

PhD research fellowships

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The PhD research fellowships are part of a new Centre for Agricultural Innovation (CAI). The CAI is a joint initiative between The University of Melbourne and Agriculture Victoria. PhD research fellowships will be based at the following locations:

- Ellinbank Research Centre and SmartFarm
Ellinbank, Victoria
- Hamilton Research Centre and SmartFarm
Hamilton, Victoria
- AgriBio, the Centre for AgriBioscience
Melbourne, Victoria

Successful applicants must meet Australian university entry requirements for a Doctor of Philosophy degree.

For enquiries and to apply, please forward a covering letter, your curriculum vitae (please include evidence of research writing) and academic transcripts to:

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Predicting pasture yield

Home grown forage, including pasture, is the cheapest feed source available for grazing based systems and a key driver of farm profit if utilised efficiently. Measuring dry matter yield is the first step to properly managing this valuable feed resource. Current research activities have been investigating cutting-edge non-destructive technologies for this purpose including airborne imaging (satellite and UAV-borne), ground based-sonar, 3D photogrammetry, and LiDAR sensors.

The PhD research fellowships available in this field include:

- *Applying non-destructive pasture yield measurement technologies to alternative dairy forages.*
- *Developing and deploying innovative on-farm sensors.*
- *Preconditioning predictive biophysical pasture yield models using remote and satellite derived data.*

Predicting pasture quality

While optimising homegrown forage production and its subsequent utilisation is a key driver for farm profitability, understanding the nutritive value (e.g. metabolizable energy and protein concentration) offers additional opportunity to further enhance the profitable feeding of livestock. Emerging research has shown that 'hyperspectral' sensors can be used to predict pasture nutritive characteristics, through modelling of the reflectance of thousands of wavelengths of light from the pasture surface. The challenge now is to determine whether next-generation, lower cost sensors can be just as accurate as high-end scientific instruments and enable real-time detailed nutrient analysis of forage to become routine practice in farming settings in the future. [The PhD research fellowships available in this field include:](#)

- * Predicting nutritive characteristics of perennial ryegrass on farms: application of different sensors and analytical methodologies to optimise prediction accuracy.
- * Predicting nutritive characteristics of other forage species using hyperspectral sensors.
- * Alternative uses of next generation hyperspectral sensors to determine pasture characteristics that aid in farmer decision making.

Sensor data integration

Current research initiatives have invested heavily into innovative sensors to improve pasture monitoring and management. Aligned to current research approaches the opportunity exists for PhD students who enjoy data manipulation and modelling, or agricultural engineering, to work on multi-sensor integration for improved pasture management. This would include the improvement of data processing workflows, combining data with environmental meta-data, and joining of complementary datasets to enhance modelling capabilities. [The PhD research fellowships available in this field include:](#)

- * Moving from 'near real-time' to real-time: creating data workflows that allow farmers to view data as soon as it is collected.
- * Creating multi-sensor platforms to improve the predictive capabilities of nondestructive pasture yield sensors on farm.
- * Developing innovative data modelling approaches to improve prediction of pasture characteristics

Valuing the on-farm impact of novel pasture genetics and management technologies

Measuring and valuing the impact of new pasture cultivars, traits and technologies is complex but is important for designing new breeding programs, farmer choice between cultivars or species and the system-wide application of novel technologies. Recent advances such as the Forage Value Index (FVI) allow farmers to assess the relative merit of cultivars with contrasting performance. However, climate change and high-impact pasture technologies such as high-yielding hybrids will disrupt the way we value forages and the way this value is captured on farm. [The PhD research fellowships available in this field include:](#)

- * Developing economic and farm systems-models to value seasonal variation in forage dry matter yield and nutritive characteristics of pasture cultivars for dairy systems in future climates.
- * Utilising 'big-data' approaches to link on-farm pasture performance and milk production with variation in forage genetics.

