



Foundation for Arable Research  
Proposed Research Portfolio  
2019-2020

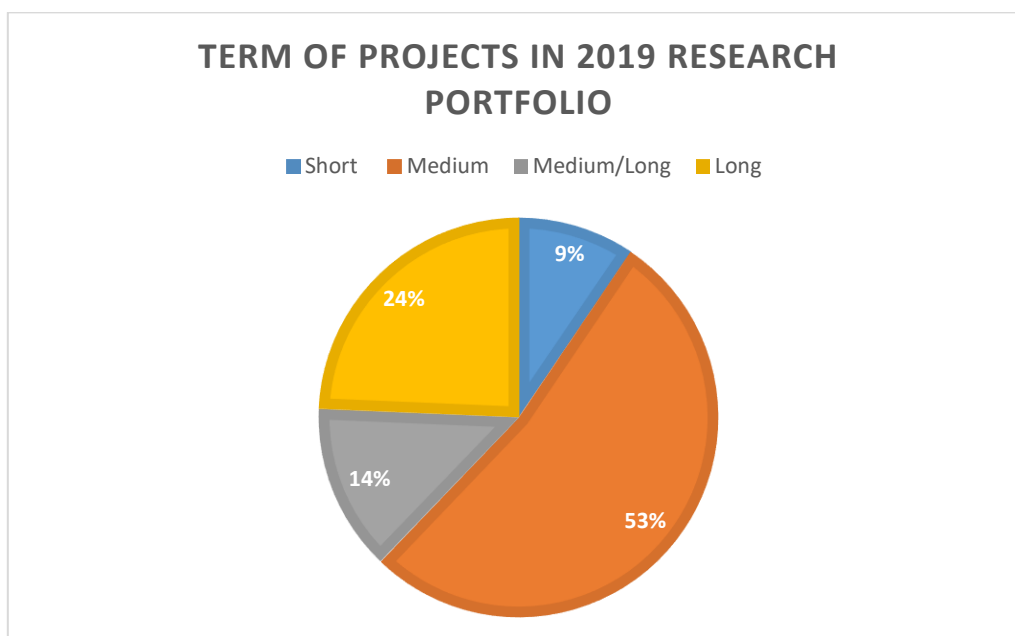
## FAR 2019 research portfolio

### Summary

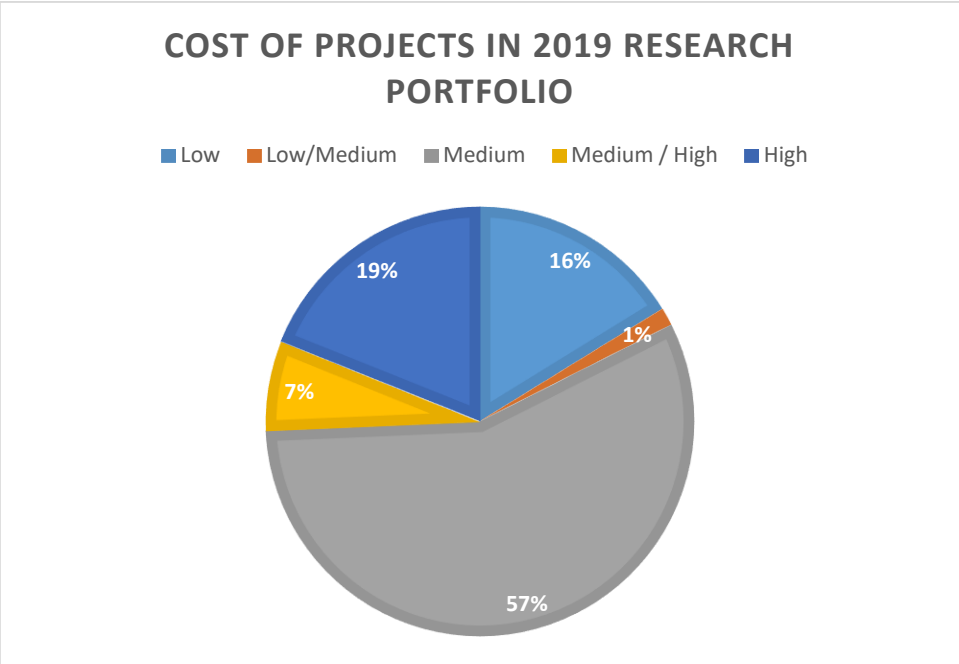
- 79 proposed projects are within the FAR 2019 research portfolio.
- 24 are projects with established contracts between FAR and other parties while 55 are project concepts for negotiation. The *contracted* status of projects is given in the description of individual projects.
- 16 are new project concepts while 83 are a continuation of existing projects. Several projects included within the 2019 FAR portfolio will finish by June 2019 and have been provided to show the balance of research at this time. The status of projects (*finishing* or *new*) is given in the description for individual projects to identify those finishing in June 2019 or those projects that are new for 2019.

### Composition of the research portfolio

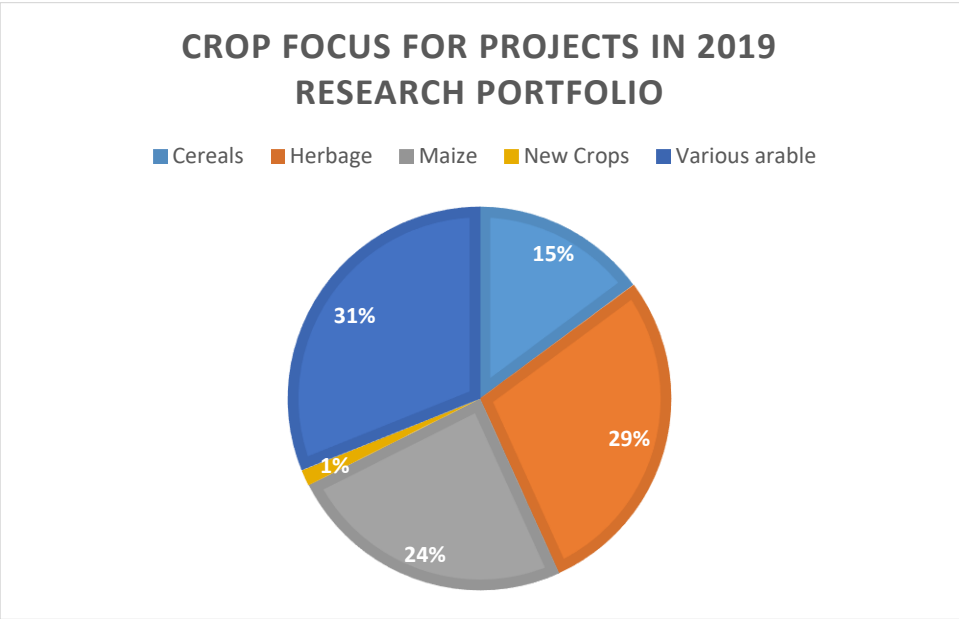
- Summary information on the composition of the research portfolio is provided below. It is important to note that the data below refer to the **number of projects in each category** and **not** the financial cost associated with the projects in each category.
- Detailed budgets for projects will be developed after approval of the portfolio by the ARGs and RDAC.
- Information on the composition of the FAR 2018 research budget is provided in an additional document for those who would like to understand how last year's financial investment associated the FAR Research portfolio was apportioned to particular crops or areas of work.
- The term (duration) of each 2019 project is categorised as either SHORT (1 year or less), MEDIUM (2-3 years) or LONG (3+ years). The Figure below shows the percentage of 2019 research projects within each of these categories.



- The estimated budget (including labour) for each 2019 project is categorised as LOW (<\$10K per annum), MEDIUM (\$10-50K per annum) or HIGH (>50K per annum). The Figure below shows the percentage of 2019 research projects within each of these categories.



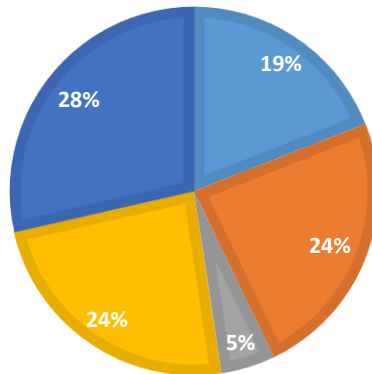
- The 2019 research portfolio is categorised by crop in the Figure below, which shows the percentage of projects focused on either cereals, herbage, maize, new crops or on various arable crops (such as those projects focused on farm environmental plans or ProductionWise).



- Those projects focused on herbage are further divided into those on Ryegrass, Cocksfoot, Plantain, Clover and Brassicas & Vegetables in the figure below.

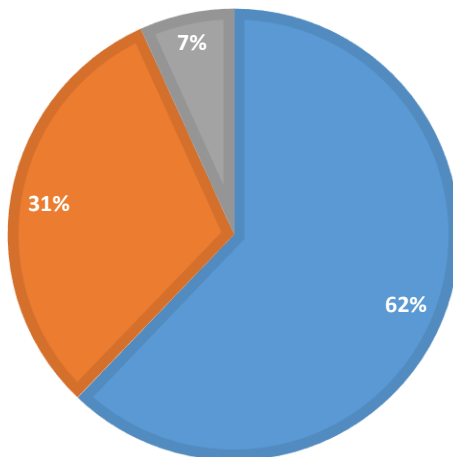
## CROP FOCUS FOR HERBAGE PROJECTS IN 2019 RESEARCH PORTFOLIO

■ Ryegrass   
 ■ Cocksfoot   
 ■ Plantain   
 ■ Clover   
 ■ Brassica & Vegetables



- Research projects on cereals are predominantly targeted to enhanced yield through improvement in cultivars and disease management.
- Research projects on maize are predominantly targeted to the identification and optimisation of cover crops and on use of reduced tillage systems for environmental benefits
- Research projects on Herbage are predominantly targeted towards improvement in seed production through the control of weeds, disease and plant development. They have largely been identified through a SIRC prioritisation process.
- A large proportion of projects have benefits across the arable sector nationally. Many of these projects are focussed on environmental compliance or on biosecurity issues.
- A small number of projects are/will explore the production of new crops such as sunflower and peanuts.
- Projects are also categorised in the figure below as those focused on productivity (i.e. yield), environmental and social best practice (i.e. Overseer development) and resilience of arable cropping systems (i.e. herbicide resistance management). These themes provide information on the targeted outcomes of the work, which are discussed in more detail in the detailed list of projects.

■ Productivity   
 ■ Environment   
 ■ Resilience



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## Proposed projects for 2019-2020

### Maximising productivity and value of cropping

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#### Cereals

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**Title:** Cereal cultivar evaluation

**Project Number:** A1902 - A1936

**Crop:** Barley and wheat

**Region:** Cereal growing

**Aim:** To determine cereal cultivar performance.

**Term of research:** Long

**What will be delivered?** Annual books delivered to growers with information on cultivar yield, disease resistance and other agronomic characteristics. A review of the CPT and its outcomes.

**Budget:** High

**Approach:** Field small plot trials in all cereal growing regions, disease nurseries and grain quality testing.

**Links to other projects and collaborations:** A1801 - A1835

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**Title:** Autumn sown oat cultivar performance

**Project Number:** AC1910

**Crop:** Oats

**Region:** Southland

**Aim:** To determine autumn sown oat cultivar performance.

**Term of research:** Medium

**What will be delivered?** Information on cultivar yield.

**Budget:** Small

**Approach:** Field small plot trials in Southland

**Links to other projects and collaborations:** C1810

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**Title:** Second year wheat cultivar performance

**Project Number:** AC1909

**Crop:** Wheat

**Region:** South Canterbury and North Otago



**Aim:** To determine cereal cultivar performance of second year wheat

**Term of research:** Long

**What will be delivered?** Information delivered to growers on cultivar yield.

**Budget:** Medium – High

**Approach:** Small plot field trial in South Canterbury and North Otago where second year wheat is more commonly included in a rotation.

