

Student Conference

Gatton: Monday 21 and Tuesday 22 October 2019
St Lucia: Thursday 24 and Friday 25 October 2019



MONDAY 21 October 2019 (Gatton)

Day 1 – Venue 8255-105

	Time	Presenter	Course code	Title	Supervisor
Session 1	8:00	Yi Ding	AGRC7611	The rock lobster industry in Australia	Ammar Abdul Aziz
	8:15	Reith Parker	AGRC7611	Animal welfare regulatory risk in Australian ruminant livestock production	Ammar Abdul Aziz
	8:30	Han Wang	AGRC7611	Review of the agricultural practices for the cotton industry in the northwest inland cotton-growing area of China	Ammar Abdul Aziz
	8:45	Ling Yan	AGRC7611	Review of the development of flower E-commerce in China	Ammar Abdul Aziz
	9:00	Guanming Wang	AGRC7611	How electronic technology will influence agriculture in the future.	Phillip Currey
	9:15	Qing Sheng	AGRC7611	Research on honey fraud in China	Rajendra Adhikari
	9:30	Sokhomony SIn	AGRC7611	Agribusiness Small and Medium Enterprises (SMEs)c access to financial services in ASEAN countries: A review	Anoma Ariyawardana
	9:45	Hayden Morris	AGRC7611	Review of consumers attitudes, perceptions and behaviours towards imported seafood products from Asia	Anoma Ariyawardana
10:00 – 10:25		BREAK – Morning Tea			
Session 2	10:30	Meab Mdimi	AGRC7618	Opportunities for capturing greater nutritional outcomes for peri-urban households of Dodoma City, Tanzania	Anoma Ariyawardana
	10:45	Yuxin Wang	AGRC7611	Chinese consumers' perceptions of milk safety issue based on actions implemented by government and milk companies in China: A review	Anoma Ariyawardana
	11:00	Umar Abubakari	AGRC7611	Disentangling approached to E-extension: mapping the terrain	Severine van Bommel
	11:15	Emily McKechnie	AGRC7618	Community use of a landscape approach to wild dog control	Severine van Bommel
	11:30	Yiwei Chen	AGRC7618	Efficacy of oxfendazole and piperazine against small strongyles of horses and subsequent egg reappearance period	Anne Beasley
	11:45	Ziwei Wang	AGRC7617	Efficacy of three combination anthelmintic products against equine cyathostomins in Australia	Anne Beasley
	12:00	Hasanain Ali Abed Al-Gburi	AGRC7618	Effect of protease enzyme on egg production, eggshell quality and gut microbial profile of laying hens	Elham Assadi SoumeH
12:15 – 12:55		BREAK – Lunch			

MONDAY 21 October 2019 (Gatton)

Day 1 – Venue 8255-105

	Time	Presenter	Course code	Title	Supervisor
Session 3	13:00	SiYuan Zhang	AGRC7617	The effectiveness of probiotics Fermented Herb Extract (FHE) on both forage and grain feedlot diets (Multikraft) and forages (Brome grass) by <i>in vitro</i> fermentation	Sarah Meale
	13:15	Bwalya Nkole	AGRC7618	The growth performance, organ development and gut morphology of broiler chickens under thermoneutral and heat stress conditions	Elham Assadi Soumeh
	13:30	Yunjia Yang	AGRC7617	Targeted and non-targeted metabolomics in broiler chicken plasma under thermoneutral and heat challenge conditions	Elham Assadi Soumeh
	13:45	Kai Li	AGRC7618	Links between heat stress and health status of cows	John Gaughan
	14:00	Hao Xiang	AGRC7618	Validation of the dairy heat load index	John Gaughan
	14:15	Raagini Kanjithanda	AGRC7618	The ecology and control of Black Rat (<i>Rattus rattus</i>) populations at the Port of Brisbane, Australia	Luke Leung
	14:30	Nan Jin	AGRC7618	Surveying morphometric characteristics and the disease status of wild dogs in South East Queensland	Peter Murray
14:45 – 15:10		BREAK – Afternoon Tea			
Session 4	15:15	Shruti Shrotri	AGRC7617	Oestrous cycle of the captive southern hairy nosed wombats as assessed by urinary steroid metabolites	Steve Johnston
	15:30	Jiaheng Li	AGRC7617	Organic acids and probiotics as substitutes for antibiotic growth promoters in broilers	Wayne Bryden
	15:45	Han Dang	AGRC7617	The effects of dietary lauric acid on growth performance of broiler chickens	Xiuhua Li
	16:00	Yunyi Liang	AGRC7617	Probiotics and organic acid as alternatives to antibiotic growth promoter in broiler diets	Xiuhua Li
	16:15	Oluwafemi Oshodi	AGRC7618	Making safe silage from cassava leaves	Karen Harper

TUESDAY 22 October 2019 (Gatton)

Day 2 – Venue 8178-103

	Time	Presenter	Course code	Title	Supervisor
Session 1	9:00	Cheuk Him Nicholas Ng	AGRC4614	Phylogenetic analysis of Australian psyllids in preparation for potential incursions of <i>Candidatus Liberibacter</i>	Anthony Young
	9:15	Isabelle Johansen	AGRC4614	Biomass partitioning and growth parameters of genetically modified sorghum with higher protein and larger grain	Ian Godwin
	9:30	Dawson Henricks	AGRC4614	Determining the potential use of Molybdenum (Mo) as a tracer to quantify fertiliser Phosphorus (P) recovery from the soil	Mike Bell
	9:45	Belinda Weber	AGRC4614	The potential for infra-red thermography to indicate feed efficiency in young bulls	Karen Harper
	10:00	Madeliene Facy	AGRC4614	Quantifying heterosis using genomics in Popplewell Composite beef cattle	Mark Dieters
	10:15	Melody Thomson	AGRC4614	Hidden gems: are ground pearls causing pasture dieback	Anthony Young
	10:30	Sophie Dansie	AGRC4614	The response of garlic (<i>Allium Sativum</i> L.) seed-bulbs to pre-planting cold temperature storage	Robyn Cave
10:45 – 11:10		BREAK – Morning Tea			
Session 2	11:15	Jane Dunn	AGRC4614	A comparative study of the growth and nutritional value of original and newer cultivars of Rhodes grass (<i>Chloris gayana</i>)	Shane Campbell
	11:30	Shaun Hudson	AGRC4614	Investigating the influence of temperature and pH on the release of hydrogen cyanide from cassava tissues	Shane Campbell
	11:45	Justin Macor	AGRC4614	Long-term changes in native pasture composition in North Queensland under different grazing management strategies	Shane Campbell
	12:00	Peta Stockwell	AGRC4614	Phosphorus metabolism in the muscle of growing weaners	Simon Quigley
	12:15	Ciara O'Brien	AGRC4614	The effectiveness of stem-injected chemical and biological herbicides for the management of invasive woody weeds on Franklin Vale Creek, Spicers Hidden Vale	Victor Galea
	12:30	Amy Bentley	AGRC6650	Probiotic supplementation and the amelioration of stress in weanling horses	Anne Beasley
	12:45	Brittany Nurse	AGRC6650	The effects of using the lunge and automated horse walker as exercise techniques on the splenius and biceps femoris muscles in the horse	Rebeka Zsoldos
13:00 – 13:40		BREAK – Lunch			

TUESDAY 22 October 2019 (Gatton)

