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ADDING VALUE TO THE BUSINESS OF CROPPING

FAR Profile

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Contents

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Making cropping the highest returning sustainable land use for New Zealand farmers

Sustainability and profitability should go hand in hand. FAR is helping to make this happen by investing in research, development and extension to support positive change in the arable industry.

The New Zealand cropping industry is world leading in many areas. We have some of the highest crop and seed yields of a number of species in the world as well as being a world leader in both herbage and vegetable seed production. Our ability to be a world leader is due to a number of key points - the availability of water, good soils, a favourable climate and extremely highly skilled growers and industry.

FAR has a part to play in the success of the industry by ensuring we are undertaking high quality research and that the outcomes can be implemented by our growers to keep them as world leaders.

FAR principal aims

- To improve the sustainability of New Zealand crop farming systems.
- To collaboratively invest in, manage and deliver outcomes from a pro-active, cost effective portfolio of research and development that will meet the needs of the cropping and related industries to deliver benefits to New Zealand crop growers.
- To facilitate the flow of ideas and outcomes from externally funded New Zealand and international research either to New Zealand crop growers and the industry or to applied research programmes.
- To undertake and/or promote two-way information and technology transfer between industry, growers and researchers with due regard for the market and market trends.
- To develop and sustain the human capability required in cropping research.

Objectives

FAR's objectives are to:

- Enable a sustainable and profitable cropping industry by investing in research, development and extension to foster positive change.
- To make cropping the highest returning sustainable land use for New Zealand farmers.

Values

- Excellence
- Independence
- Responsiveness
- Integrity
- Empathy

FAR has been delivering to a clear strategy over recent years and the new FAR Strategy, effective until 2021, provides a clear framework to move forward.

Foundation for Arable Research's 2017 – 2021 Strategy

Leading research	+	Strong collaborations	+	Excellent communication	+	Sustainable businesses
Deliver innovative products and technologies. Strengthen farm viability through crop productivity. Provide solutions for environmentally robust farms. Develop quality food and feed production systems.		Encourage effective primary industry research and extension partnerships. Enhance New Zealand, Trans-Tasman and international relationships/ collaborations.		Deliver clear on-farm benefits to growers using efficient and effective channels. Provide quality results to inform sound policy and decision making.		Understand market requirements for food and feed. Provide frameworks for farm and industry recording and reporting. Develop great people across the arable industry.

Actions

- Prioritise projects that address key issues and monitor outcomes.
- Further develop environmental research and extension capacity.
- Identify potential new crops and markets.
- Work with end users to better understand on-farm implications of market requirements.
- Develop or refine technologies to meet identified needs.
- Align extension to best meet growers' requirements.
- Continually assess potential outcomes and delivery options from research.
- Ensure FAR structure and practices are effective.

About FAR

Who we are

The Foundation for Arable Research (FAR) is an applied research organisation responsible to New Zealand arable growers. FAR is involved with funding of seed, grain and cereal silage research and technology transfer. The organisation was formed in 1995 and operates under the Commodity Levies Act 1990.

How we are funded

An Arable Commodity Levy is collected at the first point of sale for all grain and seed, with the exception of maize which is collected on the seed purchased. The levy rates for 2017 are:

- Maize: $1.00 per 10,000 seeds purchased.
- Herbage and amenity seed: 0.9% of sale value.
- All other grain and seed crops (cereals, pulses etc.): 0.9% of sale value.
- Cereal silage: $10/hectare.
- Open pollinated vegetable seed crops: 0.9% of sale value.
- Hybrid vegetable seed crops: 0.6% of sale value.

FAR also receives funds from research grants, co-operative research and information sales.

Research Investment

- FAR talks with growers, Arable Research Groups and the Research and Development Advisory Committee to understand and define research priorities.
- FAR's research portfolio includes a mix of short term, one to three year, applied projects and longer term, up to 15 year, basic projects.
- Projects may be wholly FAR funded, or FAR levies may be used to leverage support from government agencies such as MBIE or MPI, or other primary industry groups or companies.
- FAR contracts in researchers from universities, CRIs, and private companies as required to make up skill sets in project teams. These external researchers may manage whole projects or work on objectives within them.

Extension

FAR employs a range of traditional and electronic methods for knowledge transfer. These include:

- Hard copy newsletters, results reports and summaries.
- Field days, workshops and conferences.
- E-newsletters, social media and a comprehensive website.
- Specialist groups eg Women in Arable, Arable Ys.

FAR structure

FAR exists to support New Zealand cropping farmers and as such, our organisational structure includes strong grower input at all levels. Growers are represented on our Incorporated Society, Board, Research and Development Advisory Committee, and Arable Research Groups, ensuring that decisions around research priorities and direction maintain a grower and industry focus.

Incorporated Society members

FAR is an Incorporated Society with 21 members from across all seven regions. The Incorporated Society meets annually to be briefed on FAR activities and financial performance, and to approve the Annual Report and financial statements. They also have a role in Board appointments.

