

Sustainable Vegetable Systems

Quarterly Report - Programme Governance Group

Quarter 2, October – December 2021

Contract Agreement Number: 21859



Ministry for Primary Industries
Manatū Ahu Matua



In partnership with:



1.1 Summary of progress during this quarter

Workstream 1 – Controlled experimentation to quantify nitrate leaching

- A fresh market potato crop has been established in the Canterbury Vegetable rotation. Data collection continues in this crop and the onion crop in the Canterbury Potato – Onion rotation.
- Lettuce has been harvested from the Hawke’s Bay vegetable rotation, and peas sown. Onion data continue to be collected in the Hawke’s Bay onion and pea crop.
- We used a prototype of the farmer-facing tool to estimate the optimum nitrogen for the potato crop in the Canterbury vegetable rotation. This tool has a more dynamic inclusion of soil N mineralisation and previous crop residue mineralisation. The tool also provides an indication of best timing of side-dress applications based on reaching a set minimum soil N level. We are using nitrate test strips to assess soil N levels before making side-dress decisions.
- The crop rotation is shown below.

Trial crop rotations

Crop experiment and rotation outline - Hawke's Bay																									
2020		2021										2022													
Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May			
Rotation 1												Onion			Grass crop										
Rotation 2												Pak choi			Fallow		Lettuce		Peas		Fallow		Caul.		
Crop experiment and rotation outline - LINCOLN																									
2020		2021										2022													
Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May			
Rotation 1		Wheat		Broccoli mid Feb			Fallow		Onions		Fallow		Onions		Fallow		Fallow		Cover crop (ryegrass)						
Rotation 2		Pak choi - Shanghai (smaller)			Fallow		Cover crop (ryegrass / Oats)			Fallow		Potatoes - Fresh		Fallow		ryegrass									

Workstream 2 – Crop rotations

Site No.	2020				2021												2022	
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	
1	Cover Crop (ryegrass cut and carry)				Fallow		Onions		Fallow		Onions		Fallow		Fallow		Fallow	
2	Barley (crop/cover crop)				Fallow		Onions resown		Fallow		Fallow		Fallow		Fallow		Fallow	
3	Mustard	Fallow		carrots		Fallow		Fallow		Fallow		Fallow		Fallow		Fallow		
4	Potato			Fallow		Cauliflower		Fallow		Maize		Fallow		Fallow		Fallow		
5	Potato			Fallow		Onions		Fallow		Fallow		Fallow		Fallow		Fallow		
6	Maize silage			Fallow		Grass		Fallow		Fallow		Fallow		Fallow		Cabbage		
7	Pumpkin		Fallow		Grass		Fallow		Squash		Fallow		Fallow		Fallow			
8	Potato	Fallow		Wheat		Fallow		Fallow		Fallow		Fallow		Fallow		Fallow		
9	Pumpkin		Fallow		Fallow		Turf grass		Fallow		Fallow		Fallow		Fallow		Fallow	

Workstream 2 – Regional on farm monitoring

- Monitoring continues on the 9 regional sites. All sites have now had fallow periods with a following second crop planted.

The regional monitoring sites crop rotations are shown above.

- Some sites are having their soil samples split and sent to both Eurofins and the lab at plant & Food Research. This is part of an investigation of the hotwater testing repeatability and the comparison of mineral nitrogen tests versus the hotwater extractable inorganic nitrogen.
- The regional monitors meet on the last Monday of the month, along with PFR, and covers H&S, progress update, and discusses any issues and ideas amongst the nationally dispersed monitoring group.
 - Covid-19 has not caused any further delays to the monitoring programme.
 - 8 of 9 Site Agreements have been signed and returned. The remaining site is being followed up.
- The new individualised soil mineral nitrogen reports, see previous quarterly report for an example, were sent to the monitoring site growers in December. These have been further updated and will be distributed quarterly.
- The database of plant nitrogen levels has been developed. One site has been populated by PFR. These results are being incorporated into a new individualised nitrogen budget report.

Workstream 3 – Farmer facing tool(s)

- A meeting was held for PFR modellers and industry members to discuss the approaches needed and issues to consider in developing a grower-facing tool that is workable and usable. The meeting switched from face to face to being conducted online. The success of breaking the meeting into 2 two-hour sessions on consecutive days and using the whiteboard tool Miro (<https://miro.com/>) was very successful and will be used as a model for future meetings.
- A key aspect was the need to make the tool management focused to achieve grower buy-in. The tool needed to support Farm Environment Plans, but not be driven by regulation. Supporting decision making will lead to practice change. Any leaching values need to reflect and account for the level of uncertainty.
- The key next step is to include social science findings from Workstream 4 in subsequent workstream 3 discussions.
- Modelling scenarios for all crops harvested so far are being developed and data collated.
- A new Workstream 3 leader, following establishment by Andrew Barber, has been approached and is currently considering the role.

