

Sustainable Vegetable Systems



**Sustainable
Vegetable
Systems**

Quarterly Report - Programme Governance Group

Quarter 1, July – September 2022

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

- Data has continued to be collected from the 'Nui' ryegrass seed crops in Rotation 1 and 2 sown in Lincoln and the 50:50 mix of 'Asset' and 'Tama' ryegrass sown in Hawke's Bay Rotation 3
- 'Casper' cauliflower has been growing in Hawke's Bay Rotation 4, and a plan for sequential harvest to meet commercial standards has been developed
- Heavy rainfall in both Canterbury and Hawke's Bay has meant that there have been several leachate samples. We have adapted N management to the heavy rainfall conditions, attempting to minimise N losses

Workstream 1 - Trial crop rotations

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	... Oct	
Rotation 1	Wheat							Broccoli mid Feb				Fallow	Onions								Fallow	Cover crop (ryegrass)			
Rotation 2			Pak choi - Shanghai			Fallow	Cover crop (ryegrass / Oats)					Fallow			Potatoes - Fresh					Fallow	ryegrass				
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	... Dec	
Rotation 3														Onion								Cover crop (ryegrass)			
Rotation 4								Pak choi				Fallow	Lettuce			Peas				Fallow			Caul.		

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	Feb	Mar	Apr	May	Jun	
1	Cover Crop (ryegrass cut and carry)				Fallow							Onions							Fallow			Grass	
2	Barley (crop/cover crop)				Fallow							Onions resown						Fallow		Cauliflower			
3	Mustard				Fallow		Carrots									Fallow							
4		Potato			Fallow		Cauliflower				Fallow	Maize										Fallow	
5			Potato			Fallow		Onions										Fallow		Grass			
6		Maize silage						Fallow	Grass							Fallow	Cabbage				Fallow	Grass	
7			Pumpkin			Fallow			Grass		Fallow			Butternut Squash					Fallow				
8	Potato						Fallow	Wheat										Fallow					
9			Pumpkin				Fallow	Fallow	Turf grass									Fallow					

Workstream 2 – Crop rotations

Site No.	2022												2023
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
1		Fallow				Cover Crop (ryegrass cut and carry)							
2				Cauliflower				Fallow					
3							Onions						
4							Onions						
5				Grass							Potato		
6					Fallow	Grass				Fallow	Water melon		
7											Butternut squash		
8										peas (27th Sept)			
9		harv.	grass - sheep grazing									Broccoli (end Nov)	

Workstream 2 – Regional on-farm monitoring

- Field sampling is ongoing. Plant sample processing by the PFR laboratory for N content analysis is in the process of being shared.
- Monitoring continues at the 9 regional sites. By the end of September 3 sites remained in fallow. However, all sites were either in crop or about to be planted. The regional monitoring sites crop rotations are shown above.
- 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.
- An additional site, winter grown potato crop in Auckland, was added as an identified crop gap. This was planted in mid-June and will be harvested in November. Soil and plant samples were taken monthly and will continue through to the postharvest fallow period in December.

Workstream 3 – Farmer facing tool(s)

- Rezare completed their tool implementation pathway review and presented the findings to the SVS Project Governance Group in August.
- Three pathways are being followed:
 - 1. Open source – resulting in improved trust and transparency. A Software Development Kit (SDK) will facilitate this openness.
 - 2. Standalone visual interface. Having a functioning visual tool by the project's conclusion is an essential output. SVS will look to collaborate with Overseer around tool delivery options. This approach does not exclude others, including product groups, from developing solutions.
 - 3. Application Programming Interface (API). This is an essential component of the visual interface, while also allowing third parties to use the SVS model within their own in-house systems.
- The current tool is hosted internally by PFR. Making the tool externally available has raised intellectual property issues. This includes crop growth models, and access to soil and climate data. Collaboration between SVS and Overseer may overcome some of these IP issues. This was the subject of a Special PGG meeting in October to discuss the principles for collaboration.
- The aim is to have the externally accessible version of the tool ready for limited testing from May 2023.
- Discussions have begun with an external interface developer, although progress is subject to reaching agreement with Overseer on the most expedient pathway forward.
- It has been agreed by the Workstream 4 leadership team to put more emphasis on developing case studies. As the case studies can be developed using an internal version of the SVS tool, this is seen as a way to both engage with grower champions prior to the tool's release, while further refining the tool without the constraint of IP issues further delaying development.

Workstream 4 – Developing a change landscape

The 1st quarter saw a significant amount of dissemination work, reflected in both cash and in-kind expenditure.