FAR Board

FAR works through seven regions, four in the South Island and three in the North. Farmers from throughout New Zealand are represented on the FAR Board, which also includes independent Directors with skills in areas such as business management, basic research and other relevant areas.

Research and Development Advisory Committee

This committee meets three times each year to discuss and prioritise research requirements, particularly any new areas of research and extension.

Arable Research Groups

Each FAR region has an Arable Research Group (ARG) made up of growers and industry personnel. ARGs act as a conduit for information on seasonal and regional issues and concerns, and are elected by growers.

Research and Extension

FAR's research and extension strategy is developed in conjunction with growers and industry with emphasis on developing a balanced portfolio to address issues facing cropping farmers in both short term (three year) and long term (3-15 year) time frames. Product and cultivar development is the responsibility of individual companies, but FAR does have a role in the evaluation of cultivars, products for a new use and research to compare products.

FAR encourages collaborative investment in research and extension with other industry groups or companies both nationally and internationally. This may involve joint resourcing with expertise sourced from a number of research businesses including FAR. As such FAR fills several roles; investor in applied research, research provider and delivery agent for information and technologies developed from both government and industry investment in research.

Research has little value until useful results are provided to end users, cropping farmers. This is FAR's strength. Because we design and carry out most of our own research projects, FAR staff members are invested in, and familiar with, the on-farm issues driving research and the individual programmes. This in turn enables them to interpret and deliver quality results in formats which are appropriate for our growers and encourage adoption of new agronomic methods and technologies.

Our international contacts form an important part of our extension programme giving us the opportunity to invite visiting scientists and experts to share their knowledge with our farmers and industry.

Information is delivered to growers at field days and conferences and through written material such as fact sheets, technical booklets and newsletters. These in turn are distributed in a range of ways from hard copy via snail mail, to e-alerts, media releases and the FAR website.

International links

Fostering research collaboration with New Zealand and overseas organisations is an important element of FAR's approach to research. We have active links with researchers in a number of countries including: Argentina, Australia, Canada, China, Denmark, France, USA and UK.

These links bring information and world class researchers to our shores, provide our research programmes with new directions, allow out of season work to occur in the Northern Hemisphere, improve our extension capabilities and provide an international perspective to our farmers.

FAR has a self-sustaining business unit in Australia. FAR Australia is funded largely from Australian farmer levy funds and undertakes research where the results will benefit both Australian and New Zealand farmers.

International collaborations:

- Quantifying soil carbon pools in New Zealand cropping soils – FAR forged a research link between Plant & Food Research scientists and CSIRO expertise in Australia.
- Cereal endophyte development is a joint investment with the Grains Research & Development Organisation (GRDC) in Australia and FAR, Grasslanz and MBIE in New Zealand with science input from AgResearch.
- Integrated pest management (IPM) in arable crops projects have been funded by MPI Sustainable Farming Fund and FAR linking scientists from IPM Technologies in Australia and Plant & Food Research.
- Collaborative research on cocksfoot - FAR and Oregon State University.
- Understanding the basis of Adult Plant Resistance in wheat – a research programme, led by Sydney University, with FAR as a research provider being responsible for trials in South Australia and southern Victoria.
- Evaluating the role of reflectance measured with crop sensors in making better decisions on canopy management in wheat. This project is being run across Australasia.
- Grass seed production links with herbage seed researchers in Denmark.

Developing and sustaining human capability

FAR also has a role in helping to attract and keep people in the industry, whether on farm, in research or in supporting industries. We invest in developing capability in a number of ways including university scholarships, post-graduate training, leadership training and support to attend national and international conferences and events.

FAR New Zealand Research sites

FAR has three research sites, two in Canterbury and one in Waikato. We also carry out numerous trials on growers' farms, up and down the country.

Chertsey Arable Site

The Chertsey Arable Site is the focal point for FAR work in mid Canterbury. In any given year research trials at this 16 hectare site are likely to involve a range of grain and seed crops with a focus on water, nutrient and agrichemical inputs, sowing rates and timings, and harvest techniques. It is also a key site for FAR's Cultivar Performance Trials.

It is also home to FAR's long term cultivation and crop establishment trial which has been running since the site was established in 2003. The treatments in this trial are split into three levels of tillage intensity: intensive tillage, minimum tillage and nil and provide useful data on the effects of different intensities of soil cultivation upon yield, economic performance and agronomy of crops in rotation, and their impacts on soil quality over time.

Each December the Chertsey Arable Site hosts our major South Island outdoor extension events.

Lincoln Research Site

FAR secured the lease of the 15.5 hectare irrigated Lincoln Arable Site in 2016 with the aim of expanding our seed production research, strengthening links with the Lincoln research community and providing a showcase for the seed industry.

The site's location allows us to further develop our relationship with Lincoln University and encourage student interest in seed focused research. Its proximity to Plant & Food Research and AgResearch provides further opportunities for research collaboration.

