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SIX MONTHS ON FROM COMPLETING MY PHD – HOW IT IS RELEVANT TO MY CURRENT ROLE AS A FARM ENVIRONMENTAL ADVISOR

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Abstract

Many farmers, particularly in Canterbury, are now facing the challenge of meeting nitrogen leaching reductions while retaining a profitable system. In New Zealand an outputs approach using OVERSEER® in conjunction with Farm Environmental Plans (FEP) has been adopted to regulate nutrient loss as opposed to an inputs regulated approach which still leaves room for flexibility in both farming systems and potential mitigation options.

When exploring research options those relating to irrigation management and diverse forage species to reduce nitrate leaching losses from the cow urine patch therefore had a strong appeal, particularity from a practical farm systems point of view.

This presentation will therefore focus on the lessons learnt during my PhD and if/how they are relevant to my current role as a farm environmental advisor, particularly relating to: the day to day use of Overseer, FEP's and communication with farmers in the nutrient management space.

Personal background

In 2009 I moved to Christchurch from Tauranga and started a Bachelor of Science at Lincoln University which I completed in 2011. The BSc major I chose was Bio-security and Bio-protection with a minor in Soil Science.

Mid way through 2012 I returned to Lincoln University to do Honours in Soil Science. The title of my dissertation was "Lignite exacerbates nitrous oxide emissions from New Zealand grazed pastoral systems".

Following the completion my dissertation I spent six months month's working for Hysdroservices as a field technician along with work on a local dairy farm in the Lincoln area. In March 2014 the opportunity then presented itself to start a PhD at Lincoln University.

PhD Overview

The title of my PhD was "The effect of diverse forages and irrigation management on plant N uptake and nitrate leaching from cow urine patches". It was concluded from the research that the strategic use of diverse forages containing plantain, is a viable mitigation option to reduce nitrate leaching losses from urine patch areas in the right farm system.

The three key areas where I saw value in my PhD were:

1. Nitrogen loss from agriculture, particularity in the form of nitrate, was and still is a significant challenge that the industry is facing.
2. The PhD provided a practical farming systems based approach to mitigating nitrate leaching by looking at the irrigation regimes and alternative forage mixtures.
3. The research encompassed a soils, plants and animals approach to nitrate leaching mitigation options which created a PhD that was multidisciplinary.

Table 1. A brief overview on the key experiments and findings from my PhD.

Description	Experiment One	Experiment Two	Experiment Three
Type	Lysimeter experiment	Lysimeter experiment	Microbiology experiment (soil blocks)
Forage	Standard: PRWC* Diverse: PRWC, chicory, plantain & prairie grass	Standard: PRWC Diverse: PRWC & plantain	Standard: PRWC Diverse: PRWC & plantain
Irrigation	Optimum vs. Deficit	Pivot vs. Rotorainer vs. Flood	Pivot vs. Rotorainer vs. Flood
Cow urine- timing and N loading rate.	Spring 500 vs. 700 kg N ha^{-1}	Early summer 700 kg N ha^{-1} vs. Late summer 700 kg N ha^{-1}	Late summer 700 kg N ha^{-1}
Key measurements	Nitrogen (N) leaching Plant N uptake Plant DM yield	Nitrogen leaching Plant N uptake Plant DM yield Root distribution Soil N	Soil nitrate and ammonium concentrations Soil AOA and AOB populations
Key findings	N leaching was 88–97% lower under optimum irrigation at a urine application rate of 700 kg N ha^{-1}. Forage type had no effect on N leaching	Lower N leaching losses under the diverse forage containing plantain compared with the standard forage. Irrigation type had no effect on N leaching	Higher soil ammonium concentrations and lower nitrate concentrations under the diverse forage.