- Filming & postproduction by Wanderly Media is completed as part of the Workstream 4 engagement activities. There are four videos now ready for release:
 - Quick N testing – how to guide
 - Project introduction and overview
 - Case studies/monitor sites. Greater understanding of the nitrogen cycle
 - Science story - trial sites to labs to modellers a grower's tool
- Vegetables NZ roadshows in Pukekohe (27th July), and Chch (4th August) included SVS presentations on N-Quick Tests, N-budgeting, and the tool.
- SVS held its first Reference Group meeting on the 28th July. Seventeen attended, including SVS chairman and programme manager, 3 growers, 3 regional councils, 4 industry representatives, Overseer, 3 industry supply/services, NZGAP, and PFR. Central govt. representation was unavailable.
- Vegetables NZ held a Nitrogen Management Workshop in Nelson (11th August). The focus areas being the preparation of N-budgets linked to FEPs, N-Quick Tests, and the new hotwater soil N mineralisation test. This workshop is being used as the template to build on for a regional roadshow next year.
- Andrew Barber presented on the purpose and progress of SVS at the NZ Agronomy symposium (31st Aug.)
- The first Community of Practice workshop was held in Lincoln on the 14th September with the purpose to increase the industries confidence and expertise in vegetable nitrogen understanding and modelling. The workshop included:
 - SVS overview, Workstream 2 overview, model & tool overview.
 - N budgets and worked examples. Open discussion and feedback
 - Agreement to develop grower case studies.
- NZ Grower articles:
 - July – FEPs linking to nutrient budgeting, by Andrew Barber
 - August – N soil testing, PFR - Mike Bears' N-mineralisation article
- Logic framing of programme is complete and proving to be a useful tool for road mapping and critical pathway development, which in turn will the improve strategic outcomes of SVS.
- FOLKL has now scoped the Phase 2 focus groups with the goal of assisting in tool/prototype testing and development.

1.2 Key highlights and achievements

- The first Reference Group meeting
- The analysis by Rezare on the tool development pathway options was completed, which then formed the basis of the PGG discussions in August
- The completion of four videos, which will be progressively released prior to Christmas
- The first Community of Practice meeting, with great grower engagement and a core of first case studies
- The Nelson nitrogen workshop, which now forms the template for future roadshows. This was very practice focused, including N-budgets, N soil testing – both N-Quick test and the N mineralisation (hotwater test). The outputs linked to Farm Environment Plan requirements and consequently council rules
- Data has been collected for ryegrass crops in Rotation 1, 2 and 3
- The good management N treatment of ryegrass crops in Rotation 1 and 2 have been evaluated at each side-dressing using soil mineral N content and rates have been adjusted based on these
- Cauliflower has been managed and grown in Rotation 4. Fertiliser management was adapted to the difficult growing conditions of constant rainfall. A plan for a sequential cauliflower harvest, to meet commercial standards has been developed.

1.3 Collaboration with other programmes (optional)

Red font is new text this quarter.

Project name	Industry lead / Researcher	Description	Link to SVS
Regenerative management systems for New Zealand vegetable production	SFFF Countdown NZ, Leaderbrand Produce	Countdown and Leaderbrand are working with Plant & Food Research to explore regenerative farming practices, into intensive vegetable production. The project will include composting, cover crops, and biodiverse perennial plantings.	PFR and growers – Leaderbrand. Crop residue breakdown.
Future Ready Farms	SFFF Ballance	This programme aims to trial and develop 12 farm nutrient technologies that will help meet national environmental targets for reducing greenhouse gas emissions, agricultural chemical use, and nutrient loss to waterways. Products and tools for reduction of nitrogen emissions from the horticulture [kiwifruit] and arable sectors are identified. [FRF's will collaborate with SVS, but not looking to develop vegetable focused tools]	Scott Champion (Ind. Chair)
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.	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. 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.	SVS sampling protocol includes the hot water (HW) test in both the trials and regional monitoring sites. Mike Beare (PFR) is involved in SVS through the Tech. Panel. 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.
Crop residue N project	VR&I, PNZ, FAR / PFR	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.	Essential for the nutrient budget. Direct industry and researcher connections. Some residues will be obtained from crops in Workstream 1.

Project name	Industry lead / Researcher	Description	Link to SVS
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.
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 in the vege rich sub-catchments of the Franklin aquifer.	HortNZ is working with AC.

Project name	Industry lead / Researcher	Description	Link to SVS
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.
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

- Ryegrass and cauliflower harvests will be completed, together with soil sampling in Workstream 1. The final ryegrass crop in Rotation 4 is to be sown
- Progressing an in-principles agreement with Overseer for model collaboration and tool hosting
- Engaging a tool interface developer
- Development of the beta version of the tool – including what the Entry Level looks like, data requirements, what modelling it draws on, and outputs
- Statistical analysis of outcomes in individual crops and across the rotation will continue
- N balance discussions and development will be ongoing, and data from Workstream 1 and 2 further evaluated for N balance development
- Model development ongoing. Scenario testing of data ongoing
- Technical Panel+ meeting in Wellington on minimum standards for what is a N-budget and soil N testing. What does Good and Best Management Practice look like?
- Collaborating with Horizons and Waikato Regional Council on a Risk Scorecard that has N-budgets and N-testing at their heart
- Engaging with MfE on their N Risk Tool
- Workstream 4 Leaders meeting in Wellington (18th October). Roadshow planning
- NZ Grower articles. A Quarterly Update and the many sources of variability, by Andrew Barber

1.5 Investment (Cash & In-kind)

Investment period	Co-investor contribution	MPI contribution	Total investment
During this quarter	\$0.168m	\$0.265m	\$0.433m
Programme to date	\$1.430m	\$3.3072m	\$4.736m