

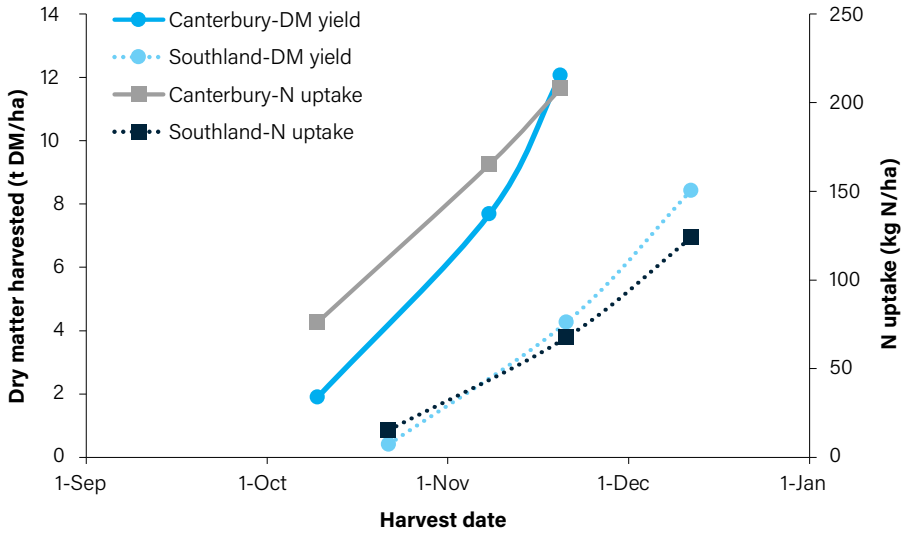


Figure 1 **Dry matter (DM) yield and nitrogen (N) uptake for catch crops sown over winter of 2018 in Canterbury (Te Pirita, sown 13 July, minimum till) and Southland (Gore, sown 3 August, one-pass spader drill)**

Test your N knowledge

Take our quick quiz to see if you're making informed, science-based choices for getting the best response efficiency from nitrogen (N) applications.

Questions

1 **Compared to granular N, the pasture response from fine particle or liquid N is:**

A. greater

B. similar

C. less

2 **Applying the plant growth hormone gibberellic acid with or without N:**

A. makes no difference to overall pasture grown

B. increases overall pasture grown

C. decreases overall pasture grown

3 **Compared to urea, N fertilisers with a nitrate-N component:**

A. increase pasture response, especially in cool conditions, because nitrate is more readily available for plant uptake than urea

B. decrease pasture response

C. make no difference to pasture response

4 **Applying smaller amounts of liquid or granular N more often, instead of a larger amount in one application (for example, 10 applications of 4 kg N/ha instead of one application of 40 kg N/ha) produces:**

A. a similar amount of dry matter

B. more dry matter

C. less dry matter

Answers

1. B - According to research, both fine particle and liquid N produce a similar pasture response to granular N[1,2].

2. A - Extensive trials have shown gibberellic acid – with or without N – brings feed supply forward, but does not increase overall pasture yield[3,4,5].

3. C - Plants can take up N as nitrate, ammonium or urea. Conversion of urea to ammonium is rapid, so the impact of applying ammonium or nitrate instead of urea is negligible. Trials completed on nitrate-based fertiliser compared to urea (in cool soil conditions) found no difference in pasture dry matter grown[6]. In addition, regardless of N form, N should not be applied if soil conditions are less than 6 degrees, when N is used less efficiently and may leach.

4. A - A trial compared the dry matter produced from N fertigated once a month (25 kg N/ha) to weekly applications (6.25 kg N/ha) on perennial ryegrass/white clover pastures. An identical total amount of N was applied. Both approaches produced similar amounts of dry matter[7]. In another trial, granular N applied as a single application of 40kg N/ha or 10 applications of 4 kg N/ha every 3-4 days also produced similar amounts of dry matter[8].

FOR MORE INFORMATION

Contact your Ballance Nutrient Specialist.

1 Morton J, Tillman R, Morton A 2018. Review of research on pasture yield response to fine particle application of fertiliser in New Zealand, New Zealand Journal of Agricultural Research

2 Risk JT, Dawson AE 2019. Comparing fine particle and granular nitrogen response on Southland pastures. Nutrient loss mitigations for compliance in agriculture. Occasional Report No. 32. Fertiliser and Lime Research Centre, Massey University

3 Higgins S, 2016. Comparison of the relative agronomic performance of several different plant growth promoting formulations in ryegrass-based pasture, under non-moisture limited late winter/early spring conditions, Agri-Food and Biosciences Institute, Northern Ireland

4 Higgins S, Watson C 2014. Comparison of relative agronomic performance of several different plant growth promoting formulations in ryegrass-based pasture, under non-moisture limited late winter/early spring conditions, Agri-Food and Biosciences Institute, Northern Ireland

5 Ledgard SF 2016. Review of research on effects of application of gibberellic acid alone or in combination with fertiliser nitrogen on pastures, AgResearch report for Ballance Agri-Nutrients

6 O'Connor MB, Longhurst RD, Hawke MF, Smith, LC 2000. Small-plot mowing trials - Investigations with sodium nitrate as a cold weather start N fertiliser. Client Report. (AgR) Prepared for SQM Oceania Ltd

7 Fertigation – a new tool for nutrient management? Year 1 Summary Report [accessed November 2021] https://www.irrigationnz.co.nz/PracticalResources/SpecialistEquipment/Fertigation

8 Price S, Carey P 2011. Does increasing the frequency of urea application for a single rate N Increase dry-matter yield on an irrigated Canterbury pasture? Land Research Services client report for Ballance Agri-Nutrients

Benefit from exclusion

The stock exclusion rules are a chance to gain a range of additional environmental and economic benefits from fenced off areas bordering waterways.

