Faculty of Agriculture and Life Sciences

Summer Scholarships

2022/2023

LINCOLN UNIVERSITY

TE WHARE WĀNAKA O AORAKI

Scholarship Information

The Faculty of Agriculture and Life Sciences will be offering a number of research scholarships over the 2022/2023 summer vacation to capable students who are considering continuing their university studies in 2023. All scholarships are valued at $6,000 each (tax free), commencing after the end of the semester two, for a period of 12 working weeks (includes 3 weeks University Christmas close down period).

The scholarships are an opportunity for students to experience working in a research environment, to get a feel for what's involved in postgraduate research, and to gain valuable research skills. Many of the students who have previously been awarded summer scholarships have gone on to complete postgraduate degrees and establish successful careers.

This booklet outlines the summer scholarship projects received to date. Please consult the Lincoln University website for others that may have been added subsequently.

https://www.lincoln.ac.nz/study/scholarships/
Browse **Search Scholarships**
Select **Agriculture & Life Sciences Summer Scholarships**

Applications close on **Friday 16th September 2022,** and should be sent to:

Robyn Wilson
Faculty of Agriculture and Life Sciences
PO Box 85084
Lincoln University
Lincoln 7647
Christchurch
Robyn.Wilson@lincoln.ac.nz
Phone: (64) (3) 423 0652
Science South - Room 45

Eligibility

Applicants must be students intending to undertake full-time study in 2023. You may be continuing your Bachelors degree, or planning to begin an Honours, Masters, or PhD degree in 2023.

PLEASE NOTE: Due to COVID-19 travel restrictions implemented by NZ Government, all applicants for this scholarship need to be currently residing in New Zealand. We can NOT accept applications from those living overseas at the time of application as there is no guarantee you will be granted entry in time for the scholarship start date.

Applications

(Note: there is no official application form)
Please provide the following information:

- Name, student ID, address and contact details (include email address)
- Current degree being studied for
- Intended qualification to study for in 2023
- Project(s) you would like to work on (include the project number)
- Copy of your Academic Record
- Relevant previous work and/or research experience

An application for a maximum of 3 or 4 projects is considered appropriate. Please list in order of preference.

NOTE: All applicants must contact the lead supervisor listed at the bottom of each project prior to submission of their application.

Financial information

- Scholarship payments will be made fortnightly, with a final payment made on receipt of your approved project report, at the completion of the 12 working weeks.
- **For taxation purposes applicants must be intending to undertake full-time study in 2023.** (You may be continuing your Bachelors degree, or planning to begin an Honours, Masters, or PhD degree in 2023.)
- Students who receive Study Link funding should contact Study Link directly, prior to applying, as there may be implications for their funding.
- Current Masters and PhD students are not eligible to apply for this scholarship.

Timetable

• Friday 16 September 2022	Deadline for applications
• Friday 30 September 2022	Successful applicants notified
• Monday 14 November 2022 or Monday 21 November 2022 *(depending on supervisor)*	Scholarship research period begins
• Friday 24 February 2023	Final scholarship report due

Working conditions

The minimum expected hours of work will be 37.5 per week to be worked between Monday and Friday inclusive, between the hours of 7:00 am and 9:00 pm. This includes a meal break of 30 minutes and a refreshment break of 10 minutes within each three-hour continuous work period. From time to time you may be required to work outside of normal working hours. Working hours are to be negotiated with your supervisor. If any deviation to the original plan is made, then this **must** be approved by the Faculty Research Committee.

Criteria for awarding these scholarships

The criteria for awarding these scholarships take the following attributes of applicants into consideration:

Academic achievement
- Overall Grade Point Average (GPA)
- Last Semester GPA

Applicant's background
- Suitable subjects covered during study
- Suitable work/research experience

Intentions for future study
- Continuing within Bachelors degree
- Bachelors degree to be followed by Honours, Masters, or PhD

Scholarships will be awarded based on academic merit. The Faculty reserves the right to award the number of scholarships for which it believes it has suitable candidates and funding.

Guidelines for Summer Scholarship Final Report

Your final report for your scholarship should include the following:

- **Title page** – including name, supervisors and project title.
- **Abstract** – gives a brief summary of the project.
- **Introduction** –outlines the background to your summer research project, concluding with an outline of the objectives of the research you were involved in.
- **Methods** – this section covers the work carried out, described to a level equivalent to that given in a scientific paper.
- **Results** – a summary of results or achievement.
- **Discussion** – of results/achievements and how those linked with their objective and wider project objectives, if applicable.
- **Benefits of the scholarship** – your reflection on what you gained from the scholarship.
- **References cited/appendices** – if applicable.

Please provide an electronic and printed copy of your report to your supervisor(s) by Friday 24 February 2023.

Once your supervisor has approved your report and advised Robyn the final scholarship payment will be made.