Workstream 4 – Developing a change landscape

- Grower interviews to understand the practices, current knowledge and issues faced with N management of crops were conducted by phone or video conference because of COVID-19 restrictions.
- Initial findings were presented to the modelling group and Waka Paul (PFR) participated in the modelling grower-facing tool meeting.
- A report is being prepared from the data collected to help inform modelling discussion, tool development and facilitating implementation.
- A plan to continue with information sharing is being developed, with COVID-19 restrictions affecting the ability of focus groups to meet and field days to be held.
- Recognising the move away from workshops in the immediate future video and podcasts will be developed. Several service providers have been approached.

1.2 Key highlights and achievements

- The Workstream 3 (Tool) team came together in a series of Zoom workshops to address the questions:
 - Growers and industry understanding of regulatory requirements
 - A N leaching number, document a process of practice improvement, GMP, risk assessment, and confidence in the results
 - Is the tool practice based and does it support Farm Environment Plans?
 - Management focused to support decision making. Consequently, this supports FEPs need for nitrogen budgets and evidence to support management practices.
 - Does the tool fulfil regulatory requirements? How does it account for region differences?
 - Meets regulatory requirements but isn't driven by these requirements. There is an opportunity to lead this conversation – including the reality of uncertainty.
 - Is this a standalone tool or does it link to others? What do we need to link to?
 - What crops need to be incorporated? Do different varieties need to be considered?
 - What are the tool's parameters and how are these prioritised?
 - What is the 'duration' for the scope of the tool e.g., 1 crop cycle, 12 months, 2 years etc?
 - What is the 'scale' for the tool e.g., single field, whole farm etc?
 - What data is available and what needs to be generated?
- PFR's ability to continue the trials despite Covid's best attempts to stop these.

- Similarly, the regional monitors ability to work with their monitoring site growers and meet their H&S requirements while collecting monthly data.
- A fresh market potato crop has been sown in the Canterbury Vegetable rotation. Data collection continues in this crop and the onion crop in the Canterbury Potato–Onion rotation.
- Lettuce has been harvested from the Hawke’s Bay Vegetable rotation, and peas sown. Onion data continue to be collected in the Hawke’s Bay Onion rotation, and the pea crop.
- The first prototype of the farmer-facing tool was developed by PFR to estimate the optimum nitrogen for the potato crop in the Canterbury vegetable rotation. By incorporating an indication of best N timing of side-dress applications the tool is targeted at supporting growers’ decision making.
- A draft individualised nitrogen budget report has been developed using a subset of plant data supplied by PFR.
- Grower interviews to understand the practices, knowledge and issues faced with N management of crops were conducted by phone or video conference because of COVID-19 restrictions.

1.3 Collaboration with other programmes (optional)

Red font is new text this quarter.

Project name	Industry lead / Researcher	Description	Link to SVS
MPI SFF - Mineralisable N to improve on-farm N management	PFR led, funded by MPI, FAR, VR&I, Environment Canterbury, HBDC, Waikato Regional Council, Ravensdown, Hill Laboratories, Eurofins Food Analytics Ltd.	<p>The productivity of broad acre cropping depends on supplying sufficient nitrogen to meet crop demand; however, farmers often do not know how much N will be mineralised during the growing season.</p> <p>Plant & Food Research have developed a new laboratory test (published 2017) that can be used to predict in-field N mineralisation. The new test is faster and more accurate than existing commercial tests. This project will conduct on-farm demonstration trials with different crops, soils, and climates to demonstrate the benefits of the new test to improve N management on farm.</p>	<p>SVS sampling protocol includes the hot water (HW) test in both the trials and regional monitoring sites.</p> <p>Mike Beare (PFR) is involved in SVS through the Tech. Panel.</p> <p>Soil samples are being split and sent to both Eurofins and PFR to test HW result consistency and Mineral N vs hot water extractable inorganic M.</p>
Crop residue N project	VR&I, PNZ, FAR / PFR	<p>PFR-funded project looking to quantify the rate of decomposition of different vegetable residues and the rate of N release from the residues into the soil. Taking the small-scale laboratory trials conducted last year by Trish Fraser (PFR) into a larger scale field trial and literature review.</p>	<p>Essential for the nutrient budget. Direct industry and researcher connections. Some residues will be obtained from crops in Workstream 1.</p>