Fencing off waterways, although a requirement for many, can also be an investment that benefits both the farm, and the environment.

Once riparian areas (areas bordering waterways) are fenced off, planting them can provide a number of environmental benefits. Planting can help to prevent contaminants entering waterways, stabilise banks and reduce erosion and also provide or improve habitat for native wildlife, both on land and in the water.

Wide riparian areas can also be planted with productive species, such as cut and carry pasture, rewarewa, flax, or pollarding willows and poplars, according to the Productive Riparian Buffers project, led by DairyNZ and NIWA with support from the Ministry for Primary Industries Sustainable Food and Fibre Futures fund.

In terms of fertiliser spreading, riparian areas should be avoided. Contractors should be well briefed and using a spreader with a good reputation and technology, such as Super Air's SpreadSmart technology, is advisable. Super Air creates a highly accurate geospatial map of the farm, which allows identification of where nutrients should, and should not go – in exclusion zones and sensitive areas such as waterways and wetlands (see page 18).

FOR MORE INFORMATION

environment.govt.nz/acts-and-regulations/regulations/stock-exclusion-regulations/

dairynz.co.nz/environment/on-farm-actions/waterways/

canopy.govt.nz/plan-forest/why-plant-trees/waterways/riparian-zone/

beeflambnz.com/knowledge-hub/PDF/BT-1-6-integrating-native-biodiversity-templates.pdf for Integrating native biodiversity

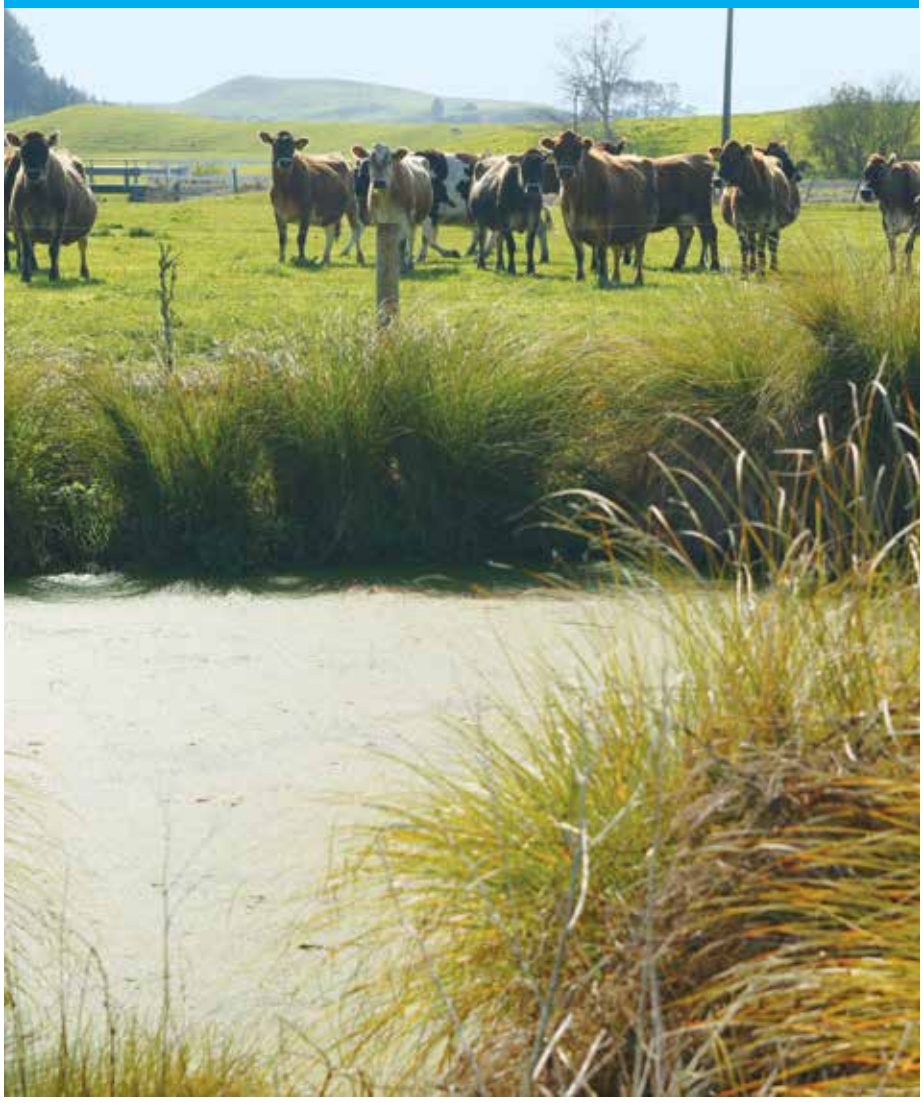
About the rules

In essence, stock must be excluded from waterways over 1 m wide by certain dates, dependent on stock type, slope and grazing intensity. New fences erected to achieve this must be setback at least 3 m from the waterway, but fences already in place setback less than 3 m can be left in place if they meet minimum standards.

One aspect of the rules not yet finalised is the degree of slope to which this rule applies for beef cattle that aren't intensively grazed.

When this rule was first released, it included maps showing low slope land where beef cattle must be excluded from waterways from July 2025. The approach for identifying these areas was to average slope over large areas. But due to concerns this could potentially include steep and high country land and exclude low slope land, the Government has proposed a yet-to-be finalised new approach, which includes

- a new mapping approach, on land with an average slope of up to 5 degrees
- using freshwater farm plans in areas outside the map, with a presumption that stock will need to be excluded from waterways on land with an average slope of between 5 and 10 degrees
- a 500 m altitude threshold.