The site also plays a key role in the Seed Industry Research Centre which was established in 2017. It provides a central location to carry out a range of trials and to demonstrate developments in seed research and technology to students, growers, industry and international researchers.

Northern Crop Research Site

The Northern Crop Research Site (NCRS) at Tamahere is FAR's key North Island base for research trials and demonstration plots. The focus at this 26 hectare site is predominantly, but not exclusively, on maize and cropping systems research, a reflection of the farming systems in the surrounding regions.

Maize trials include investigations into efficient weed, pest and disease management and nutrient management, including cover crops and inter cropping, and part of the Maize Hybrid Performance Trials (MPT) programme. Non-maize projects investigate the suitablility of crops such as barley and miscanthus for use in the region.

NCRS also hosts a long term cultivation comparing the effect of conventional tillage, strip tillage and direct drilling on the establishment and subsequent crop performance and profitability of maize each year, and their long term effects on soil quality.

Each December NCRS hosts our major North Island outdoor field day.

Cereals and maize

Cultivar Performance Trials

Soil type, weather patterns, disease susceptibility and access to irrigation all need to be considered when selecting wheat and barley cultivars. The Cultivar Performance Trials (CPT) programme, a collaborative effort between FAR, several of the major seed companies and the Flour Millers Association, aims to deliver the latest trial results in order to help growers make these critical decisions. FAR manages CPT2 which is the second stage of cultivar testing where the commercial (and a few pre-commercial) cultivars are evaluated. CPT1, assesses the most favourable cultivars from seed companies and advanced breeders' material. CPT trials are run for both autumn and spring sown cultivars and the results are published and circulated to growers twice a year.

True feed values for whole crop cereal silage

The *Whole Crop Cereal Silage Quality Evaluation* project was initiated to compare whole crop barley silage with a range of other silage types in feeding trials with sheep and cattle. This is the first known calculation of 'true' energy value of whole crop cereal silage from in vivo experimentation in New Zealand. Researchers found that the true feed value of whole crop cereal silage is being under-estimated by current near infrared reflectance (NIR) spectroscopy tests and that the true metabolisable energy value in animal metabolism tests show it is approximately 1 MJ/kg DM higher than in NIR tests. This project was an industry collaboration funded by AGMARDT, FAR and Agricom, with support from Lincoln University and Plant & Food Research.

20 tonnes by 2020

The 20 by 2020 programme was launched in 2012 with the aim of achieving yields of 20t/ha of feed wheat grain by 2020.

Extending canopy duration (the amount of time that green leaves are present on the plant) increases the opportunity for light interception (photosynthesis) and thus the plant's potential to increase dry matter and grain yield. As such, the first few seasons of trial work focused on the impacts of early sowing, the most obvious way of extending canopy duration. Early sowing, particularly at the April timing improves yields, but also introduces other challenges, such as increased lodging and disease risk, which require more intensive management and increased agrichemical inputs. With this in mind, the project has moved to phase two, identifying less growthy, stronger standing cultivars with good disease resistance, which will be more suited to this early planting window.

Maize Hybrid Performance Trials

In 2014, FAR convened an industry discussion to explore the establishment of an independent maize hybrid testing scheme open to all seed companies. With industry co-operation the pilot testing programme for maize grain and silage hybrids was established in spring 2014, and trials have continued at sites around the country since then. As data builds up over progressive seasons, the Maize Hybrid Performance Trials (MPT) project is meeting its goals of providing an objective measurement of agronomic and quality performance of commercial maize hybrids across production regions and fostering industry adoption of proven hybrids to maximise industry efficiency and profitability.

The Maize Hybrid Performance Trials are organised and funded through the MPT Committee with representatives from the FAR, NZ Plant Breeding & Research Association (NZPBRA), independent researchers and the participating seed companies, and results are analysed by an independent statistician. Maize levy money is being invested in the governance of the programme, analysis of the results and reporting.

FAR has put a lot of effort into making the MPT happen and we fully support FAR and the MPT programme with its objectives of providing maize growers with reliable, independent information.

Neil Koevoet, Product Development Manager
Corson Maize Seed

Seeds

Seed Crop Isolation Distance Mapping Scheme (SCID)

Predictions made in 2004 that there was “considerable potential for the SCID system to develop into an integral part of the New Zealand Seed Production industry” have proved correct with over 1300 crops now registered on the system each year, optimising pollination isolation distances between crops for varietal purity and minimising potential crop loss through cross pollination.

SCID grew from a FAR led Sustainable Farming Fund project aimed at replacing a manual isolation checking process, which had been developed several years earlier, with a web-based system utilising AgriBase mapping software. Since it was formed, SCID has provided a unique marketing advantage to New Zealand for gaining international seed production contracts as well as a process which can help resolve crop site conflicts.