Day 2 – Venue 8178-103

	Time	Presenter	Course code	Title	Supervisor
Session 3	13:45	Darwin Horyanto	AGRC6650	Impacts of heat stress on growth performance, ileal nutrient digestibility and meat quality on broiler chickens fed standard vs reduced crude protein diets	Elham Assadi Soumeh
	14:00	Jacoba Madigan-Stretton	AGRC6001	Super-dosing of multi-enzymes in reduced energy diets of broiler chickens: impacts on growth and gut health	Elham Assadi Soumeh
	14:15	Thomas Lally	AGRC6001	The relationship between BioCondition, small and medium-sized mammals and other landscape variables	Peter Murray
	14:30	Ying-Hsu Liao	AGRC7618	Impact of fallow frequency on soil aggregation and water stability	Alwyn Williams
	14:45	Roy Govinden	AGRC7618	Evaluating the effects of crop row spacing and weed control treatments on the management of turnip weed [<i>Rapistrum rugosum</i> (L.) All.] in wheat [<i>Triticum aestivum</i> L.]	Bhagirath Singh Chauhan
	15:00	Munkhjargal Nyamsuren	AGRC7618	The effect of stubble management on aggregated distribution and associate wind erodibility	Gunnar Kirchhof
	15:15	Arisede Chisaka	AGRC7618	Identification of new maize single cross testers for CIMMYT heterotic group B maize germplasm adapted to mid-altitudes	Mark Dieters
15:30 – 15:55		BREAK – Afternoon Tea			
Session 4	16:00	Alina Naa Densua Alberto Djanie	AGRC7618	The effect of heat treatment (hot water and dry heat) and drip-line placements on the yield and quality of garlic (<i>Allium sativum</i>)	Robyn Cave
	16:15	Yimeng Li	AGRC7618	The effect of air nanobubble in distilled water on the growth of hydroponic lettuce	Robyn Cave
	16:30	Paawan Sood	AGRC7618	Farmers' perception on pesticide use practices and poisoning in India	Severine van Bommel
	16:45	Liu Shi	AGRC7618	Using pre-treatments to improve seed-based restoration outcomes	Steve Adkins

Thursday 24 October 2019 (St Lucia)

Day 3 – Venue 39A-209

	Time	Presenter	Course code	Title	Supervisor
Session 1	9:00	Shiyi Li	FOOD4618	Encapsulated probiotics using a double emulsion and the impinging aerosols method in thickened skim milk and yogurt	Bhesh Bhandari
	9:15	Jia Wen Tey	FOOD4618	How does Australian pork taste? A project to improve the flavour of pork for Asia-Pacific consumer	Eugeni Roura
	9:30	Thomas Hay	FOOD4618	New product development of bushfood confectionery: Desirability and commercial viability	Melissa Fitzgerald
	9:45	Kang Wei Cher	FOOD4618	3D printing Sea Cucumber	Sangeeta Prakash
	10:00	Joseph Nastasi	FOOD6001	The characterisation of the Bunya nut and its functional properties for new product development	Melissa Fitzgerald
10:15 – 10:40		BREAK – Morning Tea			
Session 2	10:45	Rafael Jode Nguenha	FOOD7617	Effect of carotenoids content and 430-nm LED array photosensitisation on inactivation of <i>Aspergillus flavus</i> and aflatoxin B1 formation in maize	Yasmina Sultanbawa
	11:00	Mengfan Cao	FOOD7618	Genome analysis of the cheese fermenting bacterium <i>Lactococcus</i>	Mark Turner
	11:15	Wen Shi	FOOD7618	The effect of c-di-AMP on the stress resistance of <i>Lactococcus lactis</i>	Mark Turner
	11:30	Runzhe Li	FOOD7618	Comparing the quality of different rice varieties from the wet season in Queensland grown on research station	Melissa Fitzgerald
	11:45	Xing Xin	FOOD7618	Comparing physical qualities of rice grown in North Queensland	Melissa Fitzgerald
	12:00	Wei Li	FOOD7618	Survival of probiotics in the localised microenvironment of 3D printed food	Bhesh Bhandari
	12:15	Yu-Jen Lu	FOOD7618	Multiple-foaming properties of milk	Minh Thao Ho
12:30 – 13:10		BREAK – Lunch			

Thursday 24 October 2019 (St Lucia)

Day 3 - Venue 39A-209

	Time	Presenter	Course code	Title	Supervisor
Session 3	13:15	Jiadi Zhao	FOOD7618	Acid gelation of camel milk	Minh Thao Ho
	13:30	Jinlei Zhu	FOOD7618	Effect of heat and pH-treatment conditions on properties of rehydrated whey protein powder	Minh Thao Ho
	13:45	Ruiliang Fan	FOOD7618	Defining the texture of the food by 'softness' and 'stickness' and industrial methods	Sangeeta Prakash
	14:00	Kirti Mittal	FOOD7618	3D printing of broccoli and pumpkin seed	Sangeeta Prakash
	14:15	Yuanyuan Xie	FOOD7618	3D printing of French fries from potato and tapioca starch	Sangeeta Prakash
	14:30	Yixiao Wu	FOOD7617	The development of <i>Nannochloropsis</i> sp. in food area	Peer Schenk
	14:45	Shanmugam Alagappan	FOOD7618	Interaction of polyphenols with soluble dietary fibres	Sushil Dhital

Friday 25 October 2019 (St Lucia)

Day 4 - Venue 39A-209

	Time	Presenter	Course code	Title	Supervisor
Session 1	9:00	Julie Sosso	AGRC6001	Prevalence of endophytes in macadamia plants in Australian nurseries	Olufemi Akinsanmi
	9:15	Celina Lim	AGRC6001	Effects of nitrogen fertiliser on growth and nodulation of <i>Millettia pinnata</i>	Brett Ferguson
	9:30	Alexandria Mattinson	AGRC6001	Induction of Novel CLE peptide hormones in response to pathogen infection of <i>P. vulgaris</i>	Brett Ferguson
	9:45	. Arzoo	AGRC7618	Identification, genetic characterisation and phylogenetic analysis of CLE peptides in algae, mosses and chickpea using bioinformatics tools	Brett Ferguson
	10:00	Zhouyang Su	AGRC7618	Relationship between Fusarium crown rot resistance and drought tolerance at gene levels in wheat and barley	Chunji Liu
	10:15	Yiyang Xiao	AGRC7618	Impact of Rootstock on early growth in macademia	Craig Hardner
	10:30	Yang Ang	AGRC7618	Assessing pathogenicity of <i>Fusarium oxysporum</i> on watermelon	Elizabeth Aitken
10:45 - 11:10		BREAK - Morning Tea			
Session 2	11:15	Shubhdeep Kaur	AGRC7618	Analysis of SIX gene expression of endophytic <i>Fusarium oxysporum</i>	Elizabeth Aitken
	11:30	Zhendong Liu	AGRC7618	Characterisation of a series of endophytic <i>Fusarium</i> species on Banana plants	Elizabeth Aitken
	11:45	Xiangyu Ni	AGRC7618	The role of SIX7 gene in <i>Fusarium oxysporum</i> f.sp. <i>cubense</i> subtropical race 4 for virulence towards Cavendish banana	Elizabeth Aitken
	12:00	Yongshen Wu	AGRC7618	Impact of low and high temperature on the physiological characteristics and yield of rice under aerobic conditions	Jaquie Mitchell
	12:15	Xiaolu Zhang	AGRC7618	Root angle and early vigour in rice plants under aerobic conditions	Jaquie Mitchell
	12:30	Orita Faleatua	AGRC7617	Genotypic variation and relationships among morphological traits contributing to maintenance of rice yield exposed to abiotic stress	Jaquie Mitchell
	12:45	Rui Yan	AGRC7617	Physiological mechanisms contributing to low-temperature tolerance under aerobic conditions	Jaquie Mitchell
13:00 - 13:40		BREAK - Lunch			

Friday 25 October 2019 (St Lucia)

Day 4 - Venue 39A-209

	Time	Presenter	Course code	Title	Supervisor
Session 3	13:45	Abhishek Soni	AGRC7618	Management of invasive <i>Navua</i> sedge (<i>Cyperus aromaticus</i>) using competition and simulated herbivory interactions of Humidicola grass (<i>Brachiaria humidicola</i>) and Rhodes grass (<i>Chloris gayana</i>)	Kunjithapatham Dhileepan
	14:00	Chengxi Huang	AGRC7618	Isolation and characterisation of the core bacterial taxa associated with banana	Paul Dennis
	14:15	Shruti Thapa	AGRC7618	Use of plant growth promoting rhizobacteria for the biological control of <i>Phytophthora capsici</i> in Snap beans (<i>Phaseolus vulgaris</i>)	Peer Schenk
	14:30	Sijia Xu	AGRC7618	Seed bank dynamics of <i>Avena sterilis</i> ssp. <i>ludoviciana</i> under different tillage systems practices in the north-eastern grain region of Australia	Steve Adkins
	14:45	Zhetian Zhang	AGRC7618	Identifying pastoral species for local soil types for outcompeting and suppressing Fireweed	Steve Adkins
	15:00	. Shamli	AGRC7618	Testing alternative host opuntia species as a potential target for biocontrol agents (<i>Dactylopius</i> sp.) previously established in Queensland	Steve Adkins
	15:15	Azalia Renee Rodriguez	AGRC7618	Fur seal and sea lion vulnerability and resilience to climate change	Nathalie Butt
	15:30	Michael Walsh	FOOD7618	Towards the circular nutrient economy - recycling nutrients from wastes as next-generation fertilisers	Susanne Schmidt