*PRWC – perennial ryegrass and white clover

Farm Environmental Advisor (FEA) Role

Many farmers in New Zealand, particularly in Canterbury, are now facing the challenge of meeting nitrogen leaching reductions while retaining a profitable system. Under Canterbury's land and water plan farmers must operate at good management practice and most will require a farm environmental plan (FEP) and OVERSEER® nutrient budget for Land Use Consent. Currently the outputs based approach which has been adopted to regulate nutrient losses as opposed to an inputs regulated approach leaves room for flexibility in both farming systems, potential mitigation options and future farming scenarios. However, there is also the potential for significant limitations on some farming operations which could impact on the value of the farm.

The farm environmental advisor role at Ravensdown currently entails a range of services which aim to help farmers obtain resource consent. On a weekly basis this can range from collaborating with the farmer to collect data about their farm system, modelling baseline, year-

end and scenario nutrient budgets using OVERSEER®, creating farm environmental plans and the associated farm maps. It also involves keeping up to date with new rules and regulations at a national and regional level.

Relevance of PhD to Advisor Role

Daily use of OVERSEER®

To generate an OVERSEER® nutrient budget which reflects a farm system as accurately as possible requires both an understanding of the farm system but also an understanding of the science and the fundamentals that are driving the OVERSEER® model. One of most challenging aspect from completing my PhD to moving into an industry role has been the jump from a largely dairy focused area of research to a role that requires an in depth understanding of a range of farm systems. In this regard, arable farms and, sheep and beef systems have been somewhat of a foreign language to me.

However, one of the requirements of a PhD is an extensive literature review that covers the wider scope of the research, looks at what has been discovered to date and investigates where there may be gaps in the current knowledge. To enable me to be able to interpret the results from my experiments, there was a requirement to develop a sound understanding of what drives nitrate loss in the soil, plant, animal system and what physical and chemical and biological processes may be causing changes in nutrient loss. Many of these factors I have found are also relate closely to the processes within OVERSEER® that drive nutrient output values. I feel that as I gain more experience in my role as a farm environmental advisor, the foundations built from my PhD will continue to aid me in the day to day use of OVERSEER® and in the quality of the nutrient budgets/reports that are produced.

Farm Environmental Plans

A PhD by nature is typically highly focused towards a specific component or aspect, in my case it was the mitigation of nitrate leaching from the cow urine patch through irrigation or alternative forage species. It is also a necessity that it is structured this way, not only to gain an in depth understanding of the topic and to ensure quality results are obtained but also from a financial and time management point of view.

In contrast to this a farm environmental plan is typically designed to be broad spectrum and encompasses much more than just a single aspect of a farm system. For example, what may appear to be the perfect tool in the box to reduce nutrient losses on one farm does not necessarily mean it will work for the farm system down the road. Furthermore, you soon realise that a farm environmental plan is a bit like a puzzle, it is made up of several different pieces and your area of research may only make up one or two of those pieces in the puzzle.

In the last six months I have also had to learn to accept the large areas of grey that there are within the industry. The nature of working in the industry is very much centred on the concept of “it depends”. It depends on the farm system, yearly and seasonal variables or regional and sub-regional regulations and numerous other factors. By nature this differs substantially to the structure of a PhD which is centred on a much more black and white concept of developing a hypothesis, testing the hypothesis, presenting the results and discussing why those results were likely to have occurred. All of which is based off or supported by scientific evidence.

Farmer Communication

My PhD was funded by the Ministry of Innovation and Employment, and DairyNZ as part of the Forages for Reduced Nitrate Leaching (FRNL) programme. This meant that there were several opportunities over the last three years to attend field days and discussion groups run by the FRNL programme. These events were often hosted from both a science perspective and a practical farming solutions perspective due to the number of monitor farms that are involved in the project. Attending these field days often involved presenting my research to a range of audiences and allowed for some interesting discussions, particularly around what the farmers actually wanted out of the research, and their opinion on what they thought would/wouldn't work and why. It also provided a value opportunity to gain experience in present information in a way that is relevant to your audience. I often found that farmers often wanted to know how the results fitted into a big picture scenario, in comparison a conversation with my supervisors or presentation at certain conferences would often look to drill down and focus on a small aspect or a single experiment at that point in time.