**Links to other projects and collaborators:** A1901-A1935

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**Title:** 20 by 2020: 20 t/ha x 2020 high yielding feed wheat

**Project Number:** C1901, C1902, C1903 and C1904

**Crop:** Wheat

**Region:** Cereal growing

**Aim:** To increase feed wheat yields.

**Term of research:** Long

**What will be delivered?** Management strategies to increase wheat yields.

**Budget:** High

**Approach:** Screening wheat germplasm adapted to early sowing with high yield potential and testing selected cultivars in a sowing date trial for high yield. Trials run in Canterbury.

**Links to other projects and collaborations:** C1801, C1802, C1803 and C1804

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**Title:** Cereal disease management

**Project Number:** C1905, C1906, C1911, C1913, C1918, C1921 (fungicide programmes), C1908, C1912, C1916 (cultivar resistance); C1930 (Pathogen resistance) (*Contracted*); C1920 (Cereal rust pathotyping).

**Crop:** Wheat, Barley and Oats

**Region:** Cereal growing

**Aim:** To improve cereal grain yield and quality with optimal cereal disease management strategies.

**Term of research:** Long

**What will be delivered?** Management options for improved disease control. Influence of cultivar disease resistance on the disease management programme. Status of *Ramularia* and *Septoria* sensitivity to fungicides. Cereal rust pathotyping to alert farmers to new rust strains that could overcome cereal cultivar rust resistance.

**Budget:** High

**Approach** Field trials assessing a range of fungicide programmes and influence of cultivar resistance. Trials run in Canterbury and Southland. Laboratory analysis of pathogen sensitivity to fungicides.

**Links to other projects and collaborations:** C1805, C1806, C1811, C1813, C1818, C1821 (fungicide programmes), C1808, C1812, C1816 (cultivar resistance); C1730 (Pathogen resistance) (*Contracted*); C1820 (Cereal rust pathotyping).

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**Title:** SFF *Ramularia*: Minimising the threat to barley crops

**Project Number:** SFF C1826 (*Contracted*)

**Crop:** Barley

**Region:** Cereal growing

**Aim:** To develop the most effective joint agronomic and chemical control options for managing *Ramularia*.

**Term of research:** 2018-2021

**What will be delivered?** Information on *Ramularia* resistance to fungicides, barley cultivar resistance and effective fungicide programmes to control *Ramularia*.

**Budget:** Medium or High

**Approach:** Sensitivity of *Ramularia* isolates to fungicides tested. Barley cultivar tolerance to *Ramularia* assessed. Seed collected from farms tested for *Ramularia* and pot trial with infected seeds conducted. Barley fungicide programmes trials in Canterbury.

**Links to other projects and collaborations:** C1806, C1813, C1818.

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**Title:** SFF Managing BYDV in cereals sustainably

**Project Number:** SFF X1607 (*Contracted extension*)

**Crop:** Cereals

**Region:** Cereal growing

**Aim:** To develop BYDV management strategies for cropping farmers

**Term of research:** Medium

**What will be delivered?** Information on wheat crop tolerance to BYDV by growth stage.

**Budget:** Low as part SFF extension

**Approach:** Protect large plots to a range of growth stages and harvest with a weigh wagon.

**Links to other projects and collaborations:** None

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**Title:** MBIE Cereal endophyte

**Project Number:** MBIE G0702 (*Contracted*)

**Crop:** Cereals

**Region:** Cereal growing

**Aim:** To assess forage yield of endophyte-infected 'Rahu' rye compared to endophyte-free 'Rahu' rye. Assess pest and disease status in these field trials to determine if endophyte has reduced these pressures.

**Term of research:** Long (project expected to finish June 2022) – part of larger AgResearch project funded by MBIE, FAR, Grasslanz Technologies Ltd and GRDC.

**What will be delivered?** Growers have access to best management agronomic packages on use of endophyte cereals including interaction with agrichemicals.

**Budget:** Medium-High

**Approach:** Small plot trial work, insect population study, small scale pot study in Canterbury.

**Links to other projects and collaborations:** AgResearch

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**Title:** Grain storage pests

**Project Number:** X1608

**Crop:** Cereals

**Region:** Cereal growing

**Aim:** To determine resistance to pirimiphos methyl in pests of stored grain

**Term of research:** Long

**What will be delivered?** Information on insect resistance to pirimiphos methyl and strategies to cope with resistance should it be confirmed.

**Budget:** Low

**Approach:** Maintenance of existing insect colonies, collection of additional insect populations where resistance is suspected, resistance

**Links to other projects and collaborations:** This is an extension to the SFF programme SFF X1608 and will investigate grain storage issues in the North Island.

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**Title:** Nitrogen management in autumn sown milling wheat

**Project Number:** C1915, C1922.

**Crop:** Milling wheat

**Region:** Cereal growing

**Aim:** To improve cereal grain yield and quality with optimal nitrogen management strategies.

**Term of research:** Medium

**What will be delivered?** Information on nitrogen management in new commercial milling wheat cultivars

**Budget:** Medium

**Approach:** In 2018 two trials determined optimum N requirements for recently commercialised milling wheat cultivars with a small plot and weigh wagon trials. The 2019 proposed work will repeat those trials in Canterbury. A collaboration with the flour millers is being sought to include bake testing of wheat samples.

**Links to other projects and collaborations:** C1815, C1822.

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**Title:** Pre-harvest desiccation alternatives to glyphosate

**Project Number:** C1927

**Crop:** Cereals

**Region:** Cereal growing

**Aim:** To develop alternative cost-effective pre-harvest desiccation options to glyphosate in cereals

**Term of research:** Medium

**What will be delivered?** Information on the effectiveness of alternative pre-harvest desiccation options to glyphosate in cereals.

**Budget:** Medium

**Approach:** Small plot trial work in Canterbury with alternative desiccants and large scale windrowing trial in Southland.

**Links to other projects and collaborations:** C1635, C1827

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## Maize

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**Title:** Maize Hybrid Performance Trials

**Project Number:** M1901 (*Contracted*)

**Crop:** Maize

**Region:** Northern North Island and Southern North Island

**Aim:** Independent replicated maize hybrid evaluation

**Term of research:** Long

**What will be delivered?** Unbiased evaluation of maize hybrids across multiple sites and seasons

**Budget:** High

**Approach:** Eight plot trial across NZ. Replicated small plot trials. A review of the value of the MPT trials to the levy payer.

**Links to other projects and collaborations:** M1801, M1701, M1601, M1501. Collaborations: NZGSTA, Corson Maize Seed, HSR, SeedForce, CropSeed.

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**Title:** Long-term data analysis Neil Fisher

**Project Number:** M1913 (*New*)

**Crop:** Maize

**Region:** Northern North Island and Southern North Island

**Aim:** Undertake analysis of long-term data sets to investigate nutrient use, hybrid performance, yield, profitability etc. over the last 30+ years

**Term of research:** Short

**What will be delivered?** Economic analysis of maize crop yield and financial performance over 30+ years. Overarching analysis of comprehensive commercial maize grain data set dating back to the 1970's - what can we learn from it?

**Budget:** Low

**Approach:** TBC

**Links to other projects and collaborations:** AgResearch

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**Title:** Crop establishment NCRS

**Project Number:** M1904

**Crop:** Show long-term outcomes of changing maize establishment techniques

**Region:** Northern North Island and Southern North Island

**Aim:** Practical demonstration of different maize establishment techniques showing the effect on yield, GM and soil characteristics

**Term of research:** Long

**What will be delivered?** Multi-year comparison showing yield, GM and soil quality characteristics. Field example of establishment systems.

**Budget:** Low

**Approach:** Three treatment, replicated large scale plots, harvested by combine and weigh wagon.

**Links to other projects and collaborations:** M1804, M1902, M1915

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**Title:** SFF Transforming Variability to Profitability

**Project Number:** SFF X1412 (*Contracted extension*)

**Crop:** Various

**Region:** Northern North Island and Southern North Island

**Aim:** A simple way to integrate geospatial soil, plant and crop harvest characteristics to analyse profitability, and aid in decision making processes to improve profitability in future years. This will reduce the amount of wasted inputs entering the environment, as well as maximising profit.

**Term of research:** Long

**What will be delivered?**

- A "stocktake" of all commercially available Precision Agriculture tools available in NZ
- Development of a user-friendly system available to industry parties to allow integration and interpretation of different sets of geospatial data collected by the different Precision Agriculture technologies
- Improving the profitability of growers' land by undertaking the geospatial analysis as outlined above
- Increasing Input Use Efficiency by maximising the return from inputs, and also minimising the wastage of inputs on poor performing areas of the paddock
- Optimising inputs will reduce losses through leaching and non-target application to the environment
- Extensive extension activities to disseminate our findings

**Budget:** High

**Approach:** The project will involve four key tasks:

- The stocktake will involve a stocktake of current Precision Agriculture technologies available in New Zealand to assess variability in arable soils, crops and harvest yield and quality.
- The measurement of the most suitable current Precision Agriculture technologies will be used to undertake sensing of soil, crop and harvest characteristics on at least 100 hectares each of maize, barley, and potato crops.
- Analysis of results and relationships amongst the soil, crop canopy and yield data will then be assessed in three ways:
  - The most complex and accurate way of analysing the data is by using geospatial algorithms developed by Landcare Research;
  - By visually comparing maps to identify any obviously evident relationships and trends;
  - Using mapping software to establish zones of soil, plant and harvest characteristics and then comparing these zones with each other.
- Delivery of outcomes. Using these tools growers will be able to identify the most and least profitable areas of their crops, and the loss of profitability and the drivers of this performance.

**Links to other projects and collaborations:** X1912. Collaborations: MU, LAL, Landcare, Wilcox, PNZ, Ravensdown.

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**Title:** SFF Towards a sustainable & resilient future for maize

**Project Number:** SFF M1905 (*Contracted*)

**Crop:** Maize

**Region:** Northern North Island and Southern North Island

**Aim:** Provide on-farm research and extension tools required to successfully establish fit for purpose cover crops under maize silage and grain rotations.

**Term of research:** Long

**What will be delivered?**

- **Establish on-farm trial sites** 3 or 4 on-farm trials will be established each year to test and then demonstrate how the selection and establishment of cover crops after maize grain and silage affect N losses. In Years 1 and 2 trials will be based in the Waikato given this is where the majority of maize is grown (also proximity for intensive monitoring); in Year 3 the project team will consider demonstration trials in other regions to extend and share key principles more broadly;
- **Conduct survey to establish N use on-farm** 40-60 maize growers will be surveyed to quantify current conversion efficiencies across the industry, both in the Waikato and in other regions. Field estimates of residual mineral N/mineralisation at the start of the season will also be obtained, either from the farmers or through direct measurement;
- **Field days and industry presentations** Field days will be conducted at trial sites for farmers and industry to view first-hand the effect of cover crop selection and establishment methods on environmental outcomes. These events will be used to test the practicalities of practices and ensure what is recommended by the end of the project is readily adoptable across a wide range of systems and potential risks are minimised. Industry presentations will also be offered at big national events like Pioneer's Consultants', Contractors' and Growers' Conferences and FAR's Crops Expo;
- **Annual project reports** written reports will detail trial activity, results to date, extension activities and progress towards enduring best management guidelines;

- **Best Management Guide** A 'Best Management Guide for Sustainable Maize Rotations' will be compiled summarising key findings from the project, including guidelines to minimise residual soil N in autumn (i.e. following maize) and to mop up this N using cover crops.