List of Projects

No.	Project Title	Supervisor and email
1	Aluminium toxicity in high country soils	Assoc. Prof. Jim Moir Jim.Moir@lincoln.ac.nz
2	Animal breeding for improved resilience in hot climates	Dr. Racheal Bryant Racheal.Bryant@lincoln.ac.nz
3	Assessment on the stress response of sheep and its longevity following farmyard stress	Dr. Sandy Slow Sandy.Slow@lincoln.ac.nz
4	Balansa clover seed germination responses to different water potential and temperature	Prof. Derrick Moot Derrick.Moot@lincoln.ac.nz
5	Beer finning using new novel non-animal origin products	Dr. Leo Vanhanen Leo.Vanhanen@lincoln.ac.nz
6	Colour development in Pinot noir grapes during ripening	Dr. Bin Tian Bin.Tian@lincoln.ac.nz
7	Deriving Drone-based Digital Elevation Models	Assoc. Prof. Peter Almond Peter.Almond@lincoln.ac.nz
8	Design and analysis of novel 3D printed foods from New Zealand plant & animal proteins	Dr. Hannah Lee Hannah.Lee@lincoln.ac.nz
9	Detecting parasites through autofluorescence	Dr. Andy Greer Andrew.Greer@lincoln.ac.nz

No.	Project Title	Supervisor and email
10	Developing a novel nematode control method to eliminate unwanted nematodes from horticulture imports	Dr. Manjula Kularathna Manjula.Kularathna@lincoln.ac.nz
11	Dryland pastures – Regen Ag farmlet *(two summer scholarships)*	Prof. Derrick Moot Derrick.Moot@lincoln.ac.nz
12	Evaluating the susceptibility of commercially available Maize cultivars against native populations of root lesion nematode	Dr. Manjula Kularathna Manjula.Kularathna@lincoln.ac.nz
13	Exploring rootstock differences in vine phenology and growth	Dr. Amber Parker Amber.Parker@lincoln.ac.nz
14	Fighting fire with food	Assoc. Prof. Tim Curran Timothy.Curran@lincoln.ac.nz
15	Fighting fire with mahinga kai and rongoā (food and medicine)	Dr. Lloyd Carpenter (Te Whatu Ora - Waitaha), Assoc. Prof. Tim Curran Timothy.Curran@lincoln.ac.nz
16	Geeky geckos: Developing photographic methods for use with software packages to identify individuals of Woodworthia brunnea, the Canterbury gecko	Dr. Jennifer Gillette Jennifer.Gillette@lincoln.ac.nz
17	How do plants communicate with associated beneficial microbes?	Dr. Artemio Mendoza Mendoza Artemio.Mendoza@lincoln.ac.nz
18	How much nitrate moves through Canterbury's braided rivers?	Dr. Naomi Wells Naomi.Wells@lincoln.ac.nz

No.	Project Title	Supervisor and email
19	Insect biodiversity amongst Aciphylla patches: looking for beetles in a needle-stack	Mike Bowie Mike.Bowie@lincoln.ac.nz
20	Kawakawa and the hungry little caterpillar. What bioactive properties increases the medicinal value of Kawakawa leaves?	Mike Bowie Mike.Bowie@lincoln.ac.nz
21	Novel insights into indigenous starter culture selection for NZ wine innovation	Prof. Stephen On Stephen.On@lincoln.ac.nz
22	Pea seed production under heat stress	Prof. John Hampton John.Hampton@lincoln.ac.nz
23	Plantain-based pasture to reduce nitrogen losses from grazing dairy systems	Dr. Omar Al-Marashdeh Omar.Al-Marashdeh@Lincoln.ac.nz
24	Quality and yield of ancient and modern Barley cultivars	Dr. Mariana Andreucci Mariana.Andreucci@lincoln.ac.nz
25	Soil pH and nutrient dynamics of dryland pasture legume species in high country	Assoc. Prof. Jim Moir Jim.Moir@lincoln.ac.nz
26	Testing plant interactions with their environment	Prof. Rainer Hofmann Rainer.Hofmann@lincoln.ac.nz
27	The enzymatic hydrolysis of plant proteins by novel enzymes	Dr. Keegan Burrow Keegan.Burrow@lincoln.ac.nz

No.	Project Title	Supervisor and email
28	Tū Te Rakiwhānoa Drylands terrestrial arthropod sampling and identification *(two summer scholarships)*	Dr. Cor Vink Cor.Vink@lincoln.ac.nz
29	Understanding the role of microbes in resilient soil ecosystems	Prof. Eirian Jones Eirian.Jones@lincoln.ac.nz
30	Yield survey and data collation of pastures in New Zealand	Prof. Derrick Moot Derrick.Moot@lincoln.ac.nz

Details of each project available are as follows:

1 Aluminium toxicity in high country soils

Soil acidification is a critical issue which limits grassland and crop production globally. In some soils acidification enhances the mobilization of toxic metals including aluminium (Al), particularly at a pH<5.5, resulting in increased uptake by plants. Pastoral high and hill country farmers in New Zealand often face challenges maximising the productivity of their system due to acidic and low nitrogen (N), phosphorus (P) and sulphur (S) fertility soils. Aluminium toxicity is found extensively throughout New Zealand and is an issue associated with acidic soils. Some soil orders are more susceptible to Al toxicity due to higher concentrations of extractable AlCaCl2, which can severely restrict the establishment and growth of legume species. The rooting depth of legumes can be severely affected by subsoil Al toxicity, which occurs in many high and hill country soils. However, the exact nature and drivers of aluminium toxicity in soil are still poorly understood.