FINISHED

The rock lobster industry in Australia

Name: Yi Ding
Supervisor/s: Dr Ammar Abdul Aziz

Abstract: Australian Rock lobster industry as a leading industry owns a high international reputation on food safety and quality, it plays an important role in Australian economic contribution as well. In order to remain the sustainable development and create more margin to the farmers and local communities, having a deep understanding of the industry is essential. The major issues exist in the field are mainly focused on sustainable development, including the declined number of Rock lobsters with surging demand, sole export market threat to the business profits. The method of the research is relying on literature review to build a systematic understanding of the industry. The news and interviews on the newspaper will also be considered since it reflects the standpoint of stakeholders of the industry. To date, the Australian rock lobster industry has already started to discover new overseas market rather than single market, China. The limited capture regulation also issued to decrease the total capture amount to protect the Rock lobster species. The implication of the study is going to address the potential challenges of the industry that relying on the natural resources, also by analyzing the market threats may exist in such valuable international seafood industry.

Animal welfare regulatory risk in Australian ruminant livestock production

Name: Reith Parker
Supervisor/s: Dr Ammar Abdul Aziz

Abstract: Unavailable

Review of the agricultural practices for the cotton industry in the northwest inland cotton-growing area of China

Name: Wang Han
Supervisor/s: Dr Ammar Abdul Aziz

Abstract: China is the world's largest cotton producer and importer. China's cotton production mainly relies on the use of intensive agricultural systems. However, compared with advanced cotton-growing countries, China's cotton production methods are backward, with the small scale of operation, low productivity, high production costs and serious environmental pollution. Especially in China's main cotton-producing areas, the northwest inland areas use high-density planting, reducing plant height, film mulching and other agricultural practices to increase cotton production. However, the main problems currently facing the region include the significant increase in cotton planting costs, the environmental pollution caused by the overuse of agrochemical products and plastic films, the vulnerability to natural disasters such as low temperatures and frosts, and the continuous shortage of labour. These factors require further optimisation of cotton farming practices in the region. By drawing on and guiding cotton growers to use systemic modelling management methods to predict and quantify changes in planting time and irrigation plans to increase water use and avoid the negative effects of natural disasters, while exploring rational agrochemical application techniques and alternative agricultural practices can reduce environmental pollution and reduce production costs. In addition, it should be added to the investment in agricultural mechanisation and to increase labour by reforming planting and management models to save labour. It is also necessary to combine the agricultural practices of cotton growing in advanced areas to improve the production process at all stages and achieve the sustainability of cotton production.

Review of the development of flower E-commerce in China

Name: Ling Yan
Supervisor/s: Dr Ammar Abdul Aziz

Abstract: Unavailable

How electronic technology will influence agriculture in the future

Name: Guanming Wang
Supervisor/s: Dr Phillip Currey

Abstract: Unavailable

Research on honey fraud in China

Name: Qing Sheng
Supervisor/s: Dr Rajendra Adhikari

Abstract: Honey, as a nutrient-rich natural food and health care product, is loved by consumers across the world for centuries. China has been steadily ranked at top, for several decades, in terms of the scale of industry, productivity and volume of honey export. The demand for Chinese honey is increasing gradually in domestic and global markets, mainly for the increased level of consumption and people's standard of living. However, the reputation of Chinese honey is being threatened by fraudulent activities of some actors in the industry. Both consumers and the Chinese honey industry could suffer from the negative impacts of these fraudulent activities. Although this problem is taken into notice by many stakeholders around the world, most of the research is focusing on detecting the fraudulent activities, and not enough attention is given to bringing the research knowledge into one place. The aim of this project is to comprehensively analyse the nature of fraudulent activities in the Chinese honey industry by reviewing the past 20 years' literature systematically. The premise of eliminating these misconducts rests on understanding the most common fraudulent behaviours and motivations behind them. Then, implications of these activities, along with the existing barriers to eliminate them, will be identified and discussed. Finally, recommendations will be drawn for the stakeholders of the Chinese honey industry.

Agribusiness Small and Medium Enterprises (SMEs) access to financial services in ASEAN countries: A review

Name: Sokhomony SIn
Supervisor/s: Dr Anoma Ariyawardana

Abstract: Unavailable

Review of consumers attitudes, perceptions and behaviours towards imported seafood products from Asia

Name: Hayden Morris
Supervisor/s: Dr Anoma Ariyawardana

Abstract: Unavailable

Opportunities for capturing greater nutritional outcomes for peri-urban households of Dodoma City, Tanzania

Name: Meab Mdimi
Supervisor/s: Dr Anoma Ariyawardana, Dr Benjamin Dent

Abstract: Increasing rates of urban population and high malnutrition among women and children under 5-years of age in Tanzania is putting more pressure to increase the availability and consumption of fresh and healthy food to its people. High levels of micronutrients available in Traditional African Vegetables (TAVs) provide the opportunity of improving nutritional status of women and children. Therefore, this research explored TAVs within the peri-urban space and their potential to contribute to nutritional improvement. Dodoma region was selected for this study as it ranked sixth in Tanzania for the highest rates of child malnutrition. Data were collected through in-depth interviews and focus group discussions with experts in TAV research, nutritionists, agricultural extension officers, farmers and consumers. The research revealed that horticulture in Dodoma is characterised by smallholder vegetable farmers. Because of the semi-arid climatic conditions, TAVs are grown more than exotic vegetables as they are more resilient to harsh conditions and easy to manage. This corresponds to the higher levels of consumption of TAVs than exotic vegetables, not necessarily because of their nutritional value, but their availability. It was also noted that TAVs knowledge is weak resulting to low adoption of or of nutritional interventions. Scaling the promotion and awareness interventions of nutritional benefits of TAVs' is recommended at all levels of the chain. However, these interventions require a coordinated effort to increase the production and consumption and to capitalise on the opportunity to increase nutritional outcomes of TAVs. Further research on how activities across the chain such as preparation, preservation and temperature control affects the nutritional value of TAVs is recommended for capturing full nutritional benefits.

Chinese consumers' perceptions of milk safety issue based on actions implemented by government and milk companies in China: A review

Name: Yuxin Wang
Supervisor/s: Dr Anoma Ariyawardana

Abstract: Food safety is the most basic livelihood issue and has been highly concerned by the public. In 2008, the whole society was shocked by the melamine milk pollution incident happened in China. The milk scandal caused consumers to lose trust in all local dairy companies and even the government. 11 years after the incident broke out, industry analysis data shows that Chinese dairy industry grows year after year. However, in fact, the perceptions and trust of consumers are the more significant factors that ultimately determine whether the industry can survive or not. This review aims to first explore what actions have been implemented by the Chinese government and local dairy companies, and then explain the consumers' perceptions of milk safety. This review collected secondary information published in government websites and company annual reports. Besides, a systematic literature review was used to understand consumers' attitudes. Results show that, from then on, the government published various regulations, revised Food Safety Law, and carried out stricter enforcement. Enterprises began to optimise the supply chain structure and take quality as the primary consideration. While the quality of milk is getting better and better, consumers' confidence is slowly recovering. Finally, by comparing government interventions, milk companies' actions, and consumers' demand, suggestions are given to the local milk industry that what potential opportunities they can catch to fully rebuild trust with consumers.

Disentangling approached to E-extension: mapping the terrain

Name: Umar Abubakari
Supervisor/s: Dr Severine van Bommel

Abstract: Unavailable

Community use of a landscape approach to wild dog control

Name: Emily McKechnie
Supervisor/s: Dr Severine van Bommel, Professor Helen Ross

Abstract: Wild dogs are considered a major issue for Australian agricultural communities, causing livestock and economic losses. The literature states that the most effective way to reduce wild dog numbers is for communities of landholders to use a coordinated landscape and nil tenure approach to combat the issue. While this is an identified solution, there are only limited instances in available literature where this approach is being used successfully, so we must ask, why aren't more communities using this approach?