Good winter grazing

What can you do to manage the risk of nutrient and soil loss from winter crops, and help meet the intensive winter grazing rules due to come into force this year?

Select paddocks

Select paddocks early, and consider:

- soil type - which can impact nutrient loss and animal welfare. Lighter, well drained soils are generally the most suitable for intensive winter grazing, but can present a greater risk of nitrogen (N) leaching. Heavier soils are typically more prone to structural damage (pugging and compaction) and sediment and phosphorus (P) loss.
- critical source areas - identify critical source areas (such as swales and gullies that can channel overland flow directly to waterways), and leave an ungrazed, uncropped buffer zone within and around these areas, to slow overland flow and trap suspended sediments and nutrients.
- slope - as increasing slope increases the risk of sediment and P loss. Consider how the paddock will be grazed and class of stock grazing in relation to slope.
- stock type - consider the stock class best suited to the environment. Some paddocks may be suitable for wintering sheep but not cattle, for example.
- animal welfare - where possible, plant crops in paddocks with access to shelter. Alternatively, allow a feed buffer in your budget to account for feeding extra during adverse winter weather events.

Best practice fertiliser management

- Test soil using the Ballance Brassica Test at least 6, but ideally 12 months before sowing. This allows time to adjust soil pH and correct nutrient levels with a suitable base fertiliser if necessary. The test measures the amount of available N in the top 150 mm of soil, which is used to calculate the amount of N required to meet crop demand.
- Use a starter fertiliser at sowing. Drill with the seed (in a separate box), or broadcast then incorporate into the soil just before sowing. Putting N and P close to the seed gets the crop off to a good start and helps optimise yield.
- Once the crop is growing vigorously, test herbage to check nutritional status and apply post-emergence N for:
  - » fodder beet just before or at canopy closure. Review soil test results to check reserves of available N. If low (<100 kg N/ha), apply 100-150 kg SustaiN/ha at canopy closure. If high (>200 kg N/ha), post-emergence N will likely not be required, as long as N has been applied in the starter fertiliser.
  - » brassicas at 6 and 12 weeks after sowing. If very high amounts (>100 kg N/ha) are required, split the applications. As a rule, the first application should go on at canopy closure.

Grazing management

- Record what you will be doing and where. This can be shared with staff so everyone has the same understanding of how grazing will be managed.
- Graze paddocks strategically. On sloping paddocks, fence across the slope and start grazing at the top of the slope, so the crop acts as a filter. If there is a waterway in the paddock, start grazing at the far end of the paddock.
- Measure feed accurately to ensure the total quantity grown will meet winter animal requirements and allow extra feed for poor weather events.
- Long, narrow breaks for sheep/cattle mean the crop is utilised more efficiently.
- Back fencing sheep/cattle off grazed breaks helps to minimise pugging and runoff risk.
- Place portable troughs and supplementary feed in drier parts of the paddock, well away from waterways or critical source areas.
- Exclude stock from critical source areas, ideally keeping them out for the duration of the winter period.
- Exclude stock from waterways with an ungrazed buffer zone of ideally at least 5 m, but more on sloping ground. Check if your regional council has rules on buffer zones and winter grazing.

Plant a catch crop

To reduce N losses, consider planting a fast growing crop in late winter/early spring such as greenfeed oats (see page 11 for more on catch crops).

FOR MORE INFORMATION

nzarm.org.nz/winter-grazing-tools#Wintering%20Plans

Reducing P losses

Managing phosphorus (P) losses can lift profit, and put you in a better position to meet P limits in the future.

Phosphorus (P) losses from land are already regulated in many regions, and by 2026, such losses are likely to be regulated across New Zealand.

The main source of P loss from land is P bound to soil particles in runoff, and is best managed by good grazing management, developing riparian margins and by following the four Rs – applying the right P fertiliser product in the right place, at the right time and rate.

Up to 20 per cent of P applied to land can be lost via runoff and leaching, and following the four Rs can help to reduce such losses.

Right product

Different P fertiliser products contain different proportions of water soluble P – the P which plants can readily use, but which also can be lost in runoff (and sometimes by leaching). For example, superphosphate is highly water soluble, while other fertilisers such as Serpentine Super or reactive phosphate rock are less water soluble, and become available to plants more slowly over time.

Phosphorus losses can be reduced by using a fertiliser with a low level of water soluble P, such as:

- SurePhos (available in the North Island only)
- the PastureSure range
- Serpentine Super
- Pasturemag.

Right place

This means avoid applying P fertiliser in critical source areas for P loss, such as areas:

- where runoff occurs
- close to waterways, such as lakes, streams, rivers and wetlands
- where the soil is less likely to hold onto P.

Soil's ability to retain P is indicated by its anion storage capacity (ASC), and areas with an ASC of less than 10 per cent should be avoided (see Figure 1).

Even products with low levels of water soluble P should be avoided or minimised on critical source areas.