Summary - A comparison between studying and industry

Table 2 highlights some of the key similarities and differences I have found between studying and starting an industry role.

I think one of the most valuable skills required going forward is the need for practical experience and exposure to a range of farm systems. Not necessarily only in terms of on farm experience but also exposure to the tools used on a daily bases in the industry such as OVERSEER® or FEP templates, and how these are used in a farm systems/management approach and not just as data entry tool.

To those looking at doing a PhD with the intention of moving into an industry I would recommend getting out to industry field days and discussion groups as often as possible and not just the ones that are specifically relevant to your field. Talk to people in the industry, research the role you want to go into and find out what the key skills are that may be required for that role. Where possible try to build those aspects into your PhD or look for opportunities to gain some practical experience through part time work or industry courses.

The past six months at Ravensdown have been both a challenging and rewarding experience. I think the sound understanding of the science driving the OVERSEER® model that has been gained from my PhD will continue to be invaluable going forward in this new role however, there is still a way to go until I wrap my head fully around the range of different farm systems and variables that occur on daily basis within the industry.

Table 2. Some of the key similarities and differences between studying and starting an industry role.

Skills and Knowledge	PhD	FEA
Understanding the science driving OVERSEER®	Comprehensive understanding of physical, chemical and biological processes that drive nutrient losses both practically and in theory	Requires comprehensive understanding of the processes that drive nutrient loss to understand modelling outputs and the effect of any changes made
Practical daily use of OVERSEER®	Typically limited unless it is a component of the PhD	Requires an understanding of OVERSEER® beyond just that of data entry
Farm systems knowledge	Typically specifically focused on one sector – i.e. dairy focused for my PhD. Comprehensive understanding of that particular topic.	Requires a broad understanding of a range of farm systems including sheep & beef, arable and horticulture, from an animals, soils, plants and management perspective.
Farmer engagement	Opportunities to engage and network with a range of audiences including farmers, industry and researchers at field days, workshops and conference	Primarily communicate with farmers to gather farm information for modelling, as well as industry and planners regarding consent work.
Industry scope	Typically narrow and highly specialised to one area. Develop and awareness of gaps between the science, industry and the farmer when moving into an industry role.	Requires exposure to a much broader spectrum with regards to different farm systems, planning regulations, business aspects, constantly evolving industry direction and development etc.
FEP's	Typically only covers one or two aspects of FEP's. Develop a sound understanding of potential factors driving nutrient losses through literature reviews and experiments.	Typically requires a broad spectrum approach, a practical farm solutions knowledge and an understanding of what factors drive nutrient loss.
Critical thinking/problem solving	Large component of PhD to enable results to be interpreted and overcome issues that may arise with experiments	Required when modelling farm scenarios but still requires a comprehensive knowledge of the farm system.
Industry related courses	Typically not included as part of a PhD but can be sought out and undertaken whilst completing the PhD (recommended!)	Requires you to complete both sustainable nutrient management courses and become CNMA registered.
Data analysis and statistics	Essential to interpreting results and producing results/research articles that are of a high quality	Requires the ability to gather quality data to produce nutrient budgets and reports that are of a high quality
Exposure to planning regulations	Limited unless it is a component of the PhD. Workshop and conference attendance provides some exposure to this area.	Requires exposure to council rules and regulations to ensure accurate information is given to farmer and, nutrient budgets and FEP's are accurate for resource consent.
Nutrient loss mitigation	Develop a sound understanding of potential factors driving nutrient losses and potential mitigation options both science based and practical farming solutions based (PhD topic dependant).	Requires a practical farm solutions approach to mitigating nutrient losses for scenario modelling and FEP's
Practical work experience	Typically specialised to field and lab experiments. Become familiar with certain forages and their management i.e. yields, fertiliser and irrigation management (PhD topic dependant).	Practical on farm experience would be highly beneficial to this role, particularly relating to the sense checking of information.