Ryegrass yields: plant growth regulators and interactions

The use of the plant growth regulator (PGR) Trinexapac-ethyl has been connected with seed yield increases of up to 50% in perennial ryegrass crops. FAR research into the use of Trinexapac-ethyl (TE) in perennial ryegrass seed crops began in 2000. Since then, much work has been carried out to increase industry knowledge around how best to use this very effective chemistry. Trials have investigated different application rates and timings and TE formulations. Understanding the interactions between nitrogen, closing dates (defoliation), and irrigation allow New Zealand growers to make informed decisions about appropriate application rates. Research into the impact of PGRs on tall fescue and cocksfoot seed yields has also provided useful information for growers.

Seed Industry Research Centre

Maintaining and increasing New Zealand’s competitive advantage on the global seed market requires a robust long term research support capability. With this in mind, FAR, a group of seed companies and research organisations worked together to form the Seed Industry Research Centre.

New in 2017, this virtual centre is an incorporated society with a strategic view, governed by farm and industry representatives. It combines farmer levies with a contribution from seed companies and other research organisations to create a larger fund to be invested in non-proprietary seed research across the value chain. The Seed Industry Research Centre places the industry in a stronger position to attract government investment and strengthen international collaborations.

FAR’s seed research has been of tremendous value to us over the years.
Ian Hydes, Methven

White blister disease of radish seed crops

White blister, also known as white rust, can severely reduce radish seed yields. It is a difficult disease to control, especially when infection is systemic within the host plant. FAR researchers are working to understand exactly how the disease is spread, including the role of seed borne inoculum and of host weeds. Control should occur as a preventative approach mixing and rotating fungicides from various modes of action to reduce the risk of fungicide resistance. Because white blister is not a true fungus, fungicides which are used for potato blight control are likely to provide best control. Cultural controls such as paddock selection, removal of host weed species and good plant nutrition may reduce the risk of infection.

Weeds, pests and diseases

Crops grow best when they are not being challenged by weeds, pests and diseases. FAR is involved in a range of projects investigating the most effective, economic and sustainable options for managing weeds, pests and diseases.

Cereal disease management strategies

Disease management in cereals requires constant monitoring in order to keep up with new chemistry and with the ability of some pathogens to develop tolerance or resistance to chemicals. FAR works closely with research groups here in New Zealand and internationally, to ensure that growers are up to date with developments in this important area.

FAR's Cropping Strategies were introduced in 2011 with the aim of delivering several years of research results in a format that clearly outlined what those results meant for crop management. To date, the Cereal Disease Management Strategy booklet has been updated twice, as research has highlighted the impact of factors such as new active ingredients and the discovery of strains of Septoria tritici blotch (STB) which are resistant to SDHIs in Europe.

Herbicide resistance

With 96% of respondents in a FAR grower survey identifying weed management as a key issue, the threat of herbicide resistance cannot be ignored. FAR led research projects have confirmed the presence of weed resistance to glyphosate and to Group A and Group B herbicides in arable and other farm systems.

Research is underway to further understand the mechanisms of resistance development and spread; to develop management strategies for properties where resistant plants are present and to reduce the risk of resistant plants spreading through transfer of seeds or pollen. Herbicide user strategies aimed at slowing the development of further cases of resistance have also been developed.

Biosecurity

FAR has been involved in responses to several biosecurity incursions in recent years. These have included black grass, pea weevil and velvetleaf. Our strength in this area is our knowledge of crops and cropping systems and our access to a network of international experts who can provide information on these weeds and pests in their countries of origin.

A current focus is on managing on-farm biosecurity, and we are working to develop a modular Farm Biosecurity Plan that can be readily adapted to suit individual farm businesses.

> *FAR's ability to provide independent scientific advice has enabled informed decision making in several responses to arable industry biosecurity incursions.*
>
> Guy Wigley, Federated Farmers, Biosecurity Spokesperson

Integrated pest management

Integrated pest management (IPM) combines biological, chemical and cultural controls in order to maximise the use of beneficial insects whilst minimising unnecessary insecticide use. Under IPM, pest management decisions are based on pest:predator ratios which are monitored throughout the growing season.

FAR led research projects have developed IPM strategies for cereal and brassica crops.

Farm systems

Overseer® review and N Check

FAR initiated a review of Overseer® in cropping systems following concerns about whether it was fit for purpose for this sector. An independent panel of experts found that Overseer® was the best tool available for estimating long term, average nitrate leaching losses from the root zone across the diversity and complexity of farming systems in New Zealand, but that further work on the cropping model was needed to enhance confidence in Overseer® estimates of nitrate leaching from arable farms. Work on the cropping model is ongoing but as an interim measure, an alternative option is available for Canterbury farmers which allows them to estimate an N loss figure for their farm.

Stubble burning review

A FAR review commissioned by Environment Canterbury (E-Can) found that stubble burning is a rapid, economic, and relatively environmentally benign way of dealing with crop residues without the need for removal of straw by baling or for stubble chopping followed by relatively intensive cultivation. The resulting report also outlined the importance of strategic use of stubble burning for Canterbury cropping farmers, particularly those who grow small seed crops.