I chose the Forest Springs-Berat valley area in Queensland, Australia to conduct my research, which has a wild dog presence that is considered a concern by the Southern Downs Regional Council. My research focuses on this community's response to wild dog control and investigates whether they currently use a landscape approach to tackle the issue, and to see what is happening in practice. To add to my discipline's understanding of the issue of a community using concerted action to address an invasive pest issue, I sought to investigate how the issue of wild dogs is framed within the community. I used semi-structured interviews of community members and individuals who are organisationally involved in invasive animal control within the study area. The frames used to develop the interview questions were 'how the problem of wild dogs is framed in the community,' 'the framing of the cause of the problem,' and 'how the possible solutions are framed.'

My results found that the landholders of the study area, for the most part, do not work together, yet they believe that a landscape approach is needed. Everyone interviewed identified the current wild dog presence as a problem, but those that aren't directly affected by them aren't willing to engage in concerted action with their neighbours, unless an organisationally involved individual approached them and encouraged them to work together and supplied a plan and tools of action. The individuals that were organisationally involved are willing to help but want the landholders to approach them first.

This project has identified a fundamental concern in pest control – the breakdown of communication between stakeholders. This major issue is only in one small community but is indicative of a larger social issue that has ramifications for community based invasive pest management. This project highlights the major concerns, and given further opportunity, additional research could be conducted to find solutions to this issue, and act upon them.

Efficacy of oxfendazole and piperazine against small strongyles of horses and subsequent egg reappearance period

Name: Yiwei Chen
Supervisor/s: Dr Anne Beasley

Abstract: It is necessary to find effective anthelmintic drugs to control the important equine parasites, such as small strongyles (cyathostomins), which commonly show resistance to the benzimidazole drug class in Australia. However, in Australia, there is no recent efficacy data on piperazine, which is an older class of anthelmintic that is only available in one commercially registered product in Australia. This study tested the efficacy of two products: Oxfendazole (OXF) and a combination of OXF and Piperazine (OXF+PIP) in 20 young (weanling/yearling) horses. Ten horses were assigned randomly for treatment with OXF (nw=6, ny=4) and OXF+PIP (nw=6, ny=4). A fecal egg count reduction test (FECRT) involves fecal collections from these horses on days 0 and 14 relative to anthelmintic administration. Fecal samples were then collected from weanling horses (n=12) on a weekly basis between weeks 2 and 9 to calculate the egg reappearance period (ERP). The fecal egg count reduction of OXF was 42% (95% CI 22–61%), which means resistance was confirmed. And the efficacy of OXF+PIP was 93% (95% CI 86–100%), which is higher than using OXF alone, however, its resistance status is classed at 'suspected' at this level. At 9 weeks post-treatment, the ERP following the OXF+PIP treatment had been reached, as fecal egg count reduction dropped to 51%. This study has confirmed that OXF treatment is not effective against cyathostomins and the combination of OXF+PIP treatment offers a much more effective control option for the horse industry. It would be recommended to test the efficacy of OXF+PIP with more horses from different farms.

Efficacy of three combination anthelmintic products against equine cyathostomins in Australia

Name: Ziwei Wang
Supervisor/s: Dr Anne Beasley, Dr Rebeka Zsoldos

Abstract: One objective of the research is to confirm the efficacy of the available combination anthelmintic products (Strategy-T®, Equimax® Elevation and Equitak® Excel) for horses in Australia. And another one is to know the 'egg reappearance period' (ERP) following administration of each of these combination products. Cyathostomins are ubiquitous intestinal parasites that could cause diseases in horses. Methods of controlling cyathostomins have largely relied on anthelmintic drugs. Recently, three chemical classes (benzimidazoles, tetrahydropyrimidines and macrocyclic lactones) can be used as the functional ingredients in the anthelmintic products; however, they should be used carefully to avoid the development of resistance. Combination products are thought to help delay the onset of anthelmintic resistance. Nonetheless, there is no published data on the efficacy of combination products or the ERP of these products in Australia.

In this research, 23 adult horses (mares and geldings) are divided into 3 groups. They are given 3 different combination anthelmintic products (Strategy-T®, Equimax® Elevation and Equitak® Excel). There are 8 horses in the Equimax® Elevation group (ELEV), 8 horses in the Equitak® Excel group (EE) and 7 horses in the Strategy-T® group (ST). On Day 0 of the trial, a faecal sample is collected from each horse and each horse then is given a full syringe of the drug orally. The second faecal sample collection is on Day 14 post-treatment. And the following sample collections will be done once a week until the egg counts go back to 80% of the original volumes on Day 0. FECRT is used as the resistance testing method in this project. The number of horses that are included in the research is suitable for the experiment to know the efficacy of anthelmintic products. However, the doses that are given to each horse from the same group are not exactly the same because some horses throw off part of the paste. And although most of the samples for each group are collected, the calculated egg counts data might have deviation. In conclusion, the commercial combination anthelmintics (Strategy-T®, Equimax® Elevation and Equitak® Excel) are efficacy to cyathostomins in the horse's body. And the ERPs can last at least 8 weeks. With the results of the research, when the practitioners in the equine industry choose to use Strategy-T®, Equimax® Elevation or Equitak®

Excel as the anthelmintic product, the drug interval can be at least 8 weeks in the late winter to spring.

Effect of protease enzyme on egg production, eggshell quality and gut microbial profile of laying hens

Name: Hasanain AL-GBURI
Supervisor/s: Dr Elham Assadi Soumeh, Dr Nick Hudson

Abstract: The sustainability of the egg industry plays a critical economic role in Australia and the world agriculture. The indigestible protein fraction originated from limited protein digestibility due to insufficient endogenous enzymes in the small intestine of laying hens has a negative effect on elevating toxic metabolites in the caecum and suppressing laying hen's performance, egg quality parameters and egg production. Therefore, exogenous protease enzyme may improve absorption and utilisation of dietary proteins and amino acids through hens' gut epithelium cells and reduce the availability of these nutrients for microbial fermentation.

In this study, exogenous protease enzyme has been supplemented to the diet to enhance the digestibility and utilisation for hen's production performance. It is hypothesised that the addition of protease enzyme to a barley/canola meal-based diet will enhance egg production performance, improve egg quality parameters and reduce pathogens in the cecum.

A feeding trial was conducted to determine the effects of protease supplementation on egg quality parameters for commercial ISA Brown laying hens (40 weeks). In this experiment 96 laying hens with similar body weights and egg production rate were distributed in a completely randomised arrangement to 2 experimental diets with 12 replicates and 4 birds/replication (24 cages). Experiment diet-1: Control (Barley 63.293%, Canola meal CM 11.113% and Sunflower meal SFM 10.000%). Experiment diet-2 (Barley 63.293%, CM 11.113% and SFM 10.000%) supplemented with protease enzyme at 100 g/ton. and formulated to meet minimum requirements of all nutrients for laying hens. ISA Brown Laying hens' production performance was determined every day while external and internal egg quality parameters were measured every fortnight. At the end of the trial, laying hens were sacrificed to evaluate gut microbial profile in the caecum. The hens were studied for body weight, feed-intake, egg shell breaking strength, egg shell weight, albumin height, color, Haugh unit.

The results showed that the ISA Brown laying performance, egg production and external and internal egg quality parameters were enhanced in the protease added experimental diet. The data of ceca microbiome composition will be ready next weeks and will be included in the final project. In conclusion, the results of this research trial will help farmers to develop nutritional strategies and feed formulation practices to improve nutrient digestion and utilisation, increase egg production and egg quality parameters and enhance gut health and microbial profile in laying hens.