This scholarship involves field work sampling acid soils in high country, in combination with experimentation on the LU campus examining the nature of these soils. On-farm field sites in south Canterbury and central Otago will be visited and sampled, including soils and pasture legumes. Glasshouse and laboratory experiments will be conducted over the summer, involving plant growth and incubation experiments.

Supervisor: ***Assoc. Prof. Jim Moir***

Email: Jim.Moir@lincoln.ac.nz

2 Animal breeding for improved resilience in hot climates

Lincoln University is collaborating with Livestock Improvement Corporation (LIC) to investigate the effect of dairy cows carrying the SLICK gene on heat and cold tolerance. In this research, calves born in August 2022 with or without the SLICK gene will be compared in their growth rate, grazing behaviour and body temperature when exposed to different climatic conditions. The research will be carried out on the university's research dairy farms. Temperature and activity sensors will be attached to calves and visual observations of their behaviour, including respiration rate, will be carried out to determine whether animal genetics affects behaviour of young stock. Because the work is carried out in collaboration with LIC, there may be opportunities to evaluate heat stress in some of their SLICK

animals in the North Island where heat stress conditions are more prevalent.

Supervisor: ***Dr. Racheal Bryant***

Email: Racheal.Bryant@lincoln.ac.nz

3 Assessment on the stress response of sheep and its longevity following farmyard stress

The welfare of our farm animals is becoming a more important consideration to end consumers of our meat and dairy products. Consumers, not only require good quality products they also demand greater transparency and assurance that the animals have been raised and managed on farm in an ethical manner with high welfare standards. Managing stress by modifying various husbandry practices is important to ensure animal welfare. As such, having data about how animals respond under stress-inducing situations and the longevity of that response is needed so that we can modify our farming practices accordingly and improve animal welfare. Previous studies in sheep have shown that following farmyard stress which involved animals being herded by a barking dog, there was an immediate stress response that impacted meat quality in the early post-mortem period. However, other less invasive biological and behavioural measurements and the longevity of the stress response has not yet been explored.

In this project, the student will evaluate the stress response of sheep and its longevity following farmyard stress. Methods will include obtaining physiological data via biosensors, behavioural observation and analytical assessment on biological samples. The student will gain key skills in running a sheep trial, collecting samples and data as well as analysing and interpreting the results.

Supervisor: ***Dr. Sandy Slow, Jasmine Tanner, Dr. Nadia Mitchell, Dr. Hannah Lee***

Email: Sandy.Slow@lincoln.ac.nz

4 Balansa clover seed germination responses to different water potential and temperature

Balansa (*Trifolium michelianum*) is an annual clover that provides high yields of quality feed in early spring for lactating stock. In a recent field experiment it failed to germinate from the soil seed bank which may have

been due to high soil temperatures, despite high soil moisture. This project will quantify the germination of balansa clover seed from two cultivars, 'Taipan' and 'Viper', in response to different water potentials and temperatures and compare it with other annual clovers, such subterranean clover. The research will help farmers work out ideal conditions for autumn sowing of these important dryland species.

The work will also involve assisting the dryland pasture research at the Field Research Centre, Lincoln University. You will set up and monitor the experiments and collate the data. The results will be incorporated into a 2023 Journal of New Zealand Grasslands manuscript and could be developed into a hydrothermal time model.

Supervisor: ***Prof. Derrick Moot, Dr. Sonya Olykan***

Email: **Derrick.Moot@lincoln.ac.nz**

5 Beer finning using new novel non-animal origin products

Beer and other alcoholic beverages are often fined to clarify, stabilise biochemically, and modify flavour and aroma. Current industry practice uses fining agents from a range of origins. Sourced from animals, animal processing by-products, minerals, bacteria, and fungi extracts and general plant sources. With increasing consumer preference towards sustainable and natural food products, the use of non-animal origin-based food processing aids is of interest.

In this project it is proposed to evaluate a range of potential new novel non-animal derived beer fining agents. In cooperation with a local brewery and other local food innovators.

Supervisor: ***Dr. Leo Vanhanen***

Email: **Leo.Vanhanen@lincoln.ac.nz**

6 Colour development in Pinot noir grapes during ripening

Pinot noir grapes have a thin skin, which means extraction of flavour and colour from grape skin into wine is always a challenge for winemakers. Understanding the colour development in Pinot noir grape skin is important for wine producers to manage the colour extraction during wine production. Anthocyanins and other phenolic compounds sourced from grapes have great impact on colour intensity and colour stability in red wines.