This report was submitted for consideration within a review of the Air Chapter of the *ECan Natural Resources Regional Plan* and contributed to a decision to allow the practice to continue, with some limits for zones immediately surrounding urban areas.

The FAR led Stubble Burning Review played a critical role in ensuring the on-going ability of Canterbury cropping farmers to use this important management tool.

Dave Grant, Methven

Farm Environment Plans

Regional authorities across New Zealand are turning to Farm Environment Plans as a method of helping farmers identify and mitigate environmental risks on their properties. FAR launched its first regional Farm Environment Plan Template for Cropping Farms for Canterbury growers in 2015. A Hawkes Bay template followed in 2017 and other regions seem likely to follow suit. Growers are supported through the Farm Environment Plan process by way of workshops and phone support.

Value of irrigation

FAR is the industry link in a long term MBIE-funded research programme aimed at integrating the next generation of irrigation management tools for cropping, horticultural, and pastoral farms and helping farmers to increase water and nutrient use efficiency. The *Maximising the Value of Irrigation Programme* is researching advanced scheduling and control systems to help ensure water is applied where, when, and in the amount, needed. The team are working with industry to develop best options for new or upgraded irrigation hardware based on economic and environmental trade-offs; and to develop effective audited self-management systems that provide accurate estimates of drainage and nitrogen leaching under irrigation.

Fluxmeters

In 2014 a network of drainage fluxmeters was successfully established at 12 sites in five regions under a range of mixed arable and horticultural crop rotations to measure drainage and nutrient (N and P) losses from cropping systems. The network information shows that nitrogen losses are driven by a number of interacting factors. Some are related to the farm soils and the climate but others are related to farm management practices. These are the ones that farmers can manage. Good management practices have already been developed to manage the N supply to the crop without reducing yields.

Tools and technologies

ProductionWise®

FAR launched its ProductionWise® online recording system in 2013. ProductionWise® is constantly being fine-tuned for ease of use and to meet the needs of New Zealand cropping farms. Since 2013, numerous functions have been added, including an App which means farm operations can be entered via phone or tablet in the field, and a link which enables approved advisors to log in and note recommendations for their clients. ProductionWise® can calculate gross margins and create grain traceability, chemical application and other such reports. It can also assemble the farm data required by Overseer® into one report, speeding up the Overseer® nutrient budgeting process.

ProductionWise® was developed by FAR in partnership with Grain Growers Limited and is freely available to all FAR levy payers.

The ProductionWise® app allows us to update our data out in the field as it happens, and everyone finds it simple to use.