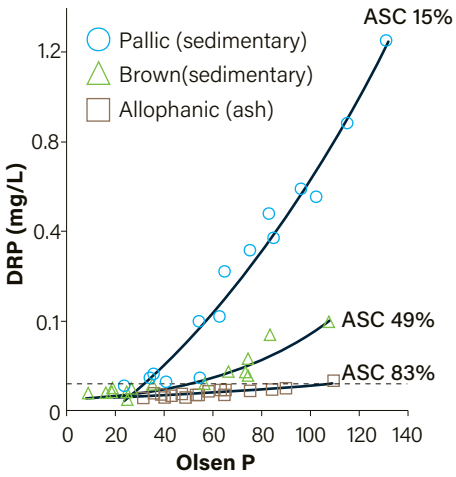


Figure 1 **Phosphorus concentrations in runoff increase as soil Olsen P levels increase, especially in soils with ASC less than 20 per cent, where less P is bound to clay particles.**

Source: Fertiliser Use on New Zealand Dairy Farms, Fertiliser Association of New Zealand.

Right time

Avoid applying highly water soluble P fertiliser if heavy rainfall is forecast (a single rainfall event of 30 mm or more within 21 days), particularly between April and October. Alternatively, use a low water soluble P fertiliser such as SurePhos.

Right rate

This means keeping Olsen P to optimal levels, as the risk of P runoff increases as the Olsen P of soil is raised, especially at levels of 60 or more (see Figure 1).

In low ASC soils that cannot hold onto much P, consider changing to crops that require a lower Olsen P.

FOR MORE INFORMATION

See page 18 for information on Super Air's SpreadSmart system, which allows you to apply the right product, at the right application rate, in the right place, at the right time.

Regulation roundup

Regional councils around New Zealand are at various stages of setting desired outcomes for dissolved reactive phosphorus (DRP) in rivers.

Phosphorus in water is commonly measured as either total P or DRP, which is more readily available to plants, so its concentrations better indicate a waterbody's potential for algae and plant growth.

Some councils have already set limits for DRP in rivers. These levels must provide for ecosystem health national bottom lines, cannot be higher than the current state, and if the community chooses to do so, could be improvements on the current state.

Under the Essential Freshwater package, councils must notify their plans by the end of 2024, with final decisions made by 2026 (or 2027 if granted an extension).

Winter soil savers

Which practices are proven to help keep soil on the land during and after intensive winter grazing?

Intensive winter grazing – when stock graze annual forage crops such as swedes or kale – can result in soil loss, and after grazing, soil left bare is a critical source area for sediment loss.

The challenge is how to retain soil on the land both during and after grazing forage crops.

A recently completed industry and Ministry for Primary Industries Sustainable Farming Fund project 'Helicropping - protecting our soils' has investigated a range of factors that can help to keep the soil on the land. Ballance Forage Specialist Murray Lane outlines the recommendations that have come out of the project.

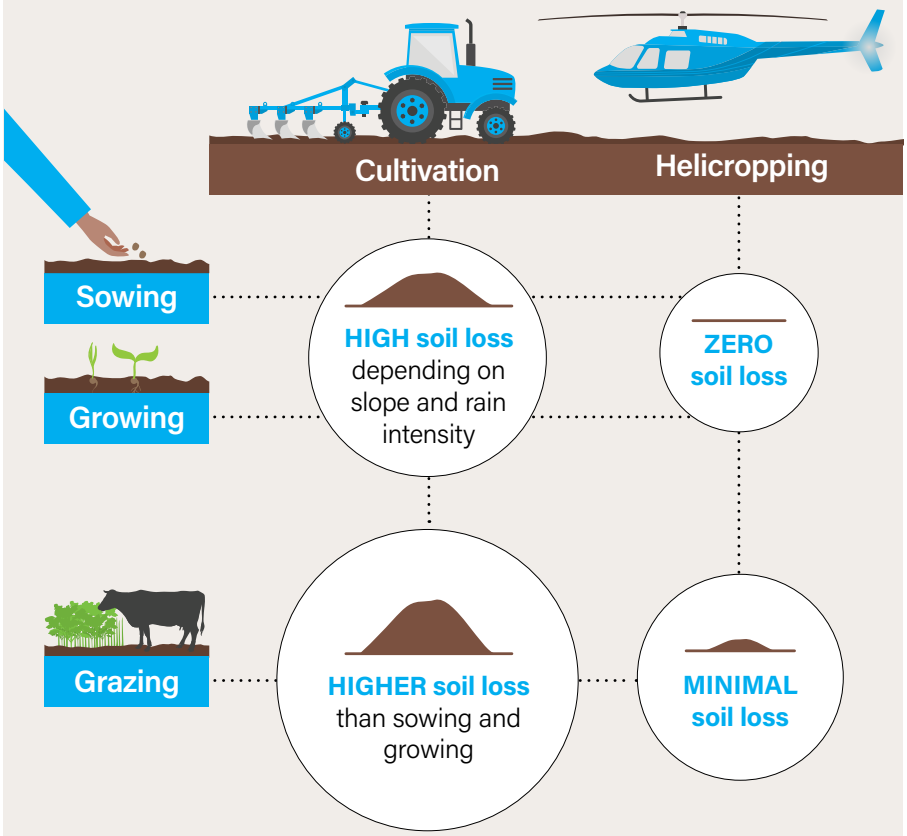
"We have come a long way in the past three years in our understanding of the role of helicropping in helping to conserve our soils."

- Colin Armer, Farmer and Chair of Sustainable Helicropping Group

1. Leave the soil undisturbed

"During the project, it became very clear that the primary means of protecting the soil was to leave it undisturbed. No-tillage cropping such as helicropping does just that," says Murray.

"Once cultivated, significantly more soil is likely to be lost, due to damage to soil's structural integrity. Soil damage and loss is only worsened with 500 kg animals on it over winter."



2. Use bird-repellent treated seed

"Soon after winter grazing, a cover crop or new perennial pasture can be surface sown to protect the soil, even in the middle of the winter. Applied from the air, this technique leaves the soil undisturbed, and does not require machinery access.