In this project, anthocyanins and other phenolic compounds related to red wine colour development will be analysed in Pinot noir grape skin during ripening. Pinot noir grapes are sourced from a commercial vineyard. The findings of this project will be useful to better understand how the initial anthocyanins and phenolic content in Pinot noir grapes can influence the outcome of Pinot noir wine colour intensity and stability.

Supervisor: ***Dr. Bin Tian***

Email: **Bin.Tian@lincoln.ac.nz**

7 Deriving Drone-based Digital Elevation Models

Detailed and precise digital elevation models are essential for understanding and modelling soil erosion processes. Yet outside the limited coverage of Lidar elevation surveys they are unavailable. With the advent of highly capable drones, aerial imagery can be readily obtained, which allows for computer-based photogrammetry techniques to be used to derive accurate models of the surface topography.

This project entails a summer scholar accompanying a PhD student in the Department of Soil and Physical Sciences to her study area in Central Otago and flying a drone to capture aerial images along a pre-planned flight path. The imagery obtained will then be processed in “Structure-from-motion” software to construct a digital surface model. The student will then process that model to derive measures of terrain form (morphometric variables) that can be used to assess soil transport paths and erosion rates. The student will be working under the guidance of Associate Professor Peter Almond to gain understanding of he relevance of surface models for soil erosion modelling and Dr. Crile Doscher for the mechanics of aerial image capture and processing. A student with experience with GIS would be well suited but that skill is not essential if the student is numerically and computer-competent.

Supervisor: ***Assoc. Prof. Peter Almond, Dr. Crile Doscher (ESD)***

Email: **Peter.Almond@lincoln.ac.nz**

8 Design and analysis of novel 3D printed foods from New Zealand plant & animal proteins

The NZ government’s vision of Food Transition 2050 emphasises diversification and hence evaluation of both animal and non-animal protein for food applications is gaining increasing attention. One of approach to

increase available protein is to reduce food wastage and fully utilize existing animal and plant based proteins by improving their functional and nutritional value. 3D printing technology can offer opportunity to create the food industry to prepare complex shaped foods with increased functional and nutraceutical value. The aim of this project is to develop novel 3D printed foods from New Zealand plant and animal proteins and evaluate their physico-chemical characteristics in particular the science of the flow and deformation behavior of 3D food inks using rheometer and texture analyser.

The student will investigate the rheological properties of 3D inks and printed foods, such as viscosity, texture, heat and shear stability, which have a significant influence in food design and sensory perception. The changes that occur during steady-state rheology will elaborate the extrusion properties of 3D inks as a function of shear rate.

Supervisor: ***Dr. Hannah Lee, Dr. Lokesh Kumar***

Email: **Hannah.Lee@lincoln.ac.nz**

9 Detecting parasites through autofluorescence

This project will attempt to develop a proof of concept for the visualization of parasite nematodes through the use of autofluorescence. Infection with gastrointestinal parasitic larvae are a major constraint to all grazing livestock. The infective larvae are small, being around 1mm in length and consequently difficult on detect on pasture which leaves limited options for the rapid determination of the number of larvae present on a pasture to estimate either larval challenge, or the size of a population when trying to provide refugia. Recently we have discovered that with the certain wavelengths of light these larvae will display autofluorescence whereby they ‘glow’ when exposed to light.

Working with colleagues from Canterbury University with expertise in computer vision and machine learning this project will explore the possibility of, and potentially optimize, using autofluorescence to detect and distinguish parasitic nematode larvae with the ultimate goal of developing an in situ real-time method of determining the parasite load on pastures.

Supervisor: ***Dr. Andy Greer***

Email: **Andrew.Greer@lincoln.ac.nz**

10 Developing a novel nematode control method to eliminate unwanted nematodes from horticulture imports

New Zealand (NZ) imports a significant volume and variety of nursery stock each year. These imported goods present a significant biosecurity risk of introducing unwanted pests and pathogens into NZ. A range of plant parasitic nematodes, such as potato cyst, beet cyst, root lesion, and root-knot nematodes, are associated with these imports. These nematodes parasitize plants reducing their growth and survival, resulting in significant crop yield losses. Due to a decision made by the NZ Environmental Protection Authority (EPA), currently available chemical treatments used at the border to eliminate these nematode threats will be phased out soon. Therefore finding an alternative method to protect our border is a high priority.

The selected student will be involved in innovative research to validate the efficacy of a range of newly developed nematode management methods. The student will be working alongside an MSc student and with scientists at Lincoln University, Plant & Food research.

Supervisor: ***Dr. Manjula Kularathna, Marissa Mcdonald, (MSc candidate)***

Email: **Manjula.Kularathna@lincoln.ac.nz**

11 Dryland pastures – Regen Ag farmlet *(two summer scholarships)*

The dryland pasture research team has an extensive research programme operating from Omarama to Hawkes Bay. Two summer scholarships are available to assist with pasture and animal measurements on our regenerative agriculture farmlet. These involve lucerne, sub clover and multispecies grass based pastures. The scholars will work at the University and visit high country and hill country properties throughout Canterbury to gather data.