Craig Whiteside, Clinton

HydroFix Irrigator Stabiliser System

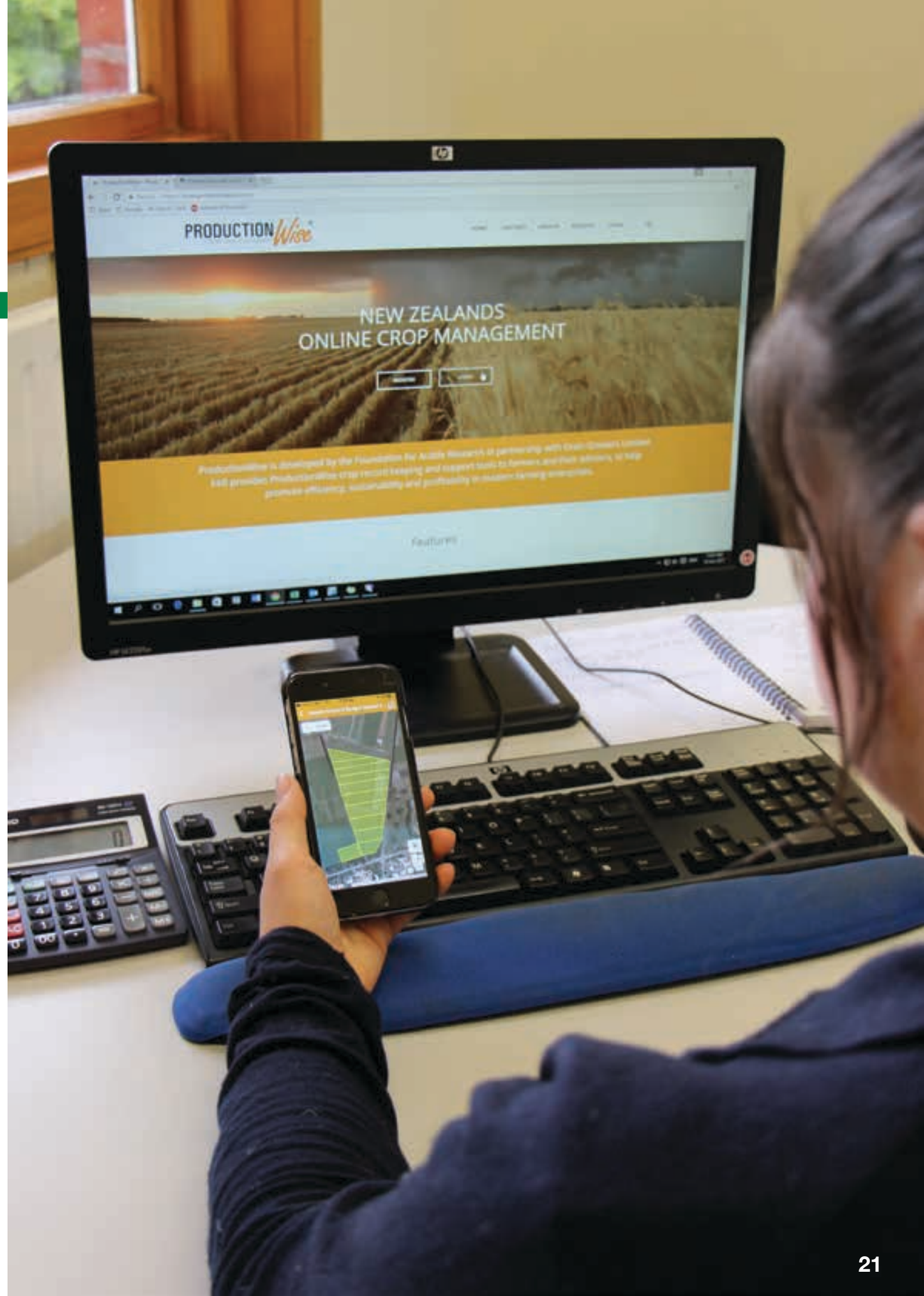
The HydroFix Irrigator Stabiliser System originated from a request for help following the 2013 gale force winds which damaged more than 800 irrigators across Canterbury. The loss of irrigation systems for several months caused major losses of production for farmers and the cost of repairs was estimated in the millions of dollars. FAR contacted the University of Canterbury and with the help of a groups of mechanical engineering students, a patented solution was developed and then licenced to Carrfields Irrigation for further development and commercialisation. The HydroFix Irrigator Stabiliser System won the 2016 Irrigation NZ Innovation Award.

Sirius Wheat Calculator

The Sirius Wheat Calculator is a computer programme that helps growers identify nitrogen and irrigation needs for wheat crops. It was launched in 2005. The calculator uses current and historical weather data to estimate yield, and has scenarios to look at the yield impact of a dry or wet season. It is an interactive programme and allows growers to see the yield impacts of changing the amounts and timings of nitrogen and irrigation. Graphs help the user see when nitrogen and water levels are low, the impact this has on the canopy and crop yield and whether their management is influencing leaching and residual nitrogen levels. Wheat growth stages and margins over nitrogen and irrigation costs are also presented. When it was launched a large number of farmers used this decision support tool to fine tune management, resulting in significant reductions in the use of N fertiliser. It has provided the impetus for change and increased farmers' understanding of crop nutrient needs such that most farmers now operate effectively without using the wheat calculator.

NCheck

NCheck is an electronic tool which provides a short term alternative to Overseer® for Canterbury farmers. It was developed by Environment Canterbury with support from FAR and Horticulture NZ, to assist Canterbury arable and horticulture farmers through the compliance process, allowing them to quickly and cheaply attain N loss numbers, in order to confirm whether or not they require a consent to farm. The NCheck figure can also be used when applying for short term consents, simplifying the compliance process and making it a lot cheaper for those growers who have chosen to use it.



People

FAR has a long history of educating, encouraging and supporting people across all levels of the arable industry. Extension aside, programmes have been developed to improve leadership skills; to encourage young people into the industry and to support postgraduate careers in the research community.

Women in Arable

Women in Arable is a collaboration between FAR staff and arable women, and is aimed at improving women's on-farm and business management skills. Meetings and field days are held throughout the year, providing a mixture of hands-on learning opportunities, research, regulation and compliance updates, and farm visits. Members include hands-on farm partners and industry reps, those who focus more on business administration and compliance and others who are busy with jobs or families but want to stay in the loop. The group is based in Ashburton, but occasional meetings are also held in Southland.

Arable Ys

Arable Ys is a FAR initiative aimed at building confidence in, and creating opportunities for, the next generation of arable farmers. Arable Ys attracts students, farm workers and managers, family members moving towards ownership and industry representatives. Meetings cover topics from crop growth stages and research updates, to farm finance and environmental compliance, while field days provide the opportunity to understand how such knowledge can be applied to suit specific farm scenarios. Further learning is delivered through annual FAR-led, self-funded study tours which have visited cropping regions elsewhere in New Zealand, Australia, the USA, the UK and Europe.