**Budget:** High

**Approach:**

**Objective 1:** Reduce environmental impacts after maize grain and silage crops using cover crops.

- Demonstrate the benefits of cover crops following maize silage and grain crops through a mix of replicated and demonstration trials on commercial farms in Waikato.
- Compare cover crop types and methods of establishment.
- Measure key performance indicators of cover crops, e.g. growth and N uptake.

**Objective 2:** Quantify N leaching losses from exemplar maize systems

- Measure N losses under a maize cropping system using a widely used and proven apparatus.
- Collate and analyse information from surveys distributed to 40 maize growers to determine an industry benchmark on nutrient usage efficiency of maize crops.
- Demonstrate that a low footprint is possible under a maize system by comparing the best performing rotation as identified in objective 1 to industry standard practice (as determined through farmer surveys).

**Links to other projects and collaborations:** M1906, M1910, M1907, M1912, M1922, X1924, X1932, X1933, X1934, X1935, X1947. Collaborations: GTL, PLANT & FOOD RESEARCH.

**Title:** NCRS perennial clover and maize silage systems

**Project Number:** M1908

**Crop:** Various

**Region:** Northern North Island and Southern North Island

**Aim:** Assess perennial management of clovers and annual maize production in them

**Term of research:** Medium

**What will be delivered?** Practical results and guidelines for maize production by incorporating perennial clover crops to fix nitrogen, stabilise soil and control weeds.

**Budget:** Medium

**Approach:** Replicated large scale strips (approximately 0.25 ha each) to evaluate systems of cover crops and summer crop systems

**Links to other projects and collaborations:** X1924, X1902, M1807, M1802, M1804, M1806, X1932, X1934, X1935, M1905. Collaborations: AgResearch

**Title:** NCRS value of various catch and cover crops to maize silage systems

**Project Number:** X1934

**Crop:** Various

**Region:** Northern North Island and Southern North Island

**Aim:** Assess the management of various CC with maize silage following them

**Term of research:** Medium

**What will be delivered?** Practical results and guidelines for maize DM production, incorporating various winter cover crops to mitigate nitrogen losses, stabilise soils and suppress weeds.

**Budget:** Medium

**Approach:** Replicated large scale strips (approximately 0.25 ha each) to evaluate systems of cover crops and summer crop systems.

**Links to other projects and collaborations:** X1924, X1902, M1807, M1802, M1804, M1806, X1933, X1932, X1935, M1905. Collaborations: AgResearch

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**Title:** NCRS value of various cover crops to maize grain systems

**Project Number:** X1935

**Crop:** Various

**Region:** Northern North Island and Southern North Island

**Aim:** Assess the management of the use of various CC into long-term maize grain systems

**Term of research:** Medium

**What will be delivered?** Practical results and guidelines for maize grain production, incorporating various cover crops over winter.

**Budget:** Medium

**Approach:** Replicated large scale strips (approximately 0.25 ha each) to evaluate systems of cover crops and summer crop systems.

**Links to other projects and collaborations:** X1924, X1902, M1807, M1802, M1804, M1806, X1933, X1934, X1932, M1905. Collaborations: AgResearch

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**Title:** A review of the use of cover crops in maize production and other arable systems

**Project Number:** X1949 (New)

**Crop:** Maize and other arable crops

**Region:** Northern North Island and Southern North Island (plus others)

**Aim:** To identify a matrix of cover or catch crops and their functions when used in a rotation for maize production or in other cropping systems across New Zealand.

**Term of research:** Short

**What will be delivered?** A gap-analysis for 'cover' cropping in maize and other arable cropping systems.

**Budget:** Low

**Approach:** A review and gap analysis of 'cover' crops and their uses in a maize rotation as well as in the production of other arable crops.

**Links to other projects and collaborations:** M1905, M1807, M1910

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**Title:** Slugs and cover crops

**Project Number:** M1917 (New)

**Crop:** Maize and other arable crops

**Region:** Northern North Island and Southern North Island (plus others)

**Aim:** To identify a matrix of cover or catch crops and their functions when used in a rotation for maize production or in other cropping systems across New Zealand.

**Term of research:** Short

**What will be delivered?** A gap-analysis for 'cover' cropping in maize and other arable cropping systems.

**Budget:** Low

**Approach:** A review and gap analysis of 'cover' crops and their uses in a maize rotation as well as in the production of other arable crops.

**Links to other projects and collaborations:** M1905, M1807, M1910

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**Title:** Herbicide interactions with cover crops

**Project Number:** X1902

**Crop:** Various

**Region:** Northern North Island and Southern North Island

**Aim:** Identify safe herbicide/cover crop interactions

**Term of research:** Medium

**What will be delivered?** Recommendations for safe herbicide use in cover crops

**Budget:** Medium

**Approach:** Pot trials

**Links to other projects and collaborations:** M1807. AgResearch.

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**Title:** AGR weed suppression following cover crops

**Project Number:** M1907 (*Contracted*)

**Crop:** Maize

**Region:** Northern North Island and Southern North Island

**Aim:** Long-term evaluation of potential reduction in herbicide use following cover crops

**Term of research:** Long

**What will be delivered?** Practical guidelines for reducing herbicide use by the establishment of different cover crop system. AgResearch

**Budget:** Medium

**Approach:** Ongoing multi-year, replicated plot trials run by AGR

**Links to other projects and collaborations:** M1807, X1902. Collaborations: AGR.

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**Title:** Cover crop termination

**Project Number:** X1924 (New)

**Crop:** Various

**Region:** Northern North Island and Southern North Island

**Aim:** Assess various methods and timing of CC termination and impact on nitrogen availability

**Term of research:** Medium

**What will be delivered?** Recommendations of best practice to handle cover crop termination - chemical and mechanical

**Budget:** Low

**Approach:** Replicated large plot trials evaluating different termination methods and timing on cover crops prior to maize establishment.

**Links to other projects and collaborations:** X1934, X1935, M1906.

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**Title:** AmaizeN software refresh

**Project Number:** M1909

**Crop:** Maize

**Region:** Northern North Island and Southern North Island

**Aim:** Final push to get AmaizeN back in use! Confirm soil parameters, test and publish

**Term of research:** Short

**What will be delivered?** Real-time user interface to use AmaizeN.

**Budget:** Medium

**Approach:** Work with PLANT & FOOD RESEARCH (and possibly others) to ensure we have correct soil parameters, then test system and release, possibly in conjunction with Balance, Ravensdown, NZFQC.

**Links to other projects and collaborations:** M1809. Plant & Food Research, Ballance, Think.

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**Title:** Maize Action

**Project Number:** M1903

**Crop:** Maize

**Region:** Northern North Island and Southern North Island

**Aim:** Regular in-season maize newsletter

**Term of research:** Short

**What will be delivered?** Regular in-season maize newsletter with up-to-date information for growers

**Budget:** Low

**Approach:** Not applicable

**Links to other projects and collaborations:** M1803, M1703. Collaborations: PLANT & FOOD RESEARCH

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## Herbage

**Note:** The following are projects identified by the SIRC Technical Group as a high priority

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### Ryegrass

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**Title:** A review of weed control of grass weeds in ryegrass.

**Project Number:** H1905

**Crop:** Ryegrass

**Region:** Southland, North Otago, Canterbury, Manawatu, Wairarapa

**Aim:** To improve weed control and reduce seed lot contamination by annual grass weeds and volunteer cereals in ryegrass.

**Term of research:** Medium

**What will be delivered?** Management strategies and herbicide options to reduce/control these weed problems.

**Budget:** Medium

**Approach:** A gap analysis on regional management of grass weeds across New Zealand's arable production areas with a particular focus on herbicide resistance. Arable Updates on the management of key grass weeds such as Vulpia, Poa and cereals.

**Links to other projects and collaborations:** H1806

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**Title:** Ryegrass seed harvest strategies to reduce seed loss.

**Project Number:** H1906 (New)

**Crop:** Ryegrass

**Region:** Southland, North Otago, Canterbury, Manawatu, Wairarapa

**Aim:** To improve seed yield by reducing harvest losses

**Term of research:** Medium

**What will be delivered?** Management strategies to reduce harvest loss.

**Budget:** Medium

**Approach** (overarching methodology): Using farmer equipment throughout Canterbury utilising large plot (>0.25 ha plots) with weigh wagon trials to investigate options such as irrigation prior to windrowing or the use of "pusher" technology to lodge crops close to harvest.

**Links to other projects and collaborations:** H1706, H1707

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**Title: Disease management**

**Project Number:** H1901, H1902, H1903, H1904.

**Crop:** Ryegrass

**Region:** New Zealand

**Aim:** To improve seed yield and seed quality with improved prediction of stem rust occurrence, improved ergot control and reduced light seed from take-all/*Fusarium*.

**Term of research:** Long

**What will be delivered?** Stem rust prediction tool that may reduce fungicide use, improved understanding of ergot biology and fungicide options for ergot control, reduced light seed yield losses from take-all with biological control seed treatments.

**Budget:** High

**Approach:** Field trials throughout North, Mid and South Canterbury with nil, grower and model threshold treatments at 3 locations with detailed weather (canopy temperature and leaf wetness) data to further validate the stem rust model.

**Links to other projects and collaborations:** H1715 (stem rust) and H1819, H1820, H1821.

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**Title: Grass and Clover Seed Production Extension**

**Project Number:** H1908, H1909 and H1910

**Crop:** Ryegrass, cocksfoot, white clover, red clover

**Region:** North Otago, Canterbury, Marlborough, Manawatu, Wairarapa, Hawkes Bay

**Aim:** To improve growers decision making on critical issues in seed crop management

**Term of research:** Long

**What will be delivered?** Field meetings in seed crops especially prior to closing, with meetings in Hawkes Bay, Wairarapa, Marlborough, Darfield-North Canterbury; Mid-Canterbury and South Canterbury.

**Budget:** Medium

**Approach:** Farmer field meetings at appropriate times in spring.

**Links to other projects and collaborations:** H1808, H1812 and H1813.

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**Cocksfoot**

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**Title: Herbicide tolerance and cultivar interaction in 1<sup>st</sup> and 2<sup>nd</sup> year cocksfoot**

**Project Number:** H1911

**Crop:** Cocksfoot

**Region:** Southland, North Otago, Canterbury, Manawatu, Wairarapa

**Aim:** To compare herbicide tolerances of cocksfoot cultivars with ryegrass and hairgrass as weeds, in both 1<sup>st</sup> year autumn sown and 2<sup>nd</sup> year cocksfoot.

**Term of research:** Medium

What will be delivered? New herbicide options for control of grass and broadleaf weeds and knowledge of variation in herbicide tolerance of cocksfoot cultivars.

**Budget:** Medium

**Approach:** 1<sup>st</sup> year trial at Kowhai-Lincoln. Cultivars provided by SIRC members (maximum of 2 per company) sown in late February in single rows. Replicated three times with 15 herbicide treatments, based on the results of the 2018/19 trial at Chertsey (H18-01). 2<sup>nd</sup> year crop at Chertsey with 11 cultivars, up to 12 herbicide treatments will be evaluated. Seed yield potential assessed via seed head density count.