Supervisor: ***Prof. Derrick Moot, Malcolm Smith, Dr. Alistair Black***

Email: **Derrick.Moot@lincoln.ac.nz**

12 Evaluating the susceptibility of commercially available Maize cultivars against native populations of root lesion nematode

Root lesion nematodes (RLNs) are known to cause significant economic losses to a variety of cereal crops around the world. Even though RLNs

are commonly found in cereal fields in New Zealand (NZ), up to now, there has been no research done in this area to understand the detrimental effects of RLNs on NZ cereal crops.

The selected candidate will work alongside a PhD student working in this area to identify the potential threats that this nematode genus poses to the NZ cereal industry. The student will be involved in evaluating the pathogenicity and reproduction of RLNs on selected commercially available Maize cultivars using laboratory assays and greenhouse pot experiments. The student would be able to learn laboratory and greenhouse techniques used in Phytonematology as well as methods used for data analysis.

Supervisor: ***Dr. Manjula Kularathna, Thiru Nagarathnam (PhD candidate)***

Email: Manjula.Kularathna@lincoln.ac.nz

13 Exploring rootstock differences in vine phenology and growth

Rootstocks are a key tool for adapting to climate change in the context of potential reduced water resources, extreme weather events such as flooding and from a sustainable water management perspective. In the Lincoln University vineyard we have two rootstock trials, one for Chardonnay that has been established for 20 years, and a new planted Pinot noir rootstock trial, planted in 2020.

The aim of this project is for the student to assess differences in phenology and growth in response to different rootstocks to develop a deeper understanding of their potential for use to adapt to climate change. This project will involve the student spending time in the Lincoln University vineyard to make these measurements, acquire a deeper understanding about plant physiology and learning data analysis skills to understand their measurements.

Supervisor: ***Dr. Amber Parker, Dr. Olaf Schelezki***

Email: Amber.Parker@lincoln.ac.nz

14 Fighting fire with food

Destructive wildfires are becoming more common in many parts of the world, including New Zealand. A key driver of fire behaviour is fuel and in wildfires the main fuel is vegetation. This means that there is a clear need

to assess the flammability of different plant species and vegetation types, including those that occur on rural lands. This project will measure the shoot flammability of a range of plant species commonly found on rural land, particularly crops and pastures, to identify those species with high flammability (representing a high fire hazard) and those with low flammability, which might be strategically planted to reduce fire spread (green firebreaks).

This project will involve collaboration with a postdoctoral scholar (Dr. Alam) and will comprise plant species identification, field work to collect samples and laboratory work to burn samples and measure their flammability (on a plant BBQ!). It is part of a wider project, which is aimed providing nature-based solutions to pressing environmental problems (such as wildfire).

Supervisor: ***Assoc. Prof. Tim Curran, Dr. Azhar Alam, Dr. Tom Maxwell***

Email: Timothy.Curran@lincoln.ac.nz

15 Fighting fire with mahinga kai and rongoā (food and medicine)

Destructive wildfires are becoming more common in many parts of the world, including New Zealand. A key driver of fire behaviour is fuel and in wildfires the main fuel is vegetation. This means that there is a clear need to assess the flammability of different plant species and vegetation types, including those that occur on rural lands. Previous research has identified many plant species used for mahinga kai and rongoā as being low in flammability, and hence good candidates for planting to reduce fire hazard. This project will employ kaupapa Māori principles to explore the traditional use of ahi (fire) in Māori society, and mātauranga Māori regarding the flammability of mahinga kai and rongoā plant species.

We are seeking a student with experience in kaupapa Māori. Some experience with plant flammability research would be an advantage, but is not essential.

Supervisor: ***Dr. Lloyd Carpenter (Te Whatu Ora - Waitaha), Assoc. Prof. Tim Curran, Dr. Azhar Alam, Dr. Tom Maxwell***

Email: Timothy.Curran@lincoln.ac.nz

16 Geeky geckos: Developing photographic methods for use with software packages to identify individuals of Woodworthia brunnea, the Canterbury gecko

Understanding basic life-history parameters of a population and obtaining accurate estimates of population size are essential to making evidenced-based decisions regarding conservation strategies. Estimating population size and characterizing life-history parameters such as survivorship can be done effectively using mark-recapture studies, which require the ability to identify individual animals. One current best-practice technique for identifying individuals is through use of photography. Protocols for use of photography, often also involving use of a software package, to identify individuals have been developed in a variety of taxa, including in lizards, but protocols must be developed for each species before use in a wider research context.