The effectiveness of probiotics Fermented Herb Extract (FHE) on both forage and grain feedlot diets (Multikraft) and forages (Brome grass) by *in vitro* fermentation

Name: SiYuan Xhang
Supervisor/s: Dr Sarah Meale

Abstract: Conventionally, chemical compounds with antimicrobial function as ionophores that can promote ruminal volatile fatty acid synthesis and can increase microbial biomass have been used in field ruminant production to minimise both energy and protein loss. However, antibiotic residues have induced new resistant microbial strains. Therefore, probiotics are regarded as an alternative to antimicrobial chemical compounds. In addition, probiotics have been verified with functions from several aspects: promoting feed digestibility, reducing total gas production as well as ruminal methane production, which have significant implications in terms of the ruminant production industry and environmental concerns. The Fermented Herb Extract is a new probiotic product of Multikraft Company. Thus, this project is designed to examine the effectiveness of this new probiotic on both grain and forage feedstuffs by *in vitro* fermentation with 4 different level of this new probiotic: 0%, 0.3%, 0.6%, 1% and 3% of dry matter. Ruminal fluid collected from two rumen-fistulated Droughtmaster steers was used to mimic the ruminal condition and fermentative process. The total volume of gas production has been measured by water displacement technique and gas samples gathered to measure the methane concentration and VFA concentration via gas chromatography. The liquid phase of the reactant was examined by pH meter; the residual weight of feed was dried in oven for 24 hours and then measured to calculate the digestibility. Currently, the chemical composition profiles of two sorts of feeds has been determined respectively; the digestibility results of all samples have been calculated, the total gas production and methane concentration of each sample has been determined; The total volatile fatty acid production and the amount of each kind of volatile fatty acid was determined separately. For the next step, statistic procedures will be used to verify this hypothesis: Fermented Herb Extract can gradually promote feed digestibility and decrease methane production as its concentration grows within the following 4 levels: 0%, 0.3%, 0.6%, 1% and 3% of dry matter. Through this project, whether this new probiotic promotes digestibility and nutritional efficiency of feed as grain and forage, and reduces greenhouse gas emission will be determined. Based on this research, the *in vivo* effectiveness of this probiotic should be examined by using living ruminants.

The growth performance, organ development and gut morphology of broiler chickens under thermoneutral and heat stress conditions

Name: Bwalya Nkole
Supervisor/s: Dr Elham Assadi Soumeh, Dr Arun Kumar

Abstract: Heat stress is a concern to poultry producers as it causes changes in the physiological, behavioural and disturbed integrity of the intestinal morphology. Consequently, heat stress leads to reduced feed intakes and altered nutrient metabolism leading to reduced body weights, reduced production efficiency and mortalities of broiler chickens. A study was conducted to evaluate the effects of feeding a standard crude protein diet (19%) and a low crude protein diet (17%) supplemented with crystalline amino acids on the growth performance, organ development and gut morphology of broiler chickens under thermoneutral and cyclic heat stress conditions. The study aimed to use nutritional strategies in broiler chicken production to help remove the adverse effects of heat stress on bird growth and performance. The experiment was conducted at the QASP facility, Gatton campus, where a total of 256-day-old Ross 308 chicks were reared for 42 days. The experiment was a 2*2 factorial design, and the birds were randomly assigned to four treatment groups that included a standard crude protein diet and a low crude protein diet fortified with crystalline amino acids including valine, glycine, isoleucine and arginine respectively under heat stress and thermoneutral environments. Cyclic heat stress environments had a temperature range of 26°C to 35°C while thermoneutral environments had a constant temperature of 26°C respectively. Each treatment group had eight birds per cage with eight replicates per treatment. The birds were on a standard broiler diet and under thermoneutral temperatures from day one to day 28, after which 64 birds were randomly assigned to each treatment group of the two diets and the two temperature environments. The research hypothesises that reducing crude protein levels to broiler diets will alleviate heat stress challenges; thus, aid to maintain intestinal integrity due to the reduction in metabolic heat production. Furthermore, the addition of crystalline amino acids to the diets will supplement the protein requirements needed for maintenance and growth rates under heat stress conditions. Statistical analysis is in progress, and the gut morphology parameters are being analysed in the laboratory. The results of the study could be used to aid poultry farmers with alternative nutritional strategies that could be used to maintain bird growth and performance in high- temperature environments.

Targeted and non-targeted metabolomics in broiler chicken plasma under thermoneutral and heat challenge conditions

Name: Yunjia Yang
Supervisor/s: Dr Elham Assadi Soumeh, Professor Melissa Fitzgerald

Abstract: Broiler chicken production has been increasingly disadvantaged by high climate temperatures. Chronic heat stress in chickens, results in reduced feed intake that leads to negative energy balance and reduced growth performance. Compared to dietary fat and carbohydrates, protein has the highest heat increment in metabolism, and hence diets with a reduced crude protein level are recommended for heat-exposed broilers. However, studies have shown that reduced-crude protein diets impair chicken growth performance due to amino acid deficiencies. In addition, some studies have demonstrated that reduced crude-protein diets increase heat production due to changed plasma metabolites. The metabolic changes in heat-exposed broilers are multifactorial and intricate, and the regulatory mechanisms of growth performance under heat challenging environment at the metabolic level remain unclear. Hence, this chronic cyclic heat stress trial aimed imitating the broiler industry under natural heat challenging conditions.

In this study, broiler chickens in the finisher phase were fed with two experimental diets: Standard diet (CP: 19%), and reduced crude-protein diet (CP: 17%; supplemented with crystalline amino acids and hence no amino acid deficiencies) in two different temperatures (thermoneutral and heat exposed) for 14 days. The reduced crude protein diet was supplemented with crystalline amino acids to meet all the amino acid requirements similar to the standard diet. The plasma metabolic profile of the broiler chickens exposed to chronic cyclic heat stress conditions (26°C to 35°C) were compared to the thermoneutral condition (26°C), to determine the plasma metabolic response including changes in vitamins, minerals, amino acids, and small metabolites when birds were fed with standard crude protein diet vs a reduced-crude protein diet supplemented with crystalline amino acids.

Liquid chromatography-mass spectrometry approaches were used for the non-targeted and targeted metabolomics' studies. The metabolites in the plasma samples of 42-day old birds were analysed using multivariate data analysis. The results showed that temperature has a greater effect than dietary protein levels on chicken plasma profile. While metabolomics' results in 2 diets are interpenetrated, probably due to bio-diversity of chicken plasma samples. The key metabolites linked to metabolisms will be identified in the final thesis.

This research will help to develop nutritional and management strategies to reduce the challenges of heat stress and its effects on broiler chicken production. In addition, this study will provide further research direction of metabolites and metabolic pathways under chronic heat stress.

Links between heat stress and health status of cows

Name: Kai Li
Supervisor/s: Associate Professor John Gaughan

Abstract: Animals will react to heat stress and this reaction can lead to some negative and unfavorable consequences, heat stress does not only harms animal welfare but also reduces livestock production, causing inevitable economic harm. Since dairy cows can be affected by heat stress in many different areas such, the growth, development, immune function, reproduction, and lactation, it is very important to fully understand the response of animals to heat stress. At the same time, a series of effective methods to help dairy cows go through extreme heat stress situation can be developed to ensure that animals can maintain healthy and productive. An experiment was designed to help to understand the relationship between heat stress and dairy cows. The experiment was conducted in university of Queensland, Gatton campus in 2019, it lasted 96 days and used 200 lactating Holstein-Friesian dairy cows, throughout the experiment, three different sets of data were recorded. The first group of data is respiration rate, panting scores, cow activity (eating, drinking, ruminating), cow posture (lying or standing) and cow location (shade, sun, feed-pad, paddock) will be obtained at 06:00, 10:00, 12:00, 14:00, 16:00 and 18:00 every 3rd day; the second group of data is during periods of high heat load (THI > 80). Individual daily milk yield, somatic cell count and milk quality will be obtained daily, and the last group of data is about live weight, BCS, lameness score and cow health status will be obtained fortnightly. At this point in the project, only the first set of data has been analyzed. The preliminary results showed that the temperature-humidity index has positive proportional relationship with other factors including solar radiation, relative humidity, black globe temperature, etc. Moreover, the relationship between ambient temperature and THI may need to be investigated in further research since the trend of these two factors has no obvious differences. After analyzing the other two sets of data in the near future, it can be predicted that cows in this experiment were greatly affected by heat stress. In general, cattle are more sensitive to the change of environment temperature than other animals, to be specific, high temperature and high humidity in summer have higher chance to cause heat stress reaction in cows. Heat stress can destroy physiological function of cows, even death in severe cases, therefore, getting the fundamental solution of this problem is necessary and requires to be done quickly.