**Links to other projects and collaborations:** H1801

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**Title: Understanding seed yield responses to irrigation and impacts of PGR burn under dryland and irrigation**

**Project Number:** H1912 and H1913

**Crop:** Cocksfoot

**Region:** Southland, North Otago, Canterbury, Manawatu, Wairarapa

**Aim:** To understand water stress effects on seed yield and interaction of water stress and PGR foliar burn effect

**Term of research:** Medium

**What will be delivered?** Information to growers on critical irrigation times and the impact of water stress on yield and PGR leaf burn.

**Budget:** Medium/ High

**Approach:** Plot trials with three replicates (PGR leaf burn) in 2<sup>nd</sup> year Savvy and Greenly irrigated and dryland at Chertsey and four replicate plot trial with trickle tape and 7 irrigation treatments in 23<sup>rd</sup> year Savvy at Chertsey.

**Links to other projects and collaborations:** H1703, H1705, H1604, H1803 and H1808.

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**Title: Understanding the causes of seed yield failure in cocksfoot**

**Project Number:** H1914 (New)

**Crop:** Cocksfoot

**Region:** Canterbury

**Aim:** To understand the causes of 2018/19 seed yield failure and impacts of disease and pollination/seed set on yield failure.

**Term of research:** Medium

**What will be delivered?** Information to growers on cocksfoot diseases and factors that can depress seed yield

**Budget:** Medium – High

**Approach:** Review foliar and root samples for disease pressure, weather data and crop inputs from the Canterbury region to determine a likely explanation and if it requires further investigation set up experimental work.

**Links to other projects and collaborations:** H1803, H1808.

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**Title: Understanding autumn versus spring nitrogen requirements for optimum seed yields in multi-year grass seed crops**

**Project Number:** H1915 (New)

**Crop:** Cocksfoot

**Region:** Canterbury

**Aim:** To understand optimum autumn and spring N requirements of multiyear seed crops.

**Term of research:** Medium

**What will be delivered?** Information for growers to make informed N timing and rate decisions.

**Budget:** Medium – High

**Approach:** Preliminary work (2016-2018) in cocksfoot showed less spring N was required for optimum seed yields than was used by growers. In 2018/19 two trials (H1811) in cocksfoot at Methven determined optimum spring N requirements with plot and weigh-wagon trials. The 2019/20 plot trials in farmer's fields (mid-Canterbury) will include variable autumn and spring rates.

**Links to other projects and collaborations:** H1811, H1705, H1604. Builds on collaborations with Oregon State University

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**Title: Understanding the basic physiology of grass seed crops (PhD)**

**Project Number:** H1817 (*Contracted*)

**Crops:** Ryegrass and Cocksfoot

**Region:** Southland, North Otago, Canterbury, Manawatu, Wairarapa, Hawkes Bay

**Aim:** To understand the mechanisms of crop development in various cultivars of ryegrass and cocksfoot

**Term of research:** Medium

**What will be delivered?** General information about which environmental stimuli lead to crop development in different cultivars and interactions with tiller age allowing for better timing of crop inputs. Research capability for the industry.

**Budget:** medium (including labour etc)

**Approach:** Using field plots and controlled growth chambers, different cultivars will be closely monitored for key developmental timings of 'double ridge' and 'terminal spikelet' to determine when and why different cultivars flower.

**Links to other projects and collaborations:** H1616, H1817.

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**Plantain**

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**Title: Plantain seed production – weed control**

**Project Number:** H1916, H1917.

**Crop:** Plantain

**Region:** North Otago, Canterbury

**Aim:** To understand crop management requirements of early and late flowering plantain cultivars including sowing date, defoliation, weed control, disease management, seed development and harvesting.

**Term of research:** Medium – Long

**What will be delivered?** Information for growers to improve crop management and seed yield of plantain.

**Budget:** Medium

**Approach:** Preliminary work H1802 (2018/19) compared three sowing dates for three cultivars, thermal time development, seed development and closing dates (1 cultivar). The proposed work in replicated plot trials at Lincoln Kowhai will build on this initial work.

**Links to other projects and collaborations:** H1802

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**Clover**

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**Title: Weed management in legume seed crops**

**Project Number:** H1918

**Crop:** White and red clover

**Region:** North Otago, Canterbury, Manawatu, Wairarapa, Hawkes Bay

**Aim:** To improve weed control in white and red clover using new herbicides and mixtures to control emerging weeds and replace herbicides that are been withdrawn from the market.

**Term of research:** Medium – Long

**What will be delivered?** Management options for weeds that cause dressing loss and competition and emerging weed species, especially alternative herbicides for Jaquar (to be withdrawn from the market).

**Budget:** High

**Approach:** Field trials at Chertsey and/or in farmer's fields to control sowthistle and potentially beaked parsley. A review of Dock control in clover.

**Links to other projects and collaborations:** H1809 field trials at Chertsey and Barrhill.

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**Title: Pest management in red clover**

**Project Number:** H1921

**Crop:** Red clover

**Region:** Southland, North Otago, Canterbury, Manawatu, Wairarapa, Hawkes Bay

**Aim:** To manage new and established insect pests with predators and IPM approaches

**Term of research:** Medium – Long

**What will be delivered?** Develop integrated pest management (IPM) programme for seed growers to manage red clover case bearer (RCCB) and thrips.

**Budget:** Medium

**Approach:** In Canterbury and with AgResearch (Scott Hardwick) we will monitor RCCB with pheromone traps and the development of thrips and predators and impacts of insecticides on both pests and predators.

**Links to other projects and collaborations:** H1711, H1815

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**Title:** Crop architecture effects on white clover seed yield

**Project Number:** H1920 (New)

**Crop:** White clover

**Region:** Canterbury

**Aim:** To improve light interception during stolon extension

**Term of research:** Medium – Long

**What will be delivered?** Management options for reducing crop bulk and shading to encourage stolon extension (flowering requires leaf production)

**Budget:** Medium

**Approach:** Field trials at the Chertsey arable site and in grower paddocks to re-evaluate clover management of modern cultivars in higher input systems (higher Olsen P, irrigation) of current arable farms. Row spacing is one variable, plus bulk suppression to reduce shading and encourage stolon extension.

**Links to other projects and collaborations:** Linkage H1809, H0512

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**Title:** Clover harvest management and combine speed

**Project Number:** H1907 (New)

**Crop:** White clover

**Region:** Southland, North Otago, Canterbury, Manawatu, Wairarapa, Hawkes Bay

**Aim:** To quantify optimum harvest approaches for different crop bulk scenarios and combine harvest speeds and approaches to harvest

**Term of research:** Medium - Long

**What will be delivered?** Management options for improved clover harvest outcomes.

**Budget:** Medium

**Approach:** Field trials in Canterbury with replicated plots and/or weigh-wagon large plots. Linkages to Gentos Argentina who are also evaluating combine speed in white clover.

**Links to other projects and collaborations:** H1706



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**Title: International Collaboration**

**Project Number:** H1922, H1923 (New)

**Crops:** Grass and clover seed

**Regions:** National

**Aim:** To maintain linkages with key international seed research partners in Denmark, Oregon and Argentina.

**Term of research:** Long

**What will be delivered?** Knowledge of leading research internationally as well as important collaborative networks

**Budget:** medium (including labour etc)

**Approach:** Maintain international collaboration with Oregon and Argentina with joint parallel research projects around mutual benefit projects, including nutrient uptake, PGR responses, slug management and harvest losses. This year's trial will examine closing dates for ryegrass using PGRs.

**Links to other projects and collaborations:** H1805, All projects

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**Brassica and other vegetables**

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**Title: Weed control in vegetable seed crops**

**Project Number:** B1901

**Crop:** Beets

**Region:** Canterbury

**Aim:** To control weeds currently poorly controlled by current managements, including mallow, pansy

**Term of research:** Medium – Long

**What will be delivered?** Management options for improved weed control in vegetable seed crops.

**Budget:** Medium (including labour etc)

**Approach:** Field-based trials in Canterbury with replicated plots in fields of beets, including timings and rates of Hammer Force. Builds on 2018/19 study (B1806).

**Links to other projects and collaborations:** B1609, B1406, P1303, B1806

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**Title: Disease control in vegetable seed crops**

**Project Number:** B1902 & B1904

**Crop:** Radish, brassicas and Beets

**Region:** Southland, North Otago, Canterbury, Manawatu, Wairarapa, Hawkes Bay

**Aim:** To control diseases/pathogens such as white blister, *Pseudomonas*, blackleg, *Phoma* and rusts in radish and beet seed crops

**Term of research:** Medium – Long

**What will be delivered?** Management options for improved disease control in vegetable seed crops that meet fungicide resistant management strategy guidelines.

**Budget:** High

**Approach:** Field-based trials with replicated plots in fields of radish and beets, Builds on 2018/19 study and previous studies in radish (B1807) and beets (B1806). Review of white blister research and gap analysis.

**Links to other projects and collaborations:** B1705, B1706, B1606, P1310, B1807 & B1808.

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**Title:** Brassica harvesting with “Pusher” technology

**Project Number:** B1905

**Crop:** Brassica – probably using OSR as a model crop

**Region:** Southland, North Otago, Canterbury, Manawatu, Wairarapa, Hawkes Bay

**Aim:** To reduce harvest losses in adverse wind events and reduce reliance on using desiccants at harvest.

**Term of research:** Medium

**What will be delivered?** Information for growers to reduce harvest loss risk and reliance on desiccant chemicals

**Budget:** Medium

**Approach:** This project will continue work (project B1803: 2018/19) in a pusher trial in OSR in South Canterbury using large plots and the weigh-wagon assessments of yield and vacuum sampling for harvest loss. Treatments will include windrowing too.

**Links to other projects and collaborations:** B1803, B1801

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**Title:** Brassica N & S nutrient requirements

**Project Number:** B1906

**Crop:** Brassica – possibly using OSR as model

**Region:** Southland, North Otago, Canterbury, Manawatu, Wairarapa

**Aim:** To winter/spring N & S requirements to achieve optimum yields and seed quality with low N losses.

**Term of research:** Medium – Long

**What will be delivered?** Information for growers to improve N management and minimise N loss and background information for Overseer model.

**Budget:** Medium

**Approach:** Preliminary work (2018/19) using OSR in South Canterbury compared 12 N strategies with 6 N rates and 2 timings (green bud and yellow bud) showed an optimum spring applied N of 116 kg/ha. The 2019/20 trial will look at N & S nutrition and mass balance N uptake and N return in residues.

**Links to other projects and collaborations:** B1812, P0806, B1802

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**Title:** Bird management robot “Aviator”

**Project Number:** X1821 (*Contracted*)

**Crops:** Vegetable seeds and brassica forage seed

**Region:** Southland, North Otago, Canterbury, Manawatu, Wairarapa, Hawkes Bay

**Aim:** To field test the robot developed by engineering students at Canterbury University (CU)

**Term of research:** Medium

**What will be delivered?** A bird scaring mobile robot technology that can be commercialised to seed growers

**Budget:** medium (including labour etc)

**Approach:** Final year engineering students at Canterbury University over 2017-2019 have developed a robot with onboard navigational and bird detection capability. In 2020 the work will focus on field testing the robot (project managed by Ivan Lawrie)

**Links to other projects and collaborations:** None

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**Title:** SFF Alternative pollinators

**Project Number:** SFF B1816 (*Contracted*)

**Crop:** Carrot, radish and forage & vegetable brassicas

**Region:** Southland, North Otago, Canterbury, Manawatu, Wairarapa, Hawkes Bay

**Aim:** To find pollinators to supplement honeybees to reduce pollination costs and vulnerability of relying on one pollinator species.