The aim of this summer research project is to begin the process of developing effective photographic methods to use with a software package for identifying individuals of the Canterbury gecko. This project will involve taking lots of pictures of captive and/or wild geckos, keeping the pictures organized in a large database, curating these pictures as needed, and using these pictures to test the effectiveness of several software packages. This project could involve additional field work on Banks Peninsula looking at geckos under artificial cover objects. Local travel (greater Christchurch/Banks Peninsula area) will be required, and the successful student will need to be comfortable handling geckos. Photography skills would be useful but not essential. This will be a fun opportunity for someone interested in herpetology and will develop skills that are useful in behavioural, population and conservation ecology.

Supervisor: ***Dr. Jennifer Gillette, Mike Bowie***

Email: **Jennifer.Gillette@lincoln.ac.nz**

17 How do plants communicate with associated beneficial microbes?

This project aims to understand how fungi communicate with plants during colonisation, and to investigate whether secondary metabolites (SMs) secreted by fungi regulate the establishment of the mutually beneficial plant-root holobiont. We will use the beneficial rhizosphere fungus *Trichoderma atroviride*, and strains with affected SM secretion, to track fungal interaction with the roots. The summer student will learn to use fluorescence and confocal microscopy, real time PCR, and gene expression analysis.

Supervisor: ***Dr. Artemio Mendoza Mendoza, Assoc. Prof. Chris Winefield***

Email: **Artemio.Mendoza@lincoln.ac.nz**

18 How much nitrate moves through Canterbury's braided rivers?

Although nitrate concentrations in Canterbury groundwater and drains have reached worryingly high levels, relatively low concentrations are reported for the iconic braided rivers that supply most of the plains' water. Why is this? The objective of this summer scholarship will be to take the first step towards answering this rather large question by figuring out if current monitoring approaches provide accurate information on nitrate in braided rivers. Do we need to sample all of the river 'braids', or do concentrations stay the same over the whole river? And how much do these concentrations change day-to-day in response to changing flows?

Work will involve carrying out extensive field sampling across a number of Canterbury braided rivers, as well as using image data (e.g., LIDAR) to determine how the sampled river channels move over time. This work sits within a larger braided river focused project, which will give the student the opportunity to work closely with both peers and highly experienced researchers. The student will gain skills in water science field techniques, empirical research design, nitrogen cycling, and spatial data analysis.

Supervisor: ***Dr. Naomi Wells, Prof. Tim Clough***

Email: **Naomi.Wells@lincoln.ac.nz**

19 Insect biodiversity amongst Aciphylla patches: looking for beetles in a needle-stack

Aciphylla (speargrass/wind spaniard) is an iconic element of New Zealand's high-country flora yet is often maligned by hikers and farmers due to its spear-like leaves. Many weevil species live on *Aciphylla* including the endangered Canterbury knobbled weevil, and their inherent behaviour is to drop into the protective stack of needles when disturbed. Larger patches of *Aciphylla* provide protection to other invertebrates, lizards and even plants. Surveying for the Canterbury knobbled weevil over several summers has collected a large diversity of insect species needing curation, identification. The successful summer scholarship will work mainly in the lab sorting, curating, and collating a list of species for a research publication. A few days of field work may be undertaken

collecting insects around *Aciphylla* from local sites on Banks Peninsula or general upper Rakaia Gorge region.

Preference will be given to someone with good entomological skills in identification and curation – therefore a prerequisite would be a student who has passed ENTO304 with good marks.

Supervisor: ***Mike Bowie***

Email: **Mike.Bowie@lincoln.ac.nz**

20 Kawakawa and the hungry little caterpillar. What bioactive properties increases the medicinal value of Kawakawa leaves?

Kawakawa (Macropiper excelsum) is an endemic plant of Aotearoa-New Zealand and is a rongoā rākau, medicinal plant culturally significant to Māori. Kawakawa uses include ointment and balms to treat skin issues such as eczema, burns, cuts, bites, rashes, and inflammation. The kawakawa looper/whangawhanga (Cleora scriptaria) creates the characteristic holes in kawakawa leaves and Mātauranga Māori (Māori knowledge) teaches us that leaves eaten by the caterpillars have greater healing properties. A current PhD research project has provided some support for the health properties of kawakawa having identified that there is a substantial difference in the metabolomic fingerprint of eaten and non-eaten leaves, and artificially hole punched leaves.

This summer project will investigate the metabolomic differences between eaten, non-eaten, and artificially damaged leaves. Your project will involve designing and setting up glasshouse and laboratory trials, rearing insects, collecting and processing biological material and learning to prepare samples for metabolomic analysis. You will have the opportunity to include Mātauranga into your work and learn how to implement tikanga (Māori protocols). There may also be an opportunity for an overnight fieldtrip to collect Kawakawa looper from Banks Peninsula. Accurate record keeping will be important, and you will need to be comfortable working with insects. You will be based at both Lincoln University and AgResearch, Lincoln where you will be part of a research team that covers a wide range of research disciplines.