Graduate Programme

Our Industry Graduate Programme provides recent agriculture, science and agricultural commerce graduates with the opportunity to be employed by FAR for a year, to learn about the arable industry and the careers it has to offer. The programme was launched in 2014 and each year since then, two graduates have joined us, gaining a solid introduction to the New Zealand cropping industry, working on research, extension and communication projects at our research sites across New Zealand and Australia.

> *The FAR Graduate programme has provided me with a great basis of knowledge and a solid foundation to build a future career on.*
> Sophie Blair, FAR Industry Graduate 2016

Scholarships and early career science

Each year FAR allocates post-graduate scholarships to students engaged in research that will benefit the arable industry. These scholarships have supported Honours, Masters and PhD projects at Lincoln, Massey and Canterbury Universities. In addition to this, we also help to fund post-doctoral fellowships, to provide career pathways for young scientists working in areas of importance to our industry.

Events and publications

FAR runs up to 100 events and produces dozens of publications every year. Events range from small workshops for a dozen growers through to major events attracting hundreds of people. The range of publications is equally broad, from weekly e-newsletters to specific crop focused publications. We work hard to ensure our events are timely and relevant, delivering the information our growers need, when they need it.

Field days, workshops and conferences

FAR's major field events are CROPS and ARIA, held at our Chertsey research site and the Northern Crop Research event at Tamahere. These day long field days feature up to a dozen speakers, focusing on trials and demonstrations on site, and broader industry issues. Smaller field days are held up and down the country throughout the year, delivering knowledge and advice drawn from field research on seasonal management issues such as crop establishment, disease management and weed control.

Workshops are more likely to address future thinking or non-field based issues impacting on farm businesses. Workshop topics might range from developing strategies for the introduction of new tools and technologies through to understanding the rules around environmental compliance.

FAR runs a national conference every second year. FAR, national and international speakers deliver the latest information on crop production and farm business management and challenge attendees to think about what changes are coming for the cropping industry.

Website, publications and social media

All FAR information and publications are stored on our website www.far.org.nz . As well as this, growers and other members of the arable industry receive regular e-newsletters from FAR outlining pertinent issues around crop management as well as information about upcoming events.

Crop Action is a regular newsletter that links field reports with relevant research data outlining management options. Ground Rules is another e-newsletter which provides regional updates on environmental compliance and regulation as required.

Information in e-newsletters is generally time sensitive, but FAR also produces many other publications with a much longer shelf life. FAR Updates summarise trial results while FAR Focus books bring together several years' research providing solid data around the pros and cons of new techniques and technologies. FAR Strategies outline options for managing agronomic inputs for a range of crops including cereals, ryegrass and oil seed rape.

FAR also connects with growers and industry through social media platforms Twitter (@FAR_arable) and Facebook.

FAR Australia

FAR Australia was formed in 2012 to provide a trans-Tasman research and extension pathway, providing the opportunity to access information from Australia and for joint research programmes which can add value to the cropping industries in both countries. It has office bases in Inverleigh near Geelong in southern Victoria and Mulwala in southern NSW, but is involved in cropping research across Australia. It has a subsidiary board with board directors drawn from both sides of the Tasman.

FAR Australia staff carry out a range of research projects on contract to or in collaboration with Australian farmer groups, universities and levy funded groups. Some of these have included the establishment of three specialist research centres in collaboration with key collaborators and funders. These centres are:

The Riverine Research Centre

The Riverine Research Centre is located at Yarrawonga on the NSW/Victorian border and has been set up in collaboration with Riverine Plains farming group. The site specialises in Medium rainfall agronomy with a particular focus on the agronomy of the new generation of winter wheat cultivars (see later section), nutrition and agrichemical development.

The Disease Management Centre

The Disease Management Centre located at Gnarwarre in the southern high rainfall zone of Victoria, specialises in independent disease management evaluation covering collaborative work with state departments, universities and industry research projects. The centre aims to develop specific fungal disease situations, through a combination of disease inoculum and irrigation, to assist in the development of new products and management strategies. In recent years the research portfolio has been dominated by research work on the pathogen *Zymoseptoria tritici* which causes Septoria tritici blotch (STB) or Speckled leaf blotch (SLB). This programme will increase our understanding of disease management in both Australia and New Zealand, and in particular, of disease resistance and resistance management.

The Hyperyielding Centre

The Hyperyielding Centre in Tasmania is funded by GRDC and is part of a project led by FAR Australia in collaboration with Southern Farming Systems. This site takes cereal germplasm from the screening stage through to yield evaluations and then to Variety Specific Agronomy Packages. The project also aims to improve the information provided to users of feed grain cereals in order to better match the aspirations of both the producer and the end user. It is expected that genetic material from this programme will flow into New Zealand research programmes such as the 20 tonnes by 2020 project.

One of the aims in developing the three specialist centres in Australia is that they will provide an independent platform for FAR to show case the latest advances and products that the New Zealand industry can produce. This could include things such as new germplasm or the latest technologies such as cereal endophytes, which have been pursued jointly with AgResearch, as the science provider, and GRDC.