**Term of research:** Medium – Long

**What will be delivered?** Information for seed growers on alternative pollinator raising and management.

**Budget:** Medium

**Approach.** With Plant & Food Research research team and SIRC partners evaluate field-based drone fly multiplication systems and pollination efficacy outcomes in at least two crops (carrot and radish) in Canterbury.

**Links to other projects and collaborations:** X0813, P0817, P0505, MBIE G1304

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**Title:** MBIE From bee minus to bee plus

**Project Number:** MBIE G1304 (*Contracted*)

**Crop:** Clover, Brassica

**Region:** Southland, North Otago, Canterbury, Manawatu, Wairarapa, Hawkes Bay

**Aim:** Development of a bumblebee rearing system and understanding of floral volatiles associated with attractants for honey bee pollination.

**Term of research:** Medium – Long

**What will be delivered?** A bumblebee rearing system as well as attractants to assist in pollination.

**Budget:** Low

**Approach.** Assistance to PLANT & FOOD RESEARCH.

**Links to other projects and collaborations:** PLANT & FOOD RESEARCH; SFF B1816.

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**Title:** Crop Action

**Project Number:** X1951 (New)

**Crop:** Arable crops with the exception of maize

**Region:** All cropping regions

**Aim:** Regular in-season crop newsletter

**Term of research:** Short

**What will be delivered?** Regular in-season maize newsletter with up-to-date information for growers

**Budget:** Low

**Approach:** Not applicable

**Links to other projects and collaborations:** None

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## Arable cropping meets environmental and social best practice

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**Title:** SFF Telling the farming story

**Project Number:** SFF X1845 (*Contracted*)

**Crop:** Various

**Region:** Canterbury and Otago

**Aim:** The project is celebrating good management practices associated with irrigation in Canterbury and Otago catchments

**Term of research:** Medium

**What will be delivered?** Workshops with national and regional governments, articles and publications on regional successes.

**Budget:** Low

**Approach:** Irrigation NZ working with catchment groups to capture stories on GMP and informing on progress

**Links to other projects and collaborations:** Smart tools and Tips (SFF X1844), MBIE Maximising value of Irrigation G1303.

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**Title:** SFF The Environmental Benefits of Arable Feeds

**Project Number:** SFF X1820, SFF 405545 (*Contracted*)

**Crop:** Grains and cereal silages

**Region:** National

**Aim:** To assess the environmental benefits of including grains and cereal silages in the dairy diet. With the ultimate goal of promoting the benefits of a mixed diet for dairy cows and more grain sales to dairy farmers.

**Term of research:** Medium (Two years, beginning July 2018)

**What will be delivered?** LU modelling results (Mindy) for mixed diets from 4 case study farms. Economic and Overseer FM modelling of the mixed diets.

A set of guidelines for mixed diet feeding using arable crops that can reduce nitrate leaching and nitrous oxide emissions,

The expected outcome is protecting the resilience and integrity of our major export sector

**Budget:** Medium

**Approach:** Livestock farming systems in New Zealand are under public scrutiny for their potential impacts on water quality and contribution to climate change.

Grazing of typical New Zealand pastures produces high levels of urinary N, the major contributor to nitrate leaching and a potential source of nitrous oxide emissions.

Current research suggests that multiple tactics can be used for mitigation, including changes to animal genetics, changes in pasture composition and the inclusion of lower protein feeds as part of the diet, including grains and silage from cereal and maize crops.

Four case study farms have been found. These farms are using a range of diets for dairy herds which include grains and silages (grass and cereals).

Standardised feed quality data will be used in initial simulations of the case study farms with typical diets and base information for animal metrics using the Mindy cow model. (MINDY, is a mathematical, mechanistic and dynamic simulation model of the diurnal grazing pattern of a dairy cow.

Examine the effect of physical parameters such as kernel size and moisture of grains, chopping length of silage as well as nutritional quality parameters of the feed material used on the case study farms and evaluate the impact of changed feed N composition on the N dynamic in the Mindy cow model.

- Overseer FM modelling will be used to estimate annual nitrogen leaching losses to water from the case study farms. Comparisons of leaching losses will be made between the different dietary combinations used on-farm.
- Farmer workshops to educate suppliers and users on the environmental and financial impact of incorporating more grain and maize and whole crop silage in their livestock diets.
- A FAR publication on guidelines for feeding arable supplements is disseminated jointly with Dairy NZ.
- Findings from the whole farm model comparing the different feeding regimes and their impact on the environment are presented at least one major national conference. (e.g. FAR Conference, South Island Dairy Event, NZ Institute for Primary Industry Management conference)

**Project Partners** Lincoln University, Dairy NZ, and NZGSTA

**Links to other projects and collaborations:** Forages for Reduced nitrate leaching

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**Title:** Environmental impacts of arable farms

**Project number:** X1841 (*Contracted*)

**Crop:** Environment

**Region:** National

**Aim:** There is a need nationally to be able to report on the impact of the cropping sector on the environmental (on soils, greenhouse gases, N leaching & ground and surface water quality, sediment loss from farms, efficient nutrient use etc). The aim of the LCA (lifecycle analyses) and C neutral report is to develop a crop rotation LCA methodology and to quantify emissions across case study rotations. This will allow a sensitivity analyses to be carried out quantifying the impact of on-farm mitigations to strengthen key messages to farmers.

**Term of research:** Short

**What will be delivered?** Once the methodology of agricultural life cycle assessments for crop rotations have been completed the key messages about where the best returns on-farm can be received to reduce greenhouse gas emissions across a rotation will be delivered.

**Budget:** Medium

**Approach:** Develop crop rotation LCA methodology. Complete two life cycle analyses (on and off-farm) from two case study arable farms over three years of the rotation. Carry out a sensitivity analyses to quantify the impact of on-farm mitigations to strengthen key messages to farmers.

**Links to other projects and collaborations:** X09/10 Carbon Footprinting of NZ Arable Production (Andrew Barbers report); FAR nitrous oxide sampling at Chertsey and NCRS X17-27. FAR Australia has done work in this space.

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**Title: MfE Protecting our Groundwater- Measuring and Managing Diffuse Nutrient Losses from Cropping Systems (aka - The fluxmeter network).**

**Project number:** X1801 (MfE contract) (*Contracted*)

**Crop:** Arable and vegetable cropping systems

**Region:** National

**Term of research:** Long (2014-2021)

**Aim:** To collect information about nutrient losses from cropping rotations. To use this information to explore these losses and improve our understanding about reducing the environmental risks associated with these losses with the implementation of good management practices.

**What will be delivered?** A unique set of data about nutrient losses from cropping systems. A better understanding of what can and can't be managed with respect to the farm's biophysical characteristics and the suite of management practices available to the farmer.

**Budget:** High

**Approach:** The fluxmeter network was installed on 12 host farms in 4 regions in 2014. Drainage and nutrient loss information has been collected since then and will be collected up to the end of 2020. This effort will provide a unique data set of the nutrient losses associated with the full term of many cropping rotations under a range of different seasonal effects. The project began under a 3 year MPI SFF contract and was then successfully re-contracted to MfE as a Fresh Water Improvement fund project.

In the first 3 years, the project's focus was on installation of the fluxmeters and data collection.

Drainage volume and nitrogen and phosphorus losses are measured and a suite of information about the crop and soil n status is collected as each crop in the rotation is harvested. At the end of SFF project, PLANT & FOOD RESEARCH completed a technical review of the performance of the fluxmeters at each site. As a result of this review, two sites were reinstalled in October 2018.

Additional objectives for the project have been added under the new MfE contract. These include:

- Developing, testing and implementing a soil quality monitoring programme for farmers.
- Measuring sediment losses from these cropping systems- including developing a simple sediment trapping system.
- Focusing on matching management practices to mitigate the environmental risks as shown by the data collected from the host farms
- Collating information about GMPs and producing videos about the host farmer's experiences with GMPs, for all farmers.
- Working with the Overseer team to improve Overseer for cropping systems
- Engagement with iwi and Maori cropping farmers.

**Project Partners:** MfE, FAR, VR&I Board, Regional Councils and Ravensdown.

**Science Provider:** Plant & Food Research

**Links to other projects and collaborations:** SFF X1408 This is a collaborative project between the cropping sectors, the fertiliser industry and regional councils.

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**Title: Mineralisable N to improve on-farm N management**

**Project Number:** SFF X1947 (*Contracted*)

**Crop:** Environment

**Region:** National

**Aim:** Plant & Food Research have developed a new test for estimating plant-available nitrogen referred to as the hot water extractable N test (HWN). Results show that this test is a significant improvement on the AMN test offered by commercial laboratories. This project aims to 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.

**Term of research:** Medium

**What will be delivered?** A new method that the labs can take up that is more accurate and cheaper than those currently available. Accurately predicting the supply of N from mineralisation is the single greatest limitation to correctly forecasting the amount and timing of fertiliser N additions to meet, but not exceed, crop demand. Once validated and lab available this test could substantially improve cropping farmers environmental footprint.

**Budget:** Medium

**Approach:** N controlled validation trials on farmer properties representing different cropping systems and regions. A round-robin laboratory test will be undertaken to ensure all labs are consistently providing comparable results for the mineralisable N test.

**Links to other projects and collaborations:** X1613 Nitrogen - measure it and manage it; X1408 Rootzone reality; X1801 Measuring and Managing Diffuse Nutrient Losses from Cropping Systems; G13/02 Forages for reduced nitrogen leaching.

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**Title: Farm indicators that relate to farm management practices and environmental risk**

**Project number:** X1905 (New)

**Crop:** All

**Region:** National

**Aim:** To develop and calibrate a set of environmental indicators that relate to farm management practices and alert the farmer as to whether his farm system is in

- |                      |   |
|----------------------|---|
| A low risk status    | no action required  |
| A medium risk status | step up monitoring and prepare to make a management change. |
| A high risk status   | immediate action required                                   |

**Term of research:** High (3 years)

**What will be delivered?** A set of indicators based on information already being collected by the farmer. These indicators, when routinely collected, can provide information about the status of the farm with respect to environmental risk and over time would determine trends for environmental performance and can be a reference point for FEP auditors - providing confidence to farmers about the level of consistency between different auditors. Audit consistency is a concern for many farmers. At present, the Overseer nutrient budget is the benchmark. Could be useful for benchmarking the sector's environmental performance. Would work with an Overseer budget providing real-time points of reference for the farmer, directly relating to the farm management practices.



**Budget:** High

**Approach:** Under the NPSFM all Regional Councils are developing land and water rules to control the loss of contaminants to the environment. Contaminants fall into 3 groups; nutrients, sediments and E coli. Overseer nutrient budgets are a common requirement for farming consents as are farm environment plans. The Overseer model requires considerable development for arable systems and the nutrient budgets are retrospective and based on long term weather data. Farmers do not see them as being a tool to help with management decisions. An FEP is a record of the environmental risks on the farm and the management practices being employed, it lacks any measures to inform farmers whether their systems are in a high or low status for contaminating the environment

A set of indicators directly relating to farm practices would be informative in real-time, so that management changes could be responsive.

The project would identify a set of indicators and develop the bounds between high and low risk.