Validation of the dairy heat load index

Name: Hao Xiang
Supervisor/s: Associate Professor John Gaughan

Abstract: Excessive heat affects milk production and the welfare of dairy cows. Farmers need a heat stress indicator to help estimate the heat risk. The temperature humidity index (THI) has been applied in livestock as a heat stress indicator. Recent studies established adjustments of wind and solar radiation based on respiratory dynamics changes and on a respiration rate index (using dry bulb temperature, relative humidity, wind speed, and solar radiation). However, these indices do not include the cumulative effects of heat load and natural cooling. If the night cooling is insufficient, cows may carry accumulated heat load (AHL) to their following day. Latest studies have focused on beef cattle and developed heat load index (HLI) based on the cumulative effects of heat load. Due to the differences between beef cattle and the dairy cow, there is a need for validation of the dairy heat load index (DHLI). The DHLI needs to be tested and refined, an AHL model for dairy cows needs to be developed, and this needs to be compared with THI. Thus, a three-month experiment was conducted at Gatton Campus, the University of Queensland. Two hundred cows were allocated evenly to four groups, and the corresponding groups were switched after milking to balance the solar radiation difference between the East and West. The weather data were collected every 10 minutes from an on-site weather station, all cows were observed and scored four times every day, and milk production data were collected as well. The DHLI and THI were calculated, cow parameters in particular milk yield and rumen temperature were used in the model to test the effectiveness of DHLI and THI. The duration of exposure above DHLI threshold determines the balance of heat in a cow. Hence, valid DHLI can be used to establish an AHL model. This project used logistic regressions to determine climate thresholds related to heat stress. Further, the author hypothesises an AHL model can be developed successfully. In summary, this project has positive implications for the dairy industry. The valid DHLI allows the establishment of AHL model. Farm administrator can use the AHL model to measure the heat risk, which will help them take effective management to help the cows maintain proper body temperature, thus ensuring milk production, and improve the welfare of dairy cows.

The ecology and control of Black Rat (*Rattus rattus*) populations at the Port of Brisbane, Australia

Name: Raagini Kanjithanda
Supervisor/s: Dr Luke Leung

Abstract: The black rat (*Rattus rattus*) is known to damage newly imported cars at the Port of Brisbane, Australia, leading to significant economic losses. A trapping method was recently developed and used to remove rats, but the effects of trapping on the rat population was not known. The aim of this study was to determine these effects of trapping, by investigating the behaviour and abundance of juveniles and adults over successive rounds of trapping.

Camera traps were used to monitor the age class of rats visiting the trap point and entering traps over three successive rounds of trapping. Camera trap monitoring was conducted during pre-free feeding, free feeding, trapping and post-trapping to evaluate the effectiveness of each round of trapping. Over three rounds of trapping, the ratio of adults to juveniles that visited or entered the trap was analysed, and a total of 51 rats (31 adults, 20 juveniles) were trapped. The mean number of rats trapped differed markedly over the three rounds, with the first round removing a far larger number of rats ($n = 28$) than the second ($n=7$) and third rounds ($n=16$). The change in adult to juvenile ratio and population recovery time was recorded. These results demonstrated neophobic behaviour in response to a minor new change in baiting methods during free feeding and trapping periods. This knowledge is useful in improving the effectiveness of trapping to control rats.

Surveying morphometric characteristics and the disease status of wild dogs in South East Queensland

Name: Nan Jin
Supervisor/s: Associate Professor Peter Murray, Dr Natalie Fraser

Abstract: The wild dog (*Canis lupus dingo/familiaris*) is a threat to livestock. It is regarded as a serious vertebrate pest in South East Queensland (SEQ). However wild dogs can be domestic dogs (*C. l. familiaris*) that have gone wild or dingoes (*C. l. dingo*) that in some states in Australia are a protected species, or a cross breed of both subspecies. There were no obvious phenotypic characteristics that differentiate dingoes from domestic dogs or their cross breeds therefore management of wild dogs is complicated. However, the removal of wild dogs is the main management used to protect livestock. Understanding the structure of wild dog populations and the morphological features of, and diseases affecting wild dogs could make their management more effective. In this research, the percentage of wild dogs in SEQ that are pure dingoes and their common diseases were detected through a series of necropsies and analyses. The experimental animals were wild caught dogs that were captured and euthanised at municipal animal pounds/shelters in SEQ. The first animal was caught in March, 2019. So far, there have been 17 wild caught dogs (i.e. 6 males and 11 females) measured and necropsied. The phenotypes of experimental dogs were recorded as photographs. According to their physical measurements, four animals could be considered pure dingo and the others hybrids between dingoes and domestic dogs. The DNA content of each animal was analysed by using blood samples collected from the heart. Parasites were collected during dissection of the dogs. Six dogs had intestinal parasites and two dogs had ticks. The species of parasites need to be confirmed. There were no heart worms found in any dogs.

Oestrous cycle of the captive southern hairy nosed wombats as assessed by urinary steroid metabolites

Name: Shruti Shrotri
Supervisor/s: Associate Professor Stephen Johnston, Dr Tamara Keeley

Abstract: Southern Hairy nosed (SHN) wombats are studied as a model organism to save their critically endangered sister species the northern hairy nosed wombats. Due to gaps in the knowledge of the reproductive physiology and behaviour of SHN wombats, the captive breeding success rate is poor. The aim of this study is to analyse urinary steroid metabolite levels, in an attempt to characterise the endocrinology of the oestrous cycle (follicular phase and luteal phase). Daily urine samples were collected from four females for a period of 3 months during the breeding season. The urinary progesterone metabolite levels were measured using a non-invasive enzyme immunoassay technique based on the broad-spectrum CL425 progesterone antibody (C. J. Murno, UC Davis, USA) and samples were analysed for urinary creatinine (Cr) to adjust for urine concentration. Initial statistical analysis of the data involved calculating the urinary progesterone metabolite levels (ng/ml/Cr) after which the data was subsequently analysed by the hormLong program in the R stats package. The results show progesterone peaks from baseline for all four females defining a distinct mean (\pm SEM) luteal phase of 21.5 (\pm 1.00 days) and mean follicular phase of 17.5 (\pm 1.28 days). The average oestrous cycle length was calculated to be 39 (\pm 2.28 days). The study concluded that all four female SHN wombats were cycling but some exhibited longer follicular phases than previously reported average follicular phase of 12 days. Further analysis of oestrogen will be necessary to confirm and elucidate behavioural oestrus in the species and further examine variations in follicular phase lengths.

Organic acids and probiotics as substitutes for antibiotic growth promoters in broilers

Name: Jiaheng Li
Supervisor/s: Professor Wayne Bryden, Dr Xiuhua Li, Dr Dagong Zhang

Abstract: Poultry meat has become a significant protein source for human. Due to the increasing of the population, to meet the demand of food, it is important to improve broilers' growth performance. In the broiler production system, antibiotic growth promoter was a good resource to improve the products which can obviously improve broilers' growth performance. However, antibiotics have many drawbacks. For example, antibiotics may produce a kind of antibiotic resistance gene which may affect animal or human microbiota. The microbiota may lead to human antibiotic resistance which can make many diseases such as tuberculosis and gonorrhoea become harder to be cured. Therefore, antibiotics must be replaced in future broiler production. The research question is if organic acids and probiotics can substitute antibiotic growth promoters. In this experiment, 250 broiler chicks will be fed by 5 different treatments for 3 weeks from 28/8/2019 to 18/9/2019, and each treatment will have 5 replication pens which means 10 broilers per pen. Group 1 is control group. Maxiban (antibiotic) was added in group 2, butyrate (organic acid) was added in group 3. Group 4 diet has butyrate and H57 (probiotic), and group 5 diet has butyrate and bioplus 400 (probiotic). After 3 weeks, the result will be calculated which contains each group broilers' body weight gain, feed intake, feed conversion ratio. Other factors such as organ health may also be determined. The result will be also compared between different groups. If any broiler in group 3, 4 and 5 have the similar or even better growth performance compared with group 2 broilers, the result can show that organic acids or probiotics can be a good substitute for antibiotics. Up to now, because the experiment is still not finish, there is only one-week result. In these 7 days, the result shows that group 3, 4, 5 broilers all have more weight gain and feed intake compared with group 2 broilers, and group 4, 5 broilers have lower feed conversion ratio, and there is statistically difference ($P < 0.05$), which means these groups broilers have better growth performance. If three weeks' result can show the same data, these organic acids and probiotics should be used as substitutes for antibiotics to improve broilers' growth performance.