If you are a New Zealand based organisation with new germplasm or pre breeding developments that could have a place in Australia, then contact FAR to see if there are any potential synergies that would benefit the cropping industry on both sides of the Tasman.

FAR Australia also has a role developing conduits between New Zealand research programmes and those taking place in Australia, particularly where there are clear synergies for both groups working together. This has been evident in recent research linkages on rust pathotyping involving the Australian Cereal Rust Control Programme.

FAR Australia is a stand-alone entity, funded largely from Australian farmer levy funds.

Research goals and themes

FAR has five distinct research goals, and within them, a further five research themes. Research projects are developed to meet one or more of these goals and themes.

Research goals:

1. New innovative products
2. Sustainably produced feed and food for livestock industries
3. Building better and more robust farms (environmental focus)
4. Improving farm viability (crop productivity focus)
5. Delivering benefits and outcomes

Research themes

a) Reducing cost

b) Improving yield

c) Adding value

d) Environmental responsibility

e) Innovation

Key issues

Key areas of research FAR is investing in currently include:

- Understanding and developing management strategies to minimize the risk of agrichemical resistance.
- Measuring, monitoring and managing the efficiency of inputs in cropping systems.
- Developing new crops and products to improve farm profitability.
- Providing effective tools to manage, store and report farm practices.
- Providing new solutions to manage crops and increase yields.
- How to use precision agriculture to improve profitability and sustainability.
- Understanding and maintaining soil quality on cropping land.

Goal One

New and innovative products

Reducing cost

- Vernalisation of vegetable crops to reduce overwintering in the field.
- Delivering low cost effective biological control solutions.

Improving yield

- Increasing herbage and vegetable seed yields through improved understanding of flowering and floral synchrony, improved harvest index.

Adding value

- Improving quality of seed for export and grain for milling.
- Developing new crop options for New Zealand.
- Investigating new end uses and markets for protein and other crops.

Environmental responsibility

- Delivering bioactives to control diseases and pests.
- Using advanced seed treatments to deliver agrichemicals.

Innovation

- Developing endophyte technology in a wide range of species.

Goal Two

Sustainably produce feed and food for the livestock industries

Improving yield

- Investigating time of sowing, canopy manipulation and cultivars to improve feed grain yield.

Adding value

- Determining the feed value of protein crops as animal feeds.
- Determining the feed value of grain and cereal silage to ruminant and monogastric animals.

Environmental responsibility

- Forage crop production systems that reduce the nutrient loss from grazing.

Innovation

- Sourcing and testing oil seed crops.
- Developing a sequence of nectar producing crops compatible with the manuka honey flow.

Goal Three

Building better and more robust farms - environment

Reducing cost

- Improving understanding of N mineralisation to assess soil N supply and optimise N use.
- Using sensor technologies to define paddock variability and crop input requirements.
- Using variable rate application for nutrients, water and agrichemicals.
- Developing resistance management strategies for weeds, pests and diseases.

Improving yield

- Understanding and managing crop variability to increase yield.
- Managing soil quality to reduce yield loss from deteriorating soils.
- Developing bird management methods to reduce losses in high risk crops.
- Developing resilient farm systems to reduce yield losses from extreme events.

Adding value

- Quantifying soil carbon pools in cropping systems to define the value of soil carbon.
- Using precision agriculture methods to define and segregate quality during harvest.
- Improving water management and water use efficiency to increase grain and seed quality.

Environmental responsibility

- Ensuring crop models accurately estimate nutrient and water use and loss.
- Effectively using N products to reduce N loss and improve N use efficiency.
- Enhancing the natural biodiversity on cropping farms.
- Understanding the impacts of climate change on crops, weeds, pests and diseases.

Innovation

- Selecting new pollinators or pollinator management practices to improve pollination.

Goal Four

Improving farm viability - crop productivity

Reducing cost

- Using reduced and no tillage systems for crop establishment and matching practice to crop, soil and season.
- Improving understanding of weeds, pests and diseases to achieve better control.
- Developing effective biosecurity to minimise incursions.

Improving yield

- Developing cultivar specific crop management practices for high and low yield environments.
- Evaluating genetic material to optimise production.

Adding value

- Improving seed purity by effective weed and disease management practices.
- Nutrient management to improve quality in cereals.
- Using cover crops and intercrops to provide feed and add value.
- Improving crop quality by reducing insect contamination.

Environmental responsibility

- Developing IPM, cultural and biological control practices to reduce agrichemical use and reduce resistance.
- Using crop systems to manage nutrients and soil quality and improve crop yields.
- Managing high risk invasive weed species eg velvet leaf, Noogora burr.

Innovation

- Developing and implementing new methods to detect weeds, pests and diseases in the field.
- Using different sensor technologies to detect and manage weeds, pests and diseases.