Possible contenders are:

Irrigation efficiency to reduce the likelihood of drainage

- Water use efficiency

Nutrient use efficiency

- Soil mineral N levels and partial N use efficiency
- Olsen P and partial P use efficiency
- N levels in groundwater wells

Erosion and sediment control

- Sediment movement risk (soil type x topography x rainfall x cultivation/grazing x fallow)
- Stock type and number
- Transportation pathways

(<https://waikatoregion.govt.nz/assets/PageFiles/19892/TR201038.pdf>)

*Note: A considerable amount of evidence already exists to support the development of these indicators. For example:*

- *An output from the SFF “Don’t muddy the waters” is a tool that assesses the risk of sediment movement, based on soil type, slope and cultivation practice.*
- *FAR’s investment in Aquatrac and the MBIE Maximising irrigation efficiency can surely inform the development of a water use efficiency indicator*
- *Australian potato and cereal growers are using partial N use efficiency indicators to monitor environmental risk*
- *Mineral N tracking in the fluxmeter programme of work is beginning to demonstrate high and low risk situations.*

**Project Partners:** Not yet determined. Would need to be a collaborative project with regional councils.

**Links to other projects and collaborations:** Links to the Sustainability Dashboard programme of work. Don’t muddy the waters. The fluxmeter network.

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**Title:** SFF Good Management Practices for Cropping Setbacks

**Project Number:** SFF X1822 (*Contracted*)

**Crop:** Environment

**Region:** National

**Aim:** The loss of sediment from the farm is not only an environmental risk for water quality but an economic loss on-farm. The aim of this project is to develop a methodology to quantify sediment

movement from paddocks, quantify the effectiveness of a range of widths of setbacks and case study point source management and other mitigation options.

**Term of research:** Medium

**What will be delivered?** A guide for farmers to understand functional setback widths, their ongoing maintenance and management practices to reduce soil and sediment movement. Regional rules often stipulate a fixed setback width but a flexible approach may deliver better outcomes for the farm and environment. If this is demonstrated over the project's duration then an important outcome for the farmer is documentation to support regional rules having the flexibility to enable farmers to design effective setback systems to match the physical characteristics of their farms.

**Budget:** Medium

**Approach:** Develop and test methods for measuring sediment loss from a paddock. Carry out trials around NZ on different slopes assessing the effectiveness of different set back widths. Carry out point source management case studies. Assess the agronomic role perennial wheat may play as a setback species.

**Links to other projects and collaborations:** X1801 Measuring and Managing Diffuse Nutrient Losses from Cropping Systems (this project has an objective to assess the risk of soil/sediment movement on cropping farms); X1413 SFF Sustainable dairy winter grazing project (identified on-farm risk factors with regard to P sediment); X1822 SFF Don't muddy the waters; X1803 SFF Reducing Sediment Loss from Winter Crops. Current Dairy NZ SFF called 'Productive Riparian Buffers.

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**Title:** SFF Reducing sediment loss from winter crops

**Project Number:** SFF X1803 (contracted to June 2020)

**Crop:** Various

**Region:** Hawkes' Bay

**Aim:** The project will evaluate a range of catch crop species and establishment techniques to reduce sediment and surface flow losses following winter grazing.

**Term of research:** Medium

**What will be delivered?** A report with recommendations for catch crops and establishment techniques.

**Budget:** Low

**Approach:** No direct FAR involvement- only project meetings- \$ contribution to AgFirst.

**Links to other projects and collaborations:** SFF Sediments, SFF Setbacks – other catch crop projects.

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**Title:** SFF Farmer interface for physiographic environments

**Project Number:** SFF X1804

**Crop:** Various

**Region:** National

**Aim:** This project aims to improve water quality by placing state-of-the-art science into the hands of farmers, and into the heart of their land use decisions. Physiographic Environments of New Zealand (PENZ) shows farmers how potential contaminants are likely to travel within their farm boundaries, allowing farmers to consider what actions they can take to minimise water contamination risks.

**Term of research:** Medium

**What will be delivered?**

- Develop a farmer-friendly web-based spatial platform that complements existing environmental and
- mitigation programmes offered through industry and community good extension and support programmes.
- Produce a user guide for farmers
- Produce technical and non-technical information sheets to explain the science of each physiographic environment for farm professionals and decision-makers.

**Budget:** Low

**Approach:** No direct FAR involvement- contribution to E3 scientific.

**Links to other projects and collaborations:** SFF Sediments, Setbacks.

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**Title:** SFF Effect of medium to long term irrigation on soil water holding capacity

**Project Number:** SFF X1735

**Crop:** Environment

**Region:** National

**Aim:** Literature reviews and sampling programmes on irrigated and non-irrigated farms to increase knowledge about the impacts of irrigation on soil organic carbon.

**Term of research:** Medium

**What will be delivered?** Farmers will have a better understanding of the effect of irrigation on soil water holding capacity. Results will be transferred direct to farmers and via rural professionals.

**Budget:** Low

**Approach:** Review the current state of research knowledge and findings. Complete a field study across Canterbury to measure how soil water holding capacity changes under irrigation.

**Links to other projects and collaborations:** Chertsey establishment trial (which has both cultivation and irrigation treatments) and measures water holding capacity; G1303 Maximising the value of irrigation.

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**Title:** MBIE Maximising the value of irrigation

**Project Number:** MBIE G1303

**Crop:** Environment

**Region:** National

**Aim:** To develop management strategies and new technologies that support industry to improve productivity, minimise wasted water, and reduce negative environmental impacts from irrigated land.

**Term of research:** Long

**What will be delivered?** Our target on-farm outcomes are: Less water applied/ha reducing costs, less water stress increasing yields, reduced drainage and nutrient loss, simple audited self-nutrient management.

**Budget:** High

**Approach:** 1. To develop advanced methods for combining remote (satellite and airborne) and proximally (ground-based) sensed data to quantify spatial and temporal variation in soil and land characteristics, at very fine scales (5–10 m). To enhance the S-map database with sub-paddock soil data increasing the resolution of polygons to capture variation at sub-paddock scales. Spatio-temporal monitoring will enable spatial set up of whole farm models (RS 1.4) and will combine with improved informatics systems to stream dynamic data to water scheduling and irrigation control tools; 2. To determine how soils can be manipulated to absorb and retain more water and so reduce water losses, with particular focus on determining management solutions for the shallow stony soils that are predominant in irrigation development in NZ; 3. To deliver methods for spatial estimation of evapotranspiration (ET) in irrigated fields based on 1. Combined canopy monitoring and ET modelling to predict variation in potential ET over a paddock 2. Improved soil model parameterisation to use soil maps and water balances to give spatial estimates of potential water extraction. The minimum value of these two layers will give a spatial estimate of ET. 3. Methods of spatial estimation of ET based on frequent spatial IR temperature data to further improve spatial ET estimates and provide additional monitoring options for accurate water balance calculations and water schedules; 4 To integrate information and processes developed in RA 1.1, 1.2 and 1.3 into models that consider spatial variability by scaling up from patch to management zone to paddock to farm and will form the basis of farm scale analysis, planning tools and robust recommendations. This will involve two types of activity: i) the improvement of the Agricultural Production System sIMulator (APSIM) to simulate spatial variation in water balances and crop production in response to different irrigation and soil management; and ii) the application of this to demonstrate cost/benefit effects of different combinations of management in different locations, to determine the most suitable irrigation equipment for specific farm situations, and to inform the development of components for systems to guide current or control future irrigation systems.

**Links to other projects and collaborations:** The Programme combines expertise from Landcare Research, Plant & Food Research, the Foundation for Arable Research, Lincoln AgriTech and Massey University. International collaboration with the Mechatronics and Irrigation Engineering Group, at the Australian National Centre for Engineering in Agriculture, based at the University of Southern Queensland (Alison McCarthy, the late Steve Raine); and the APSIM Initiative Team (through Hamish Brown), CSIRO, University of Queensland and Queensland Department of Primary Industries.

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**Title:** SFF Smart tools and tips for irrigation

**Project Number:** SFF X1844 (*Contracted*)

**Crop:** Various

**Region:** National

**Aim:** Identify behavioural barriers to adoption of new technology.

**Term of research:** Medium

**What will be delivered?** Guidelines for GMP and an app for irrigators.

**Budget:** Low

**Approach:** Irrigation NZ working with catchment groups to capture stories on GMP and informing on progress

**Links to other projects and collaborations:** Telling the farm story (SFF X1845), MBIE Maximising value of Irrigation G1303.

**Title:** Chertsey cultivation trial

**Project Number:** X1810

**Crop:** All

**Region:** Mid-Canterbury

**Aim:** The Chertsey Establishment Trial located was established in 2003 to investigate cultivation intensity on crop production and soil quality

**Term of research:** Long

**What will be delivered?** Information on how establishment techniques (i.e. cultivation vs no tillage) effects soils properties down the profile and what the functional implications are (i.e. implications for yield and soil water holding capacity).

**Budget:** Low

**Approach:** The split-plot experiment investigates crop establishment methods utilising commercial-scale machinery under dryland and irrigated conditions reflecting typical Canterbury rotations.

**Links to other projects and collaborations:** Establishment trials NCRS; X18/40 Benchmarking of soil health in cropping systems.

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**Title:** Catch crops to reduce nitrate leaching

**Project Number:** X1837 (*Contracted*)

**Crop:** Environment

**Region:** North South Island, Mid-Canterbury, South Canterbury North Otago, Southland.

**Aim:** The use of catch crops is recognised as a potential tool to help reduce farmers' nitrate leaching losses but without good guidelines, the successful adoption of such technology is likely to be haphazard and with variable outcomes. This project aims to expand upon current catch crop research across a greater diversity of regions, climatic conditions and soils.

**Term of research:** Medium

**What will be delivered?** The data and results from three years of on-farm trials will allow the development of good practice guidelines around the use of catch crops in winter forage grazing rotations (which will include a synthesis of research over the last 5 years). This will advise farmers on the use of catch crops on a range of soil types and climates present in the Canterbury and Southland regions.

**Budget:** Low

**Approach:** Carry out on-farm trials in regions where winter establishment of catch crops may be challenging. Treatments include establishment techniques (i.e. fallow, conventional, spader drill) and species.

**Links to other projects and collaborations:** G13/02 Forages for reduced nitrogen leaching

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**Title:** MBIE Forages for Reduced Nitrogen Leaching

**Project Number:** MBIE G1302 (*Contracted*)

**Crop:** Winter grazing, catch crops, fodder beet

**Region:** National

**Aim:** The Forages for Reduced Nitrate Leaching (FRNL) programme aims to reduce farming's environmental footprint by improving the nitrogen (N) efficiency of the animal and/or plants. FAR has involvement with two of the three research aims (alternative crops/catch crops and implementation on monitor farms).

**Term of research:** Long

**What will be delivered?** A key farmer resource that FAR is responsible for delivering is a pan sector catch crop guide that each sector can package with additional sector relevant material for their websites and distribution outlets.

**Budget:** Low

**Approach:** Conduct trials at NCRS and Chertsey. Collect all Production Wise (or equivalent) inputs for all paddocks at the three monitor farms each year and provide these to PLANT & FOOD RESEARCH for modelling. Implement at the monitor farms some of the more promising findings from previous years, for example, catch crops after forage crop (oats, winter barley, triticale, ryecorn). Produce catch crop guide.

**Links to other projects and collaborations:** X1837 Catch crops to reduce nitrate leaching; X1947 Mineralisable N to improve on-farm N management; X1803 Reducing Sediment Loss from Winter Crops; New SFF 405945 Towards a sustainable and resilient future for maize (has a catch crop component).