"However as surface sown seed can easily be taken by birds, a solution was needed. Avipel, a bird repellent seed treatment, proved to be successful in protecting the seed."

In a series of 16 trials in Taupo and Southland comparing bare and Avipel treated ryegrass, oat and ryecorn seeds, it was evident that birds rejected Avipel treated ryegrass and ryecorn seed, allowing it to establish and develop into a cover crop protecting the soil (see Figure 1 and photo).

"Avipel treated oats, however, were less successful. It is thought that birds were able to take untreated seed from the treated but wet, softened oat husks. For this reason, triticale, which has no husk, is a suggested substitute for oats. "

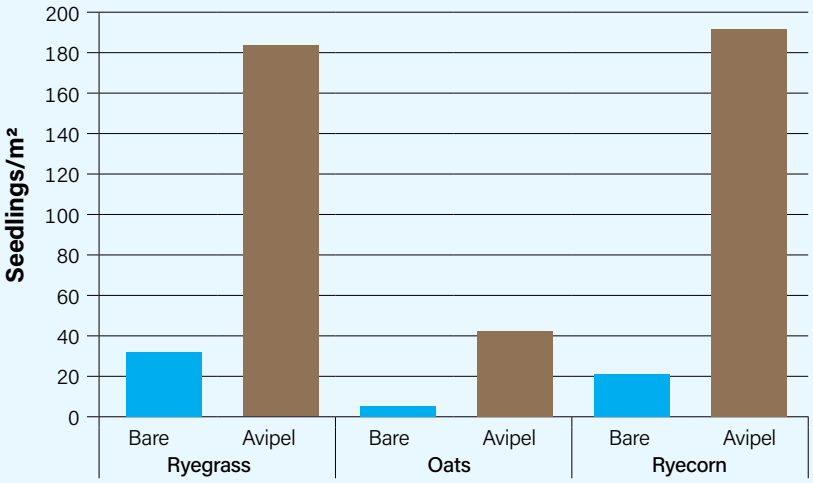


Figure 1 **Results from the Taupo trials (winter 2021) comparing seedling establishment of bare and Avipel treated ryegrass, oat and ryecorn seeds**

A successful cover crop in early November 2021 at the Southern Dairy Hub, Southland, consisting of Avipel treated annual ryegrass and ryecorn. The crop was surface broadcast on 23 July using a side-by-side farm vehicle (the wheel tracks are due to very wet conditions at the time).

3. Sow plantain as a companion crop

"Trials conducted during the project, along with farmer observations, have shown the value of sowing Agritonic plantain as a companion crop with swede or rape."

Plantain sown at 2 kg seed/ha survives under a swede or rape canopy, flowers and sets seed, contributes to the total dry matter produced, and if appropriately grazed still exists after the swedes or rape are gone, to quickly cover the soil as a ready-made cover crop.

Murray says the degree to which the plantain survives can also be used as a measure of grazing intensity. Grazing has been well managed if the plantain survives. In September to October plantain seedlings germinate to create a useful plantain finishing crop for summer.

4. Graze multi-day blocks

"While daily break feeding might optimise utilisation of a forage crop, it also concentrates hooves, creating significant soil damage (pugging) in winter.

"Multi-day block grazing can reduce hoof concentration and soil damage. For example, stock could be fenced in a four day block of feed, unable to access the earlier grazed areas of the paddock. If bad weather occurs, stock would be moved to the next block a day early, preventing soil damage. A mobile trough is needed to supply stock water."

5. Use buffer strips

The width of a buffer strip to arrest overland flow and capture sediment depends on slope, soil type, crop establishment technique, rainfall intensity and species planted in the strip.

In the project's soil loss trials, undisturbed helicropped soil on a 20 degree slope lost almost no soil when 'multi-day block' grazed compared to cultivated soil on a 10 degree slope that was strip grazed. Results suggested that a suitable grassed buffer strip should be 3-5 m wide.

The 'Helicropping - protecting our soils' project was led by Ballance Agri-Nutrients in partnership with Beef + Lamb New Zealand, Agricom, PGG Wrightson Seeds, Nufarm NZ and Environment Bay of Plenty, with co-funding from the Ministry for Primary Industries Sustainable Farming Fund.

FOR MORE INFORMATION

ballance.co.nz/helicropping

Technology a win win

With the right technology, commercial and environmental results can go hand in hand.

Super Air's SpreadSmart technology has helped a sheep and beef farmer look after the environment and increase his returns.

Meyric Hindmarsh, a Tolaga Bay sheep and beef farmer, has environmentally sensitive and unproductive areas scattered amongst the pastoral land on his farm.

Having his farm digitally mapped for the first time by Super Air enabled him to get a clearer picture of the productive pastoral areas on his farm. Armed with this valuable information, it was over to Meyric to make some decisions.

The digital farm map showed a very clearly defined spreadable area. On average, using the SpreadSmart system results in a reduction of the spreadable area by around 16 to 17 per cent, but in Meyric's case, the reduction in spreadable area was even greater.

The first decision he made was what to do with the potential saving offered by the tighter spreading area. Should he leave it in the fertiliser store, or get better commercial outcomes by putting it on areas that are going to produce pasture?

Recognising he was getting more production from the flatter areas of the farm (see slope map), he decided to focus fertiliser applications on replacing nutrients in areas where they had been removed as product (see proof of application map).

SpreadSmart enables fertiliser to be applied anywhere that clover and ryegrass based pasture is present. The only constraint on what can be done with the technology when applying fertiliser or lime is the farm owner's imagination.