The effects of dietary lauric acid on growth performance of broiler chickens

Name: Han Dang
Supervisor/s: Dr Xiuhua Li

Abstract: Antibiotics have been added to animal feed since 1951 and global demand for food has boosted global demand for chicken meat. Therefore, antibiotics are widely used in poultry farming in both developed and developing countries. The reason why is the use of antibiotics can increase the weight of birds in a relatively short period of time because it can improve feed conversion rate and thus gains more profits. However, excessive use of antibiotics can promote growth of antimicrobial resistant bacteria and long-term feeding of antibiotics leads to antibiotic residues in poultry meat, which poses a direct threat to public health. Therefore, it is necessary to find an alternative to antibiotics. Medium - chain fatty acid, lauric acid has been reported to help improve feed conversion rate and breast production, but scientific data are limited. So, further experiments are needed to investigate if dietary lauric acid can be used as an alternative to antibiotics in poultry diets. In this experiment, 270 day-old male Ross 308 broiler chicks were randomly assigned to 30 pens, each feeding regimen contains 10 birds per replicate and 5 replicates. There were 6 treatments in total. Treatment 1 was control group, sorghum control (canola oil). Treatment 2 contained antibiotics, Maxiban. Treatment 3, 4 and 5 were supplemented with lauric acid of 0.1%, 0.25% and 0.5% of diet to replace canola oil, respectively. Treatment 6 contains H57 and lauric acid at 0.25% of diet. The experimental diets fed from day 1 to 21. Bird body weight and feed intake were recorded on day 1, 7, 14 and 21. Feed conversion rate, weight gain and feed intake were calculated. At present, the experiment is still in progress and is expected to end on September 18, 2019. So, only the data from day 1 to 7 are available at present. The available data did not show significant differences in feed conversion rate, weight gain and feed intake between treatments ($P > 0.05$). So, more findings cannot be analyzed because the data from week 2 and week 3 are not available yet. The hypothesis of this experiment is that lauric acid can promote feed conversion rate and gut health of broilers, but whether it can completely replace antibiotics needs further research in future.

Probiotics and organic acid as alternatives to antibiotic growth promoter in broiler diets

Name: Yunyi Liang
Supervisor/s: Dr Xiuhua Li

Abstract: The consumption of chicken meat is increased in Australia and the world. As population grows, more chicken meat is required to meet market demands. Antibiotics have been used by the poultry industry to enhance growth and feed efficiency and reduce disease since shortly after their discovery. Unfortunately, they have come under increasing scrutiny because of the potential development of antibiotic-resistant human pathogenic bacteria. Antibiotics have been prohibited in some countries. With these considerable changes, effective intervention strategies are needed to maintain food security of chicken products to protect public health. In this context, the use of probiotics and organic acid instead of antibiotics has potential implementation value considering the safety of probiotics and organic acid and their beneficial mode of action. Firstly, the mode of probiotic action includes increase in digestion and absorption of nutrients, alter metabolism, stimulate immune system and improve health and production performance. Secondly, organic acid such as lauric acid has positive effect on energy support, metabolism and antimicrobial activity. This research mainly investigated the effect of probiotics H57, Bioplus 400 and lauric acid on chicken performance to evaluate which ingredients can act as alternative antibiotic that has the best outcome in poultry diet. This experiment has 6 treatments, each treatment has 5 replicate pens with 10 one-old-birds per pen. 6 treatment diets include Sorghum Control, Control with Maxiban, Control with H57, Control with H57 and Lauric Acid, Control with Bioplus 400, and Control with Bioplus 400 and Lauric Acid. The duration of research is 3 weeks. During experimental period, bird body weight and feed intake were recorded once a week. Bird weight gain and feed conversion ratios were calculated. The experiment has some limitations which are from old infrastructure and weather conditions. To minimise the limitations, the light and drinker should be updated to reduce the error caused by the temperature being too low or the drinker not being to automatically discharge water. As the experiment is still in progress, only one-week data is available. The current results showed that feed intake and weight gain in 6 diets are statistically different as P value <0.05. Among them, chicken who ate Bioplus 400 has the highest weight gain and feed intake. Nevertheless, chicken who ate Maxiban has the lowest weight gain and feed intake. The result of this research indicated that Bioplus 400 could be an alternative to antibiotics to most effectively improve chicken performance.

Making safe silage from cassava leaves

Name: Oshodi Oluwafemi Adedayo
Supervisor/s: Dr Karen Harper

Abstract: Efforts to expand production of livestock in the developing part of the world has been marred with the chronic shortages of traditional feed resources, couple with the rising cost of feed. Augmenting the feed quality and availability through effective utilisation of alternative feed resource like cassava would be of great advantage to increase beef production.

Cassava (*Manihot esculenta Crantz*) is one of the world's most widely grown crops and its residues (peels and leaves) are underutilised for animal feed. Cassava foliage (leaves, stems) are good alternative source of protein for beef cattle production. However, its utilisation is restricted due to presence Cyanogenic glycosides which when it's hydrolyzed yields HCN (Hydrocyanic acids) which is highly toxic to cattle. Ensiling is a resourceful way of preserving cassava material and supposedly reduces HCN to safe levels (Nambisan 2011). However, there has been increasing reports of toxicity of HCN in cattle fed on ensiled cassava materials.

However, a previous study (Bonna et al 2018) in this project showed that ensiling without pre-treatments or additives does not reduce the HCN levels to safe levels (10 ppm dry matter-DM) (FAO). Various pretreatments such as wilting and soaking, and additives such as alkali, molasses, and salt are used globally however it is not known if additives or pretreatments are effective at reducing HCN concentration of cassava silage to safe levels. Hence, the project was aimed at creating standard protocols in making safe cassava foliage silage with a minimum HCN concentration (10 ppm DM).

For this research the use of wilting and commonly used additives were used as treatments before ensiling cassava leaves using vacuum packing (Johnson, Merry et al. 2005). For this experiment, cassava leaves of cultivar MAus 7 were harvested and subjected to 12 treatments with 2 levels of wilting (wilt and no wilt) and 6 different additives (Control, 4% sugar, 1% limestone, 1% limestone and 4% sugar, 3% limestone, and 3 % limestone and 4% sugar). For the wilted treatments, samples were wilted 16 hours prior to ensiling while the non-wilted were ensiled immediately. At 3 time points (zero time, 14 days and 12 weeks, HCN was analyzed for each treatment.

The results revealed that none of the 12 treatments sufficiently reduced HCN to safe level. Generally, the wilted treatments significantly reduced HCN levels more than Non-wilted treatments in all time points ($p < 0.05$). Also 3% limestone additives had the lowest HCN concentration in both wilted and non-wilted with reduction of initial concentration by 72% and 89% respectively, after 12 weeks. Overall, the use of additives did not reduce HCN sufficiently to safe feeding levels. Also wilting was more effective than non-wilting for all the additives in reducing HCN.

References

- Johnson, H. E., et al. (2005). "Vacuum packing: a model system for laboratory-scale silage fermentations." **98**(1): 106-113.
- Nambisan, B. (2011). "Strategies for elimination of cyanogens from cassava for reducing toxicity and improving food safety." *Food and chemical toxicology* **49**(3): 690-693.