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**Title:** No-till demonstrations

**Project Number:** M1902

**Crop:** Maize

**Region:** Northern North Island and Southern North Island

**Aim:** On-farm replicated no-till trials

**Term of research:** Medium

**What will be delivered?** On-farm demonstration of no-till, including field walks by local growers

**Budget:** Medium

**Approach:** Two treatment, replicated large scale plots, harvested by combine and weigh wagon

**Links to other projects and collaborations:** M1802, M1702, M1904, M1804. Collaborations: GTL

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**Title:** No-till meta-analysis

**Project Number:** M1911 (New)

**Crop:** Maize

**Region:** Northern North Island and Southern North Island

**Aim:** Undertake analysis of multiple NZ data sets to investigate no-till crop establishment vs standard

**Term of research:** Short

**What will be delivered?** Overarching analysis of all no-till trial data dating back to 1970's - what can we learn from it? Provide grower-focussed summary and analysis of all work to date

**Budget:** Medium

**Approach:** TBC

**Links to other projects and collaborations:** (include FAR project codes if appropriate)

M1913, M1902, M1904. Collaborations: PLANT & FOOD RESEARCH, AGR

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**Title:** Strip-till trials

**Project Number:** M1915

**Crop:** Maize

**Region:** Northern North Island and Southern North Island

**Aim:** On-farm replicated strip-till trials

**Term of research:** Medium

**What will be delivered?** On-farm demonstration of strip-till, including field walks by local growers.

**Budget:** Medium

**Approach:** Two treatment, replicated large scale plots, harvested by combine and weigh wagon.

**Links to other projects and collaborations:** M1904, M1815. Collaborations: Wilcox.

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**Title:** NCRS cereal and maize silage systems

**Project Number:** X1932

**Crop:** Various

**Region:** Northern North Island and Southern North Island

**Aim:** Look at 365 day DM production by matching crop sequences

**Term of research:** Medium

**What will be delivered?** Practical results and guidelines to production system incorporating cereal crops for winter DM production and maize for summer DM production.

**Budget:** Medium

**Approach:** Replicated large scale strips (approximately 0.25 ha each) to evaluate systems of cover crops and summer crop systems

**Links to other projects and collaborations:** X19/24, X19/02, M18/07, M18/02, M18/04, M18/06, X19/33, X19/34, X19/35, M19/05. Collaborations: AGR.

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**Title:** Understanding nutrient loss and nutrient uptake (especially N) of different species

**Project Number:** B1909

**Crops:** Radish, brassicas, beets, plantain, chicory, clover

**Regions:** National

**Aim:** To provide supporting data for the Overseer model on crop N uptake and N return in residues of a range of crops covered by “proxy crops” in Overseer.

**Term of research:** Medium

**What will be delivered?** Nutrient uptake (especially N) data for Overseer modellers to use.

**Budget:** Medium – High

**Approach:** Soil mineral N at sowing, flowering and harvest, crop mass and N% at flowering and harvest, seed N%, growers N inputs to create a N mass balance for the crop.

**Links to other projects and collaborations:** B1812

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**Title:** Cadmium Uptake in Arable Crops (PhD support)

**Project Number:** X1836

**Crop:** Cereals, Milling wheat

**Region:** National

**Aim:** PhD will study uptake and transport mechanisms of Cd in food plants.

**Term of research:** Medium

**What will be delivered?** Report on uptake of Cd on arable crops. Presentations on finding at FAR events as required.

**Budget:** Low

**Approach:** FANZ and FAR supporting Massey University PhD candidate.

**Links to other projects and collaborations:** Cadmium Management Group Committee

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**Title:** Environmental demonstration plot

**Project Number:** M1906

**Crop:** Maize

**Region:** Northern North Island and Southern North Island

**Aim:** Long-term demonstration system using environmental best practices.

**Term of research:** Medium

**What will be delivered?** Long-term demonstration system using environmental best practices as discussion point and exemplar.

**Budget:** Low

**Approach:** Single field scale best-practice plot

**Links to other projects and collaborations:** M1806, M1902, M1904, M1909, M1922, X1924, X1935.

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**Title:** ProductionWise talks to Overseer - Data input efficiency for the development of Overseer nutrient budgets

**Project number:** X1212



**Crop:** All

**Region:** National

**Aim:** To develop direct farm-data transfer processes between ProductionWise and Overseer, for speedy and cost-effective development of Overseer nutrient budgets.

Note: Processes developed for direct data transfer would not be exclusive to ProductionWise. Any process developed must also enable data transfer from other farm diary systems.

**Term of research:** Medium

**What will be delivered?** Direct transfer of farm records from a farm diary system into Overseer to enable the Overseer budget to be developed. Data entry into Overseer for complex arable rotations is onerous and a large contributor to the cost of having budgets prepared by consultants and fertiliser-company staff.

**Budget:** Medium

**Approach:** ProductionWise is a farm diary system where farmers record information relating to crop production. Some information about the stock on the farm is also collected. At present, the ProductionWise report for Overseer collates the necessary input information for Overseer, but entry into Overseer is still a manual process. The development of this report has been welcomed by Overseer users and farmers as it reduced the time and number of cups of tea required during the farm data extraction process. However, the accuracy of the PW Overseer report is totally dependent on the integrity of data recorded in the ProductionWise diary.

There are opportunities in Overseer to make the data entry process quicker by grouping similar parts of the farm together into larger blocks, this works well for pastoral systems where a block may be a soil type or a management practice, such as irrigation. However, arable and vegetable systems have an additional layer of complexity relating to the crop rotation which moves around the farm. Blocking exercises for these systems usually fall back to the need to a paddock level, requiring information for many single paddocks to be entered.

At the recent Overseer visit to a Canterbury arable farm, the “light went on” for Overseer’s IT expert. He can now envisage the rotation as an additional layer which can be overlaid on soil and management layers within the model, a bit like quilts on a bed. The model is able to link information between layers and develop nutrient budgets for multiple points but it is single paddocks and the whole farm that are of interest.

Direct transfer of information will also remove errors caused by the user’s interpretation of the farm data, leading to more accurate budgets. Farmers would be able to develop their own budgets

Achieving this would enable farmers to be able to develop their own Overseer budgets and provide an additional incentive to use ProductionWise or other farm diary systems.

Discussions with Overseer have already begun.

Presentation to the ProductionWise working group has been made.

Discussions with ProductionWise.

Scoping the project.

IT development with Overseer and ProductionWise IT specialists.

*Note: Overseer is already in discussion with other groups (Ravensdown. Farm IQ) about direct data transfer, so their heads are in this space*

**Project Partners:** FAR, Overseer and ProductionWise

**Links to other projects and collaborations:** Overseer development for cropping farmers is an objective in the fluxmeter network project.

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**Title: Farm Environment Plans for Southland Arable Farmers**

**Project number:** X1904 (New)

**Crop:** Environment

**Region:** South Otago, Southland

**Aim:** To develop a FEMP template for southland arable farms  
To run FEMP workshops in Southland for arable farmers

**Term of research:** Medium

**What will be delivered?** A FEMP template and a series of workshops

**Budget:** Medium

**Approach:** Southland's Water and Land Plan requires farmers to have farm environment management plans, (FEMP) with reference to schedule N in their plan. Farmers are able to develop their own plans under industry workshop processes. Arable farmers who practise winter dairy grazing require plans by May 2019, other farmers require FEMPs by May 2020. There is an opportunity to work with B&L using their LEP templates, but farmers attending a recent field walk said they would prefer a plan that was specific for arable systems

Develop the template,

- Ground truth with Environment Southland and get approval
- Develop a workshop format specific to Southland requirements
- Deliver the workshops.

This project is specific to Southland

**Project partners:** FAR, Southland Regional Council, Beef & Lamb, farmers.

**Links to other projects and collaborations:** None

## Resilient arable farming systems

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### New crops

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**Title:** SFF Food Products for the Future

**Project Number:** SFF X1838 (*Contracted*)

**Crops:** Sunflower, Peanuts, Spelt.

**Region:** National

**Aim:** Evaluate and develop new crop species and cultivars for future food products

**Term of research:** Medium (Three years, ending June 2021).

**What will be delivered?** The project expects to identify three new crop options for irrigated land and one new crop option for dryland areas for a number of regions in New Zealand.

The crops will have been evaluated in both small plot trials and on a broader scale at a number of sites. The project will provide some understanding of how in-field management can influence crop productivity and end product quality and the influence of these on crop value. Each crop option will also be considered for nitrogen loss (below the root zone), impact on soil quality and water use efficiency when farmed using good management practices

The potential financial viability of producing different crops for food products will be assessed.

Farmers will have the opportunity to evaluate the potential new crop/food options through field walks, Arable Update fact sheets and through workshops to define future crop food product potential and the role of farmers in the value chain.

Research from associated work will be used to suggest suitable business models to deliver product to market for each crop option.

**Budget:** High

**Approach:** Year 1: Using information on market potential for a number of crops from the related work, and information from preliminary trials in FAR work in 2017 in the Waikato and Canterbury, a number of species and cultivars will be selected and evaluated in replicated plot trials at three or four locations - Waikato, North Canterbury and Mid-Canterbury. Two Canterbury sites will be irrigated and the North Island site will be dryland. Depending on the species evaluated, a further dryland Canterbury site may be included. The trials will be assessed for plant development, crop yield and some initial assessment of crop quality for a food end use. It is expected to evaluate approximately six species and, where available, two cultivars of each species. A field walk will be held at each location for farmers and industry. The information from the trial series will be collated into an overall report for all the different areas and an Arable Update will be produced.

Year 2: More promising crop options (probably three) will be planted in larger blocks at two sites to evaluate field scale production of the crop. Within these larger blocks, agronomic trials will evaluate the influence of crop management practices, such as crop nutrition, disease or pest control, on productivity and quality. The crop produced will be evaluated for post-harvest storage and handling. Prototype processed end products will be produced outside this project within the broader Future Foods programme.

Further small plot trials will re-evaluate the species tested in the first year and evaluate other new crop options and new cultivars using the same methodology as the first year.

Year 3: Small scale commercial production of the two or three most promising food crop options will occur on two or three farmer properties in each region. Within these paddocks, further evaluation of agronomic management on crop productivity and quality will be undertaken. The crop produced will be evaluated for post-harvest storage and handling. Prototype processed end products will be produced and consumer tested outside this project within the broader Future Foods programme.

More promising crop options (probably three) selected from the year two small plot trials, will be planted in larger blocks at two sites to evaluate larger scale production of the crop. Within these larger blocks, agronomic trials will evaluate the influence of crop management practices, such as crop nutrition, disease or pest control, on productivity and quality.

**Links to other projects and collaborations:** X1705 (Wairarapa alternative Crops), X1714 (Future Foods AGMARDT Project)

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**Title:** SLMACC – Alternative Crops for the Wairarapa

**Project Number:** X1705

**Crop:** High Oleic Sunflower, Lentils, Durum Wheat, Milling Wheat

**Region:** East North Island

**Aim:** Due to a ban on growing peas in the region from 2016, limited profitable cropping options have remained for growers. This project aims to deliver crops that can supply regional and national markets using an “eat local” strategy aimed at the upper end of consumers.

**Term of research:** Medium (Year 3 of 3, starting July 2019 ending June 2020).

**What will be delivered?** A range of crops for the region that are not part of current systems. Market options at a regional level for these crops (e.g. Delivery of locally grown milling wheat to local mills and bakeries/use for locally grown oilseed and pulse crops)

**Budget:** Medium

**Approach:** Harvest data and market information from the 2017-18 and 2018-19 seasons will be evaluated to select the most viable (2 or 3) crop options for the region. Small scale crop production established on-farm with appropriate commercial contractual arrangements in place.