Project name	Industry lead / Researcher	Description	Link to SVS
Mineralisable N to improve on-farm N management	FAR, HortNZ, Councils / PFR	A SFFF project looking to improve the measurement and prediction of the amount of biologically mineralised N in a field. This pool of N is a key component for understanding crop N requirements, together with measurements of mineral N (nitrate and ammonium).	Direct industry and researcher connections.
Measuring real time nitrate leaching from a Hawke's Bay onion field	Ravensdown / PFR	The purpose of this research was to compare data from two nitrate sensors installed in a sump measuring nitrate-nitrogen concentrations in situ, with data from grab samples that were taken immediately to a laboratory for analysis.	Problem recognition. Direct industry and researcher connections.
Future Proofing Vegetable Production	VNZ & PNZ / LandWISE	Completed MPI SFF project. On farm trials in Levin and Gisborne. Developed a simple nitrogen budgeting tool designed specifically for vegetable production systems.	Picking up on the nitrogen budget and further developing the components and deliverable tool. Direct industry and researcher connections.
Process Vegetable Coefficients	PVNZ / PFR	Quantify some of the coefficients needed for N uptake and use by processing crops within Overseer.	Direct industry and researcher connections.
Protecting our groundwater: Fluxmeter	FAR, VR&I / PFR	A network of tension fluxmeters were installed on commercial arable and vegetable farms around New Zealand to directly measure losses of nitrogen and phosphorus in drainage water. Completed. Now being extended by FAR & VR&I.	Problem recognition. Direct industry and researcher connections.
Measuring nitrate in drains	Auckland Univ.	A Massey Univ. trial measuring nitrate levels in tile drains is being conducted in one of the Regional Monitoring sites. Now have the contact details and will follow up. The student trial has been running since 2019.	Trial is on a regional grower's site.

Project name	Industry lead / Researcher	Description	Link to SVS
Modelling to reduce nitrogen in Pukekohe (Whangamaire stream)	MPI	Indicative environmental-economic modelling to investigate the potential scale of impacts on commercial vegetable growing from the annual median nitrate in Pukekohe. Considerable change in productive land use may be required to achieve the NPS-FM 2020 national bottom line. https://www.hortnz.co.nz/assets/Environment/National-Env-Policy/JR-Reference-Documents-/MPI_2020-42078-Pukekohe-Modelling-Report-Final-Sanitized.pdf	Aware of
Asparagus N budgeting	LandWISE, Asparagus product group / PFR	Previous survey work identified a very wide range of fertiliser practices. Preparation of FEP's highlighted the need for better information that can be fed into asparagus nutrient budgets.	Using sampling protocols developed by SVS. Direct industry and researcher connections.
Freshwater Management Tool	Auckland Council	AC is currently in the process of developing a Freshwater Management Tool. This tool will provide a more sophisticated assessment of water quality in the Auckland region. 2% of waterways in the Auckland region are predicted to exceed the 95 th percentile concentration of 9.8 mg/L. All are located in the vege rich sub-catchments of the Franklin aquifer.	HortNZ is working with AC.
Global Literature Review on nitrogen mitigation options in vege. prod.	MPI / PFR	Literature review of mitigation technologies and their potential impact. Not yet available beyond MPI and PFR.	Important background for beyond SVS when mitigations are investigated.
Remote soil water measurement	NIWA	Remote auto sampling of soil leachate. Lysimeter was originally prototyped by Landcare Research, developed into a product by NIWA. https://niwa.co.nz/publications/isu/instrument-systems-update-21-november-2015/remote-soil-water-measurement . Researcher says progress has been slow and expensive (Andrew correspondence 2020).	Watch progress, along with other emerging technology.

Project name	Industry lead / Researcher	Description	Link to SVS
Ag Matters	NZ Ag GHG Research Centre	Dissemination of practical information, backed by science, to help farmers and growers get to grips with climate change. https://www.agmatters.nz/	Collaborate on dissemination and case studies.

1.4 Upcoming

- Lettuce harvest will be completed in Workstream1. Data from the onion crops sown will continue to be collected, and the potato crop established.
- N balance discussions will be ongoing, and data from Workstream 1 and 2 further evaluated for N balance development.
- Workstream 3 meeting to report back the findings from the pre-Christmas meeting and to discuss the tool prototype.
- Workstream 4 to run a facilitated workshop using a Logic Model approach to better understand the project's impact and pathway towards success.
- Workstream 4 to work with the selected podcast and video service providers to storyboard and start capturing the material to support these dissemination tools.
- A report is being prepared by PFR based upon the grower and other industry members interviewed to help inform modelling discussion and tool development.
- Technical Panel to conduct a one-day workshop, topics to include trial results and monitoring, nutrient budgets, and tool prototype. It is proposed that this be moved from March to April to maximise the chance of a face-to-face meeting. Planning will include an alternative series of 2 hour Zoom calls.
- Community of Practice idea development and workshop planning (proposed to be moved from May to June to maximise the chance of a 2-day face to face meeting).
- Additional plant analysis to be conducted on crops prior to harvest. Allowing both a more robust data base and wider grower engagement.
- Following discussions with project partners the Reference Group leadership is going to be carried out by the Workstream 4 leader (Gemma Carroll – PNZ).

1.5 Investment (Cash & In-kind)

Investment period	Co-investor contribution	MPI contribution	Total investment
During this quarter	\$0.149m	\$0.366m	\$0.515m
Programme to date	\$0.954m	\$2.232m	\$3.186m