Using SpreadSmart's variable ground rate application, Meyric was getting a net gain of up to and over $60 per ha per application, for no capital outlay, whilst looking after the environment. By meeting and exceeding the targets reflected in his Farm Environmental Plan, he was effectively futureproofing his business.

Technology such as SpreadSmart – developed with farmers for farmers – means commercial outcomes do not need to be compromised to achieve better environmental results.

FOR MORE INFORMATION

SpreadSmart (see page 7) is available throughout New Zealand, exclusively through Super Air. Contact Super Air on 0800 787 372 or reception@superair.co.nz.

SpreadSmart application

SpreadSmart provides a **constant ground rate application** as standard. A uniform rate of fertiliser is applied over every metre flown, adjusting for the changing speed of the aircraft while flying the block.

As required and at no extra cost, a **variable ground rate application** involves a variable rate of fertiliser from the plane, which could, for example, be based on soil fertility, stocking rate, slope soil type or aspect.

1 *Slope map of the Hindmarsh property, ranging from flatter land (green) to steeper land (red).*

2 *Proof of application map, showing flight lines and changes in fertiliser application rate with a variable ground rate application. Green areas received higher application rates.*

Storing carbon in soils

Paul Mudge, Portfolio Leader: Climate Change Adaptation & Mitigation at Manaaki Whenua – Landcare Research

Manaaki Whenua – Landcare Research's Paul Mudge explains soil carbon (C) sequestration.

Importance of soil C

Soil C is important for:

- **soil health** - C is a food source for soil biota, helps store and cycle nutrients and maintain soil structural stability, which in turn influences root growth, air and water movement/storage, and therefore runoff and erosion.
- **climate regulation** - changes in soil C can influence the climate via carbon dioxide (CO_2) release or sequestration. Globally, soils contain about twice as much C as the atmosphere, so any change could have a big impact on atmospheric CO_2 concentrations.

Types of soil C

Soils can contain two types of C – inorganic and organic. Most NZ soils are dominated by organic C.

Organic C is ultimately derived from plants. Photosynthesis captures CO_2, which is converted to carbohydrates, some of which are used for plant growth, and some are released back to the atmosphere as CO_2 via plant respiration. Carbon enters the soil as root exudates, when aboveground plant material and roots die and where grazing animals are present, from dung and urine deposition (Figure 1). Carbon can also be added to the system in the form of compost, effluent, or supplementary feed imports.

Most organic C entering soils is consumed by organisms such as earthworms and microbes which release the majority back to the atmosphere as CO_2 via respiration. A proportion of C entering the soil can become protected from decomposition by being tightly bound to the surfaces of mineral particles, captured within clumps of soil particles (aggregates), or through a lack of oxygen or low pH (i.e. in waterlogged and peat soils). Changes in soil chemistry, destruction of aggregates, or drainage can make soil C more accessible to soil organisms and vulnerable to being lost as CO_2.

Soil inorganic C is commonly calcium or magnesium carbonate, which can be present in the parent material soils are formed on (e.g. limestone), or can form in arid environments when CO_2 reacts with calcium or magnesium in the soil solution and precipitates out as carbonate. In New Zealand, only soils in dry areas of Central Otago and a few others formed on limestone contain appreciable amounts of inorganic C.

Increasing organic C in NZ soils

New Zealand soils contain high organic C stocks, due to our moist temperate climate and a landscape dominated by perennial vegetation. Changes in soil organic C are determined by the difference between inputs and outputs from the system, which are driven by photosynthesis and respiration (Figure 1).

Current evidence indicates that changes in land use (e.g. from forest or cropland to pasture) can lead to increases in soil C (and vice versa), but data on the impact of changes in specific management practices within a land use (e.g. grazing management, tillage regime or fertiliser use) are more limited and any positive effects are not yet widely demonstrated[1].

Research on the effects of different management practices on soil C is ongoing[2] and a new long term national soil C monitoring system is currently being implemented to determine whether changes in soil organic C are occurring on agricultural land in New Zealand[3].

[1] Schipper LA, Mudge PL, Kirschbaum MUF, Hedley CB, Golubiewski NE, Smaill SJ, Kelliher FM 2017. A review of soil carbon change in New Zealand's grazed grasslands. New Zealand Journal of Agricultural Research 60(2): 93-118.

[2] www.agmatters.nz/goals/maintain-soil-carbon/

[3] www.landcareresearch.co.nz/publications/soil-horizons/soil-horizons-articles/national-soil-carbon-monitoring-system-for-agricultural-land/

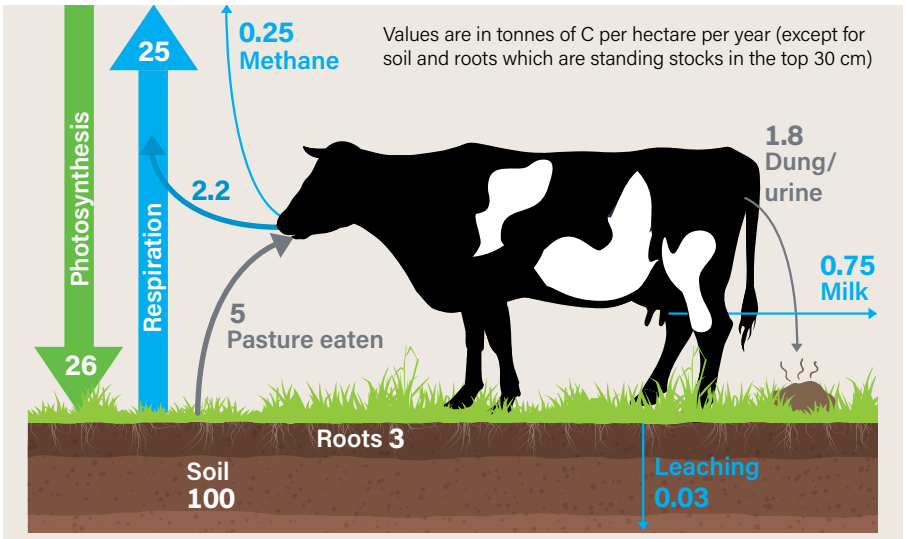


Figure 1 **Simplified C cycle for a dairy farm paddock over a year, with an example of C stocks and flows. Arrow thickness is proportional to the C flow. Green arrows indicate C inputs, blue C losses and grey internal cycling. The system is set to be at equilibrium (no net C gain or loss), which is currently the most likely situation for most NZ pastoral systems under typical grazing management.**