**Links to other projects and collaborations:** X1838 (Food Products for the Future), X1714 (Future Foods AGMARDT Project)

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## Managing herbicide resistance

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**Title:** MBIE funded reducing reliance on herbicides (Year 1/2)

**Project Number:** MBIE X1935 (New) (*Contracted*)

**Crops:** Grass seed, clover and cereals

**Regions:** National

**Aim:** To provide growers with information on the prevalence of herbicide resistance in NZ and reduce the reliance on herbicides with the same MOA.

**Term of research:** Long

**What will be delivered?** Occurrence and frequency of herbicide resistance (especially Groups A & B) for different regions (Selwyn District in year 1, Mid-Canterbury in year 2, South Canterbury in year 3). Information to manage resistance and non-resistant weeds.

**Budget:** High

**Approach:** 50 farms will be surveyed during January 2020 and seeds collected of weeds (primarily grass weeds) that are present in crops. In 2019 Selwyn District was sampled.

**Links to other projects and collaborations:** None

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**Title:** Glyphosate: application and its impacts on efficacy

**Project Number:** X1903

**Crop:** All crops

**Region:** National

**Aim:** To provide growers with information on factors that influence efficacy of glyphosate including (but not limited to) water pH, application method, formulation and use in mixes.

**Term of research:** Medium

**What will be delivered?** Better informed application of glyphosate that enhances efficacy and minimises the likelihood of herbicide resistance.

**Budget:** Medium

**Approach:** Growers, especially in South Canterbury are reporting very slow brownout or failure to kill grasses following spraying. This raises questions as to the efficacy of different formulations, the potential existence of resistance or other factors that may be affecting the efficacy of glyphosate applied by growers. Replicated field trials will be conducted using both FAR and farmer paddocks to identify factors influencing efficacy.

**Links to other projects and collaborations:** X1903 (2019 strategic investment), MBIE Reducing reliance on herbicides.

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## Alternatives to agrichemicals

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**Title:** SFF Grass grub control with bio-pesticides

**Project Number:** SFF X1901 (New) (*Contracted*)

**Crops:** wheat (and other vulnerable crops)

**Regions:** National

**Aim:** To evaluate a new generation of bio-pesticide for grass grub (developed by AgResearch) as alternatives to OP and insecticides

**Term of research:** Medium/long

**What will be delivered?** New options to replace OP insecticides for grass grub control with the expectation of a commercial product in 5-7 years

**Budget:** High

**Approach:** Replicated field trials in Canterbury for three years with a new bio-pesticides in wheat (in year one) crops following 2<sup>nd</sup> year clover (or other high risk scenario). Wheat is expected to provide excellent results but other seed crops may also be used.

**Links to other projects and collaborations:** X1205

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## Biosecurity and Preparedness

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**Title:** SFF Biosecurity - the farm border

**Project Number:** SFF X1706 (*Contracted*)

**Crop:** All crops

**Region:** National

**Aim:** Effective biosecurity for the cropping industry will often rely on the ability of individual farms to avoid, detect and/or respond to biosecurity threats on-farm. The main aim of this SFF is to provide support resources ensuring the cropping sector is more prepared for on-farm biosecurity incursions than it currently is.

**Term of research:** Medium

**What will be delivered?** Support resources for farmers to implement on-farm biosecurity, for example, modular 'Farm Biosecurity Plans' that can be adapted to suit individual farms.

**Budget:** Medium

**Approach:** Work with farmers and industry to review what should be in a 'Farm Biosecurity Plan' and to determine the support resources required. Develop support resources on the following topics:

- Wash-down facilities
- Vehicle movement/machinery operation
- Visitor tracking/apps/signage
- Risk registers templates with associated recommended practices that can be customised to farm.
- Herbicide resistance
- Incursion response protocol outlining steps to take if incursion is suspected and/or confirmed.

**Links to other projects and collaborations:** None

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**Title:** SFF Management of Velvetleaf

**Project Number:** SFF X1839 (*Contracted*)

**Crop:** Various

**Region:** National

**Aim:** The project aims to identify on-farm practices and tools for regulatory authorities to aid the containment and eradication of velvetleaf pest weed in New Zealand in the framework of long term management agreed with MPI

**Term of research:** Medium

**What will be delivered?** Management guidelines for controlling velvetleaf. Regional presentations. Update of Velvetleaf Ute guide.

**Budget:** Medium

**Approach:** Herbicide trials, geographical distribution studies and understanding the biology of the pest in a NZ context.

**Links to other projects and collaborations:** X1706 SFF On-farm Biosecurity, New MBIE Herbicide Resistance Project, maize herbicide projects. SGRR GIA collaboration. Velvetleaf long term management governance committee.

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**Title:** Managing Biosecurity Risks

**Project Number:** X1950

**Crop:** All crops

**Region:** National

**Aim:** To collate up-to-date data on emerging biosecurity risks to arable from overseas.

**Term of research:** Medium-term

**What will be delivered?** Knowledge of emerging biosecurity risks relevant to arable production that will inform our biosecurity readiness and fulfil our GIA obligations.

**Budget:** Small

**Approach:** An annual literature review, emerging risks review and a brief report from Market Access Solutionz.

**Links to other projects and collaborations:** None, Market Access Solutionz.

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## Other projects

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**Title:** AIMI (Arable Industry Marketing Initiative) Understanding Post Harvest Logistics

**Project Number:** X1011

**Crop:** Cereals and maize

**Region:** Cereal and maize growing

**Aim:** To determine stocks, sales and sowings and intentions for cereal grain crops and maize silage and grain crops.

**Term of research:** Long term

**What will be delivered?** Three cereal survey reports and two maize survey reports annually; tracking stocks, sales and sowings.

**Budget:** Medium

**Approach:** A survey group representing around 10% of maize and cereal growers are surveyed throughout the season via telephone or online survey.

**Links to other projects and collaborations:** None

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## Projects due for completion in 2018-2019 (for reference only)

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### Maximising productivity and value of cropping

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#### Cereals

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**Title:** SFF Grain storage pests

**Project Number:** SFF X1608 (*Contracted*).

**Crop:** Cereals

**Region:** Cereal growing

**Aim:** To determine resistance to pirimiphos methyl in pests of stored grain

**Term of research:** Long

**What will be delivered?** Information on insect resistance to pirimiphos methyl and strategies to cope with resistance should it be confirmed.

**Budget:** Low

**Approach:** Maintenance of existing insect colonies, collection of additional insect populations where resistance is suspected, resistance

**Links to other projects and collaborations:** None

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### Arable cropping meets environmental and social best practice

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**Title:** Understanding the quality of our groundwater resource

**Project number:** X1508

**Crop:** Environment

**Region:** National

**Aim:** Local farmers and business's initiated the well sampling project to ensure that any changes to regulations relating to farming activities and any Environment Canterbury considerations around sub-regional plans for the Ashburton-Rakaia would be based on representative data.

**Term of research:** Long

**What will be delivered?** Quantification of how water quality fluctuates in time (over seasons and years) and space (across different locations in the sampling area). This information is relevant to farmers in the region as they grapple with getting a better handle of the environmental footprint of farming in the catchment and it will provide local data to engage with the council over during the regulatory process.

**Budget:** Medium



**Approach:** Monitor 51 randomly selected wells in the East Ashburton region (at differing depths and on properties with different land uses) four times a year.

This project finishes this financial year but discussions with the project team and internally at FAR are required to decide whether FAR should fund continued monitoring of a subset of wells or if it would be more useful to go back in 5 years to see what has changed over that duration of time. FAR has purchased an Agritech Optical Nitrate Sensor which will provide continual measurements of groundwater nitrate levels and this will be installed in a monitoring well in the region and will complement the data being collected as part of this SFF).

**Links to other projects and collaborations:** This project can be linked at a high level to projects focused on reducing nitrate leaching i.e. X16/13 Nitrogen - measure it and manage it; X18/01 Measuring and Managing Diffuse Nutrient Losses from Cropping Systems. FAR is also currently testing a “real-time leaching measurement system” – The Grounded lysimeter and autosampler in one of the fluxmeter paddocks; G13/03 Maximising the value of irrigation; G13/02 Forages for reduced nitrogen leaching; X16/05 Hinds Drain community monitoring.

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**Title: Benchmarking of soil health in cropping systems**

**Project number:** X1840 (*Contracted*)

**Crop:** Environment

**Region:** National

**Aim:** use existing data to capture ‘current state of play’ of soil health on arable farms across regions of NZ and to use this as a benchmark for monitoring soil health into the future (i.e. is the current day cropping rotation resulting in a decline in soil health or has it reached steady state?).

**Term of research:** Short

**What will be delivered?** Farmers will be able to compare their soils physical health with a benchmark for the region and soil type and where available national limits and targets for the indicators will be included for comparison.

**Budget:** Medium

**Approach:** The indicators that the report will focus on are aggregate stability, C (% and t/ha), hot water extractable carbon (total and as a % of total C), penetrometer resistance and will provide some high level context of the relevance of these indicators. This data already exists, with sampling being carried out for a number of projects by PLANT & FOOD RESEARCH (Landcare soil health project (current), ECan 500 soils, land management index, Land Use Change Index (LUCI), Arable and Pastoral). National limits (where available) will be included in the report.

**Links to other projects and collaborations:** Establishment trials (NCRS and Chertsey).

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**Title: Nitrogen – Measure it and Manage it**

**Project Number:** X1613, MPI 404944 (*Contracted*)

**Term of research:** Medium (July 2016 – June 2019)

**Crop:** Experimental crops maize, potatoes and leafy greens but the mass balance quick test (MBQT) tool will be useful for wheat, barley oats and ryegrass seed.

**Region:** National

**Aim:** To develop a good management practice tool for nutrient management, based on estimating soil N supply using Quick N Test strips to develop a crop specific mass balance equation for the crop's fertiliser requirement.

**What will be delivered?** The planned final outcome for the project is a fertiliser decision tool. This is likely to be an interactive web-page which can sit on industry and Council websites. The tool will do the mass balance calculation for the fertiliser amount using the tool's background information on crop N demand and the supply of the soil mineral N y based on soil type and the Quick N strip test result.

**Budget:** High

**Approach:** Farmers are required to demonstrate they are managing environmental risk through the application of good management practices. The recognised GMP for nutrient management is to match the fertiliser application to the soil N supply and crop demand. Quick N test strips offer a cost-effective alternative to Soil N testing.

This 3 year programme of work finishes in June this year.

The science programme run by PLANT & FOOD RESEARCH centred around six replicated comparisons of the grown with crop the grower's fertiliser management practice compared to the crop managed by the Quick test mass balance protocols. Three crops were included in these trials, maize, potatoes and leafy greens and in some cases, there was no difference between the two approaches, but in others, fertiliser N applications could have been reduced by 40-50% with no loss in yield. We can have a good level of confidence in the mass balance approach supported by soil N estimates from Quick test strips.

Information about crop N demand has been sourced from existing scientific trials. FAR information for wheat, barley, oats and ryegrass seed crops will be used.

**Project Partners:** MPI-SFF, FAR, HortNZ's VRI Board, Ravensdown, Ballance

**Science Delivery:** Plant & Food Research

**Links to other projects and collaborations:** One host farmer in the fluxmeter network is using the mass balance protocol to manage his Nitrogen decisions. G1302 Forages for reduced nitrogen leaching. A range of catch/cover crop trials at NCRS i.e. M1807 is a cover crop for weed control in maize systems, X1834 is tracking nutrients from different cover crops, M1810 Intercropping project. X1803 Reducing Sediment Loss from Winter Crops. New SFF 405945 Towards a sustainable and resilient future for maize (has a catch crop component)

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