Supervisor: ***Mike Bowie, working with Chrystal O'Connor (PhD candidate), in conjunction with AgResearch entomology, proteomics, and metabolomics scientists.***

Email: **Mike.Bowie@lincoln.ac.nz**

21 Novel insights into indigenous starter culture selection for NZ wine innovation

The New Zealand wine industry generates $2 Billion per annum and has been in sustained growth for decades. Innovation is critical to continue this trend. Wine is a highly complex fermented beverage as a result of interactions between grapes and a series of microorganisms, in which the species (both Saccharomyces and non-Saccharomyces) and strains of yeast play an important role. Metabolic profiles of individual yeast strains may differ significantly, yielding different organoleptic profiles important in the “terroir” of wine. The selection of indigenous yeast strains has become a useful marketing tool, and a better understanding of their metabolic properties offers the prospect of crafting wines for specific markets.

Our previous research using proteomic and genomic analyses has revealed inter-relationships among indigenous NZ (Canterbury) isolates, and commercial yeast strains of varying international origins. This project will involve the characterisation of a selection of these strains using a range of key metabolic and organoleptic assays, to investigate the correlations between proteome, genotype and “metabolotype”, to inform a new and exciting strategy for identifying novel indigenous strains for winemaking. We envisage this project would form the foundation for a research paper to be published in an international peer-reviewed journal.

Supervisor: ***Prof. Stephen On, Dr. Junwen Zhang***

Email: Stephen.On@lincoln.ac.nz

22 Pea seed production under heat stress

Global warming and the associated rising temperatures pose increasing challenges for heat sensitive crops such as peas which are a cool season legume. Several beneficial fungi have been shown to improve plants ability to cope with heat stress. To investigate if some native beneficial fungi are able to improve pea performance under heat stress, a pea field trial was conducted with four different sowing dates (August, September, October, and November) in 2021 and seed harvested. This summer scholarship project will involve quality testing of seeds produced during the 2021 season and working on the second year repeat field trial that is currently underway.

The student will learn various techniques including seed quality tests, (eg-germination, vigour, antioxidant enzyme content, and important enzymes in protecting the cell from oxidative damage (such as catalase)), and be able to determine if the plants had improved heat stress tolerance as a

result of the fungi. This project will allow the scholar to gain a deeper understanding of the New Zealand seed industry, designing, conducting experiments both in the field and in glasshouse environments, and also statistical analyses of the data.

Supervisor: ***Prof. John Hampton, Dr. Hossein Alizadeh, Zivana King (PhD candidate)***

Email: **John.Hampton@lincoln.ac.nz**

23 Plantain-based pasture to reduce nitrogen losses from grazing dairy systems

Reducing the environmental footprint from the dairy farming sector has increasingly become a research focus in New Zealand. The nitrogen (N) deposited in urine patches of cow grazed perennial ryegrass, and white clover pasture is a significant contributor to on-farm N pollution, due to these swards delivering N in excess of animal requirements. Recently, alternative forages such as plantain (*Plantago lanceolata L*.) has been identified to reduce nitrogen losses. However, testing the implementation of plantain in a farm system is required. Currently, milk production and composition, nitrogen losses and pasture production of dairy cows managed in sub-farms to graze on ryegrass-based pasture containing different proportions of plantain are investigated at Lincoln University Research Dairy Farm (LURDF). Summer scholars are required to help with management of the farmlets, and animal and pasture data collection.

Please note that because the research is based at a dairy farm, the project can contribute towards your practical work requirement for dairy.

Supervisor: ***Dr. Omar Al-Marashdeh***

Email: **Omar.Al-Marashdeh@Lincoln.ac.nz**

24 Quality and yield of ancient and modern Barley cultivars

This project will evaluate phenology, final yield and quality of four Barley cultivars. There will be two modern and two ancient cultivars, which will be managed as seed multiplication plots. The student will be responsible for phenology evaluation, management, harvest and final yield and quality measurements. The aim is to compare the timing of phenological events and evaluate possible differences in yield and quality of grain. This will then help to determine the most appropriate end use of these varieties.

Supervisor: ***Dr. Mariana Andreucci***

Email: **Mariana.Andreucci@lincoln.ac.nz**

25 Soil pH and nutrient dynamics of dryland pasture legume species in high country

The productivity of South Island high country is typified by a short, often soil moisture limited growing season, and acid soils (pH < 5.5). Traditionally, white clover has been sown as the key pasture legume, but fails to persist. The use of alternative pasture species, such as deep rooting Lucerne, has been suggested to improve dryland pasture production. However, lucerne is known to be intolerant of acid soil conditions, and related aluminium (Al) toxicity issues. Nutrient and trace element availability is also strongly influenced by soil pH. To offset increased soil acidity, lime must be applied, and where this cannot be done, soils may be too acidic for legumes and productivity declines sharply.

This scholarship project will examine a suite of novel pasture legume species grown in acidic / high aluminium soil conditions under field and glasshouse conditions. Field work will be conducted in Central Otago.