Climate action update

An update from He Waka Eke Noa: Primary Sector Climate Action Partnership Programme Director Kelly Forster.

Over the summer He Waka Eke Noa partners asked farmers and growers to take a good look at the options for pricing agricultural greenhouse gas emissions from 2025.

Led by DairyNZ and Beef + Lamb New Zealand and supported by Federated Farmers, more than 30 workshops, webinars and events were held around the country, with face-to-face events complying with Covid-19 Protection Framework requirements.

The Foundation for Arable Research and Deer Industry New Zealand also held workshops with their members. The Māori agribusiness workstream, Te Aukaha, convened by the Federation of Māori Authorities, has been working with Māori agribusinesses. Horticulture New Zealand had held grower meetings seeking member feedback.

A range of options have been worked through over the last 18 months, and feedback was sought on two options: a farm-level levy and a processor-level hybrid levy.

The alternative to these options is the 'backstop' – agriculture in the NZ Emissions Trading Scheme (NZ ETS).

There are of course trade-offs between each option.

A key aspect of both He Waka Eke Noa options is a 'split-gas' approach that separates the short- and long-lived gases and applies different pricing mechanisms to each. This recognises the different impacts of the main agricultural greenhouse gases: biogenic methane, nitrous oxide, and carbon dioxide.

The options also recognise sequestration that is not currently eligible for the NZ ETS. It is proposed on-farm planting such as indigenous forest, riparian planting, perennial cropland, and shelter belts all count towards a farm's sequestration, which can offset their emissions liability.

Both options aim to recognise the efforts of individual farms as they reduce their absolute emissions and increase their on-farm sequestration. Farms could also choose to combine forces as collectives.

A key aspect of the options is using revenue generated directly for research and development, incentives to uptake technology, or actions on-farm that help reduce emissions. Alongside pricing, the sector and Government are actively developing and evaluating mitigation technologies, both NZ and from offshore, and striving to deliver these options to farmers.

The Government has legislated that agricultural emissions will enter the NZ ETS if an effective, workable alternative is not put forward by the Partnership.

What happens next?

He Waka Eke Noa partners are incorporating the feedback from these discussions into the pricing options work. This will inform the recommendations that they will give to Ministers after consultation. A pricing system will be running in 2025.

In the meantime, farmers and growers are continuing to work to know their numbers and incorporate agricultural greenhouse gas emissions into their farm plans.

FOR MORE INFORMATION

hewakaekenoa.nz

Kelly Forster

Production and pride

Adam Thompson on his farm near Cambridge

Production and pride are on the up since starting to plant marginal land with native trees.

A Waikato beef farmer's passion for native trees and sustainability has not just increased production from better areas, but also pride for his land.

Since moving to his 200 ha farm near Cambridge four years ago, Adam Thompson has been following a 10 year plan to plant up all of the marginal land in natives, with another 11 ha planted up in 2020/21.

"The intention was always to prioritise the best land for production and retire the rest into native plantings. The thinking was that renovating all of the land to pasture would be too difficult and wouldn't end up paying off," he says.

"We've been targeting two types of areas on our farm – steep, erosion prone hillsides and also wet areas leading in to wetlands or streams."

The right tree for each location is key, with manuka/kanuka well suited to steep, drier faces and a more diverse mix of plants that enjoy damp conditions underfoot going into other areas.

"We've used a number of methods depending on the site, either with a hard graze or pre-spray before planting. We've been using plants in 28 cell trays as they provide an economical and vigorous form for establishing regenerating bush, and cost a lot less than traditional planter bags and pots.

"Retiring these marginal areas has allowed us to increase production on the better areas for farming. We've been able to crop and apply fertiliser to areas that provide a much better return. Fencing off the retired areas has also led to better subdivision and therefore better, and easier, management.

"Good infrastructure isn't just tracks, water and so on, but things that give you pride in your land, enhance your positive environmental impact and allow you to focus your energy on areas where you can produce a better return. You're not losing as much as you think. Some farmers get carried away about every blade of grass but you'd be surprised the benefits of focussing effort on the more productive areas and having better management of them.

"Most farmers know what it looks like to be damaging your soil or creating negative environmental impacts. There's significantly more pride in seeing that land protected with native trees that were always present on that area thriving, rather than cattle not thriving."

FOR MORE INFORMATION

Adam has set up Restore Native, a nursery on the farm to help other farmers restore native trees on land not suited to sustainable farming. Read more about his story at restorenative.co.nz

Adam's advice

- Engage your council – financial support may be available, as well as people with the expertise to help deliver good farm outcomes.
- Get advice on the right tree for a location – what species grow well in the soil and aspect, and also in your area? Find out about correct spacing, site preparation and ongoing maintenance.
- Planting at the right time is critical – summer droughts are common in our area, so we plant as soon as the soil's moist enough in late autumn/winter, to give plants time to get established. In areas with severe frosts and snow in winter, consider planting in late winter/spring as temperatures rise.
- In most areas you may be able to get away with just one release spray of the plants but don't skimp on this; if they get through the first year most native plants will thrive.
- In terms of areas, pick the low hanging fruit first, and do a little bit every year.