Virtual fencing to improve pasture allocation and utilisation

This PhD candidate will integrate non-destructive technologies for measuring pasture attributes with pasture allocation at a herd scale while developing methodologies to ensure an even distribution of forage across the grazing herd. Recent developments in virtual fencing technology offer an opportunity to re-define how pasture is allocated and utilised in manner that enables the development of strategies to deliver a more uniform supply of nutrients across the herd. Implicit in the application of virtual fencing within rotational grazing systems will be a need to understand the impact on animal behaviour over time. The PhD candidate will investigate the economics of using virtual fencing to develop feeding regimes to supply consistent nutrient supply across the herd.

Using breath sensors to estimate respiration rate and daily dry matter intake of individual cows at pasture

This PhD candidate will identify sensors to measure changes in gas concentrations in dairy cow breath and use this information to estimate dry matter intake and respiration rate. Current methods to estimate pasture intake either provide an average intake across the herd or require expensive and intensive sampling and subsequent analysis. The proposed approach will compare estimated feed intake by gas sensor with other currently available methods and aims to provide near real time information on individual cow intake at grazing.

Factors affecting the rumen environment of lactating cows during heat exposure

This PhD candidate will improve our understanding of how key factors such as decreased feed intake, decreased rumination time, loss of saliva and altered eating pattern impact the rumen environment during periods of heat stress. Studies will use a range of nutrition interventions and measure changes in rumen pH, volatile fatty acids (VFA) concentrations, buffering capacity and redox potential. The information generated will contribute to guidelines for nutritional strategies to manage lactating dairy cows during hot weather.

Physiological responses of lactating cows to varied diet composition or feed additives during hot weather

This PhD candidate will measure the effects of different nutritional regimes on physiological responses of lactating cows experiencing hot weather and identify variation in the expression of genes during such conditions. Using a range of measurement technologies, the candidate will monitor core temperature data, dry matter intake, milk production and composition, skin temperature, respiration rate, and heart rate to develop an understanding of the metabolic responses to acute heat exposure when diets differing in concentrate or forage type and with the inclusion of specific dietary additives are offered. Biological samples will be collected to assess gene expression, metabolic profiles and milk microbiome. In addition, physiological responses in cows with high and low predicted heat tolerance will be compared.

Characterisation of 100,000L/lifetime cows from pasture based systems

This PhD candidate will develop a measure that can help to monitor the health and well-being of high producing dairy cows with extended longevity in the herd. This will be done by characterising very high producing cows that have achieved a high lifetime production (i.e. 100,000 L) with those of lower production. It is estimated that there is less than 200 out of 1.6 million dairy cows in Australia that have achieved a lifetime milk production of 100,000 L and farmers often say these animals go unnoticed because they have adequate fertility and production and do not require regular veterinary attention. The aim of this project is to improve our understanding of traits and genes that relate to these cows. A key aspect of this work will be how this trait compares to existing likeability, survival and residual survival breeding values and how these breeding values can be updated with this new knowledge.

Mitigation strategies to reduce direct and indirect greenhouse gas emissions from stored dairy manure and effects on nutrient use efficiency

This PhD candidate will investigate the effectiveness of various chemical and physical mitigants, characterise nutrient transformations, quantify direct and indirect greenhouse gas emissions of manure components in storage, and measure the nutrient use efficiency and losses when treated manure is applied to land. The studies will include methane reducing feed additives, chemical modifications and the use of bio-digestible polymers on stored manure. The PhD candidate will undertake studies using the Ellinbank SmartFarm, be trained in a range of laboratory techniques required for chemical characterisation and the quantification of gaseous emissions from manure, with activities undertaken at the laboratory, field and farm-scale.

Separation technologies to improve manure value

This PhD candidate will quantify chemical characteristics of manure and manure-separation co-products formed post application of physical and chemical separation and anaerobic digestion technologies. The PhD candidate will optimise a variety of separation technologies and quantify biogas generation. This project will address the requirement for improved manure management that meets the need for nutrient and water recovery and energy generation on dairy farms. The PhD candidate will undertake research at the Ellinbank SmartFarm and be exposed to different commercial dairy farms systems and undertake experiments at a range of scales.