Supervisor: ***Assoc. Prof. Jim Moir***

Email: **Jim.Moir@lincoln.ac.nz**

26 Testing plant interactions with their environment

Plants interact with a wide spectrum of environmental variables in nature. This includes abiotic (e.g. availability of water or nutrients, temperature) and biotic factors (e.g. pests and diseases). Examinations of the interactions of these environmental factors with plants provide exciting new research opportunities in plant science. This summer project studies such environmental interactions and how they affect plants. The project will enable the student to learn key skills in plant physiology and provides novel insights for the understanding of plant performance and resilience in a changing environment.

Supervisor: ***Prof. Rainer Hofmann***

Email: **Rainer.Hofmann@lincoln.ac.nz**

27 The enzymatic hydrolysis of plant proteins by novel enzymes

The enzymatic hydrolysis of proteins, via gastro-intestinal digestion process, results in the liberation of encrypted peptides. It is well established that peptides of health promoting functions (bioactive peptides) can be generated from animal protein sources including whey proteins, and meat waste. The potential of plant proteins as bioactive peptides has however been comparatively under studied. This project aims screen a range of novel fungal and plant derived enzymes for their ability to hydrolyse plant protein extracts, and optimise the conditions used during the hydrolysis process. Methods used may include, protein quantification, enzyme activity evaluation, protein purification, gel electrophoresis, antioxidant activity assays, and *in vitro* determination of bioactivity. This project will be based in the protein biochemistry lab in the Department of Wine, Food, and Molecular Biosciences.

Supervisor: ***Dr. Keegan Burrow, Dr. Hannah Lee***

Email: **Keegan.Burrow@lincoln.ac.nz**

28 Tū Te Rakiwhānoa Drylands terrestrial arthropod sampling and identification *(two summer scholarships)*

The Tū Te Rakiwhānoa Drylands project aims to protect significant areas of several threatened environment types and the native species they contain in a collection of Public Conservation Land areas across the valley floor of the Mackenzie Basin. This project is focussed on understanding the distribution and diversity of terrestrial arthropods within selected Tū Te Rakiwhānoa Drylands sites. The information gained from this work will be used to support future site-specific management plans. The study will involve field surveys using a range of sampling methods (e.g., malaise traps, pitfall traps) to determine factors such as presence, species diversity and indicative distribution and relative abundance of terrestrial arthropod groups.

The student will need to have skills in the collection and identification of terrestrial arthropods; the ideal evidence of the necessary skills would be an A- or better in ENTO304 (or equivalent entomology course). They will also spend the duration of the scholarship in Mackenzie District (accommodation provided).

Supervisor: ***Dr. Cor Vink, Dr. Tara Murray***

Email: **Cor.Vink@lincoln.ac.nz**

29 Understanding the role of microbes in resilient soil ecosystems

Healthy resilient soil ecosystems underpin Aotearoa|New Zealand land-based economies. Soils are increasingly vulnerable to land-use change, pathogen/pest invasion, and climate change, all of which degrade soil quality and can reduce their resilience to subsequent stresses. The resilience of soils to these stresses have been shown to be linked to the diversity and structure of soil microbial communities. A key group of beneficial soil microbes are arbuscular mycorrhizal fungi (AMF) which form symbiotic relationships with plant roots, making them a key component of resilient soil ecosystems.

In this summer project the student will be involved in research projects investigating how we can create healthy disease-resistant and climate-resilient soils. Specifically the student will be involved in experiments to investigate how land-use shapes AMF and other microbial communities, and how those communities affect the resilience of plants in both agricultural and native ecosystems. These projects sit within the Bioprotection Aotearoa Centre of research excellence, a national research centre dedicated to train the next generation of bioprotection researchers and to deliver world-class research that protects the productive and natural landscapes of Aotearoa New Zealand. This summer scholarship project will enable the student to gain key skills in soil microbial ecology and plant pathology whilst working in a vibrant research group. There may be opportunities to assist with field work in Te kaha, Bay of Plenty.

Supervisor: ***Prof. Eirian Jones, Prof. Amanda Black, Finn Bulman and Alana Thurston (PhD candidates)***

Email: **Eirian.Jones@lincoln.ac.nz**

30 Yield survey and data collation of pastures in New Zealand

For sheep and beef systems, pasture supply is predominantly from unimproved resident pastures. The challenges and costs associated with production land development means these pastures are not commonly renovated and restricted fertiliser input is added. A nationwide survey and mapping of yield of resident and or sown pasture species with and without nutrients can indicate locally (where?) potential yield gaps exist and the quantify the advantages (how much?) of adding nitrogen or legumes in those deficient pastoral systems.

This project aims to pool historical and current data to provide as many datapoints as possible for all agricultural regions of New Zealand through the AgYields National Database (agyields.co.nz). This summer scholarship

will involve data mining, documentation, field experimentation, desktop analysis and software skills and to gain knowledge on research, data management and repositories.

Supervisor: ***Prof. Derrick Moot***

Email: **Derrick.Moot@lincoln.ac.nz**