Prioritising planting

Keen to start planting native trees and shrubs on your farm but unsure where to start?

"Native planting can be expensive, costing up to $20,000/ha[1], so prioritising which areas to plant up is an important first step," says Ballance Science Extension Officer Angus Dowson.

He says Adam Thompson's approach (see previous page) of "doing a little bit every year" is right, but knowing where to start is not always straightforward.

"Some farmers will intuitively know where their marginal land is and which areas to prioritise for planting, but if you're looking for support in making this decision, MitAgator can be used to objectively identify critical source areas where mitigations that involve native planting can be applied."

MitAgator spatially identifies and quantifies critical source areas of contaminant losses (including nitrogen, phosphorus, sediment and *E. coli*) and selects the best mitigation options (see box and page 7).

"Mitigations such as creating wetlands or riparian zones with native planting will be more effective at reducing contaminant losses to waterways if strategically placed in the appropriate location, rather than a broadscale approach."

Angus says a MitAgator plan is a wise investment upfront to help prioritise where a much larger investment in mitigation and associated planting should be targeted.

"Then, just like Adam has done, create a 10 year plan, and do a little bit each year, working in with your council to subside costs. This will maximise the environmental impact of your efforts, and you might be surprised at what you can achieve."

"On my family's farm we focused on planting up a small critical source area of approximately 0.2 ha where water from the races is diverted through before reaching the stream. The planting cost us around $3,000, so was not a major cost, but we saved a huge amount of money and effort by prioritising smart areas for planting."

"Although it was only a small area, it taught us a lot about which plants thrive, what time of year to plant, and how best to get plants established. It has also helped us to plan our ongoing planting efforts and has been great to see the improvement in biodiversity and know that we're reducing *E. coli* and phosphorus losses to our farm's waterways."

FOR MORE INFORMATION

ballance.co.nz/mitAgator

Using MitAgator to prioritise areas for planting

MitAgator's gold standard geospatial software helps you make cost-effective decisions around reducing all four water contaminants – nitrogen, phosphorus, sediment and *E. coli* – so you can continue to farm productively while meeting regulations.

Using information from your farm map, nutrient budget and soils map, MitAgator creates risk maps, showing critical source areas for contaminant loss. Targeting these areas first will have the biggest impact on improving your farm's environmental performance.

Next MitAgator targets these areas with different mitigations, such as wetlands and riparian fencing and planting, and models the predicted improvement. You can also select one or more mitigations to see the impact and cost-benefit of implementation.

[1] Douglas G, Dodd M, Power I 2007. Potential of direct seeding for establishing native plants into pastoral land in New Zealand. New Zealand Journal of Ecology. 31.

Soil your singlet

Farmers across the globe are burying undergarments to learn more about soil health.

What does a singlet have to do with soil health (and even environmental policies)? Potentially quite a bit, it turns out.

In autumn 2021, 500 farmers from around New Zealand joined their counterparts from around the world in Ballance's 'Soil your singlet', an underground experiment to check if helpful organisms such as bacteria and worms are active in their soil.

Rather than ask farmers to part with their underwear (as required in the global 'Soil your underwear' experiment), Ballance provided farmers with a cotton singlet to bury and, depending on rain and soil temperatures, dig up 4 to 6 months later.

The results? A holey singlet indicated more plentiful, active soil organisms, whereas a relatively intact singlet could signal soil not functioning as well as it could.

Soil organisms that break down the cotton singlet thrive in well aerated, free draining soil, so an intact singlet suggests low soil organism activity, which could be due to compacted, poorly draining, or heavily disturbed soil.

Thriving soil organism populations also indicate good levels of organic matter, which is very important as it influences all chemical, biological and physical systems of soil.

Organic matter provides the energy source for microbes which drive nutrient cycling in soil. It also increases the soil's capacity to retain nutrients, improves and stabilises soil structure, improves water infiltration, and increases water holding capacity and retention.

How does this all fit in with environmental policies? Healthy soil has abundant and diverse populations of soil organisms which break down organic matter, cycle nutrients and help to create good soil structure. This can help farmers to meet the nitrogen cap, protect water quality and reduce greenhouse gases.

FOR MORE INFORMATION

ballance.co.nz/soil-health

Maintain healthy soil

Regular soil testing is the best way to get a reliable status on your soil's nutrient levels, pH, CEC and ASC. It also helps you avoid over- or under application of nutrients. It's important to use calibrated soil tests, which have been matched against optimum pasture and crop production in New Zealand conditions.

Look after soil organisms

- Keeping soil covered with growing vegetation protects the soil, and live roots support soil organisms.
- Avoid compaction or over-cultivation of soil - both processes negatively impact organisms.
- Maintain good fertility to enable plants to grow more and produce more organic matter (waste leaf/root material) and to feed more exudates to soil organisms.

24229

Ballance agri-nutrients

Together,
Creating the Best
Soil and Food on Earth

Manage your nitrogen limit with MyBallance

MyBallance

Try our new nitrogen limit feature

We've just made it easier to stay on top of nitrogen regulations. Our new MyBallance feature lets you add application data throughout the season, so you can measure any nitrogen product you apply and track how you're doing against the 190kg N cap.

Login or register now to try out all the latest MyBallance features.

myballance.co.nz | 0800 222 090