Phylogenetic analysis of Australian psyllids in preparation for potential incursions of *Candidatus Liberibacter*

Name: Cheuk Him Nicholas Ng
Supervisor/s: Dr Anthony Young

Abstract: Unavailable

Biomass partitioning and growth parameters of genetically modified sorghum with higher protein and larger grain

Name: Isabelle Johansen
Supervisor/s: Professor Ian Godwin

Abstract: Unavailable

Determining the potential use of Molybdenum (Mo) as a tracer to quantify fertiliser Phosphorus (P) recovery from the soil

Name: Dawson Henricks
Supervisor/s: Professor Michael Bell

Abstract: Unavailable

The potential for infra-red thermography to indicate feed efficiency in young bulls

Name: Belinda Weber
Supervisor/s: Dr Karen Harper

Abstract: Improving feed efficiency is an important production target for many livestock producers. Infra-red cameras are a new tool that could improve the selection of livestock with superior feed efficiency. The aim of this study is to identify if cattle producers are able to estimate the weight gain and feed efficiency potential of young bulls based on the temperatures of their eyes and the coronary band of the front left hoof using infra-red technology. Previous studies indicate that eye temperature is more reliable for measuring body temperature as there are less factors influencing its accuracy. For this experiment, fourteen (n=14) yearling Holstein-friesian bulls were used for a total of 6 weeks; 2 weeks pre-trial/adaptation and 4 weeks official trial. The chosen statistical design was a Latin Square. Using the infra-red temperatures taken per week of the trial (Day 0, 7, 14, 21, 28 and 35) regressed against feed efficiency measured across the entire 4 weeks, temperatures of the eyes were found to be more consistently related to feed efficiency than temperature of the coronary band (Eye temperature x Feed efficiency versus coronary band temperature x Feed efficiency: Week 0, R2= 0.0973 vs. 0.0289; Week 1, R2 value= 0.1877 vs. 0.043; Week 2, R2 vale= 0.0041 vs. 0.1206; Week 3, R2 value= 0.1038 vs. 0.082; Week 4, R2 value= 0.0392 vs. 0.4746). The temperature of the area between the digits of the hoof had an unexpected change in relationship with feed efficiency depending on the week of the trial that the temperature was measured. The relationship was negative if temperature of the interdigital area of the hoof was measured in Week 0 (R2 = 0.2976) but changed to positive if measured in Week 4 (R2= 0.3793). As it was found that across the weeks and among the different areas of temperature (eye, coronary band and between digits) there were varying degrees of repeatability (R2 value) and types (positive and negative). Consequently, these results show some potential for the use of infra-red technology to predict feed efficiency, however further research is required to gain a better understanding of these relationships.

Quantifying heterosis using genomics in Popplewell Composite beef cattle

Name: Madeliene Facy
Supervisor/s: Professor Wayne Pitchford, Dr Vivi Arief

Abstract: Unavailable

Epidemiological investigation of pasture dieback

Name: Melody Thomson
Supervisor/s: Dr Anthony Young, Dr Shane Campbell

Abstract: Unavailable

The response of garlic (*Allium Sativum L.*) seed-bulbs to pre-planting cold temperature storage

Name: Sophie Dansie
Supervisor/s: Dr Robyn Cave

Abstract: Unavailable

A comparative study of the growth and nutritional value of original and newer cultivars of Rhodes grass (*Chloris gayana*)

Name: Jane Dunn
Supervisor/s: Dr Shane Campbell

Abstract: Unavailable

Investigating the influence of temperature and pH on the release of hydrogen cyanide from cassava tissues

Name: Shaun Hudson
Supervisor/s: Dr Karen Harper

Abstract: Fast growing, tolerant and high in calorie content, cassava has a long history as a staple food source for both humans and livestock in tropical nations. However, there is limitations in uptake due to the production of hydrogen cyanide (HCN) upon maceration of tissues. A natural defence mechanism, HCN production occurs when linamarin released from broken vacuoles reacts with linamarase in the cytoplasm. Methods to reduce HCN include boiling and drying which damage tissues, encouraging the release of HCN prior to ingestion. This research focusses on wilting and aims to improve processing by investigating influences of pH and temperature on HCN production, aiming to release maximum HCN during processing. Cassava peel was used within this trial and both picrate colour charts and spectrophotometry were used to analyse HCN concentrations during and after treatments. Urea was used to maintain an increased pH and additional pH analysis was conducted at the completion of all trials to investigate pH changes with differing treatments and ranges of HCN release. Temperature trials are based on temperatures which may be experienced in the field to indicate the influence of temperature on the release of HCN from plant tissues. An additional aspect to trials includes investigating the addition of sugar. This is based on prior results and associate's results which indicated higher HCN test results when used as an additive. Initial results point out an increase in HCN production with increasing temperature, likely associated with increasing the enzymatic efficiency of linamarase. Further results suggest an increase in the release of HCN corresponding with increasing pH up to the range of between 6 and 8. While a minimal influence from the addition of sugar was found initially, unlike previous results. The research conducted within this trial is aimed as contributing to knowledge of processing methods which increase HCN release from plant tissues, subsequently reducing toxicity. This is in the hope of further uptake of cassava in tropical developing nations where livestock and human nutrition are important issues faced by many developing nations.

Long-term changes in native pasture composition in North Queensland under different grazing management strategies

Name: Justin Macor
Supervisor/s: Dr Shane Campbell, Dr Hayley Giles

Abstract: Unavailable

Phosphorus metabolism in the muscle of growing weaners

Name: Peta Stockwell
Supervisor/s: Dr Simon Quigley, Professor Dennis Poppi, Dr Nick Hudson & Dr Kieren McCosker

Abstract: Acute phosphorus deficiency is widespread across northern Australian soils, however only a small proportion of cattle grazing phosphorus deficient pastures receive adequate phosphorus supplementation. It is thought that the low adoption of phosphorus supplementation by producers is partially due to a lack of producer confidence and understanding of animal responses to phosphorus and the potential economic returns. While the response of growing cattle to phosphorus is well documented, less research has been conducted investigating phosphorus supplementation in breeder herds. Better understanding of the effect phosphorus supplementation has in breeding animals, and consequently on their offspring, may help improve producer confidence and adoption. This project was conducted to investigate the intergenerational effects of phosphorus supplementation in *Bos indicus* cattle. Weaners from cows that received supplements with or without phosphorus during pregnancy and lactation were themselves fed weaner diets with or without phosphorus for 70 days. Liveweight gain and plasma inorganic phosphorus concentration were measured, and muscle biopsies were collected at the completion of the experiment. RNA was extracted from muscle samples and reverse transcribed prior to quantitative PCR to determine relative abundance of IGF1, IGF1R, IGFBP3, IGFBP5, PLAG1, FGF23, and SLC20A1 messenger RNA in response to cow and weaner nutritional treatments. PCR data was statistically analysed along with liveweight and blood analysis data. Weaner phosphorus diet was found to have a significant effect on liveweight gains ($P < 0.001$), but no significant interaction between cow and weaner diet was detected. Preliminary results describe significant relationships at the weaner level for IGF1R ($P < 0.05$), and the weaner/cow interaction for IGF1 ($P < 0.1$). The IGF system plays a key role in regulating growth and is associated with liveweight gain, while the differential expression level of IGF1R detected in this work supports previous suggestions that IGF1R has a role in phosphorus metabolism. No significant relationships were described between diet and expression of phosphorus transporter genes in muscle. There are multiple potential reasons for this, and the outcomes of this investigation will contribute to the currently limited knowledge of phosphorus metabolism in the muscle. Greater understanding of the mechanisms which drive physiological responses to phosphorus in *Bos indicus* cattle may allow greater confidence in phosphorus supplementation in deficient areas, and consequentially lead to increased adoption.

The effectiveness of stem-injected chemical and biological herbicides for the management of invasive woody weeds on Franklin Vale Creek, Spicers Hidden Vale

Name: Ciara O'Brien
Supervisor/s: Professor Victor Galea, Dr Megan Brady

Abstract: Spicers Hidden Vale is a resort with a focus on outdoor activities and the preservation of the natural environment. The organisational philosophy includes supporting the rehabilitation of native wildlife and vegetation. This restoration of native flora is currently being hindered by numerous invasive woody weeds, most notably Chinese Elm (*Celtis sinensis*) and Tobacco Bush (*Solanum mauritianum*). The current mechanisms of control often result in collateral damage to non-target native species (*Eucalyptus* spp, *Casuarina cunninghamiana*). Therefore, the development of a sustainable approach to weed management is paramount to the restoration of the natural assets at this resort. This research project is investigating the compatibility and effectiveness of the stem-injection method for controlling woody weed species in conserved or environmentally sensitive habitats. A series of replicated trials were established among naturally occurring populations of Tobacco Bush and Chinese Elm at the lower region of the Franklin Vale Creek, Spicers Hidden Vale. The field trials involved the mapping, measurement and treatment of these weed species with various encapsulated biological and chemical herbicides. In terms of the Chinese Elm trial, significant plant mortality was observed among the individuals treated with glyphosate and picloram. The degree of leaf browning and defoliation was similar to that of the benchmark treatment, this being the industry accepted standard of basal bark spraying with diesel and Access™ (triclopyr + picloram). The treatment of Tobacco Bush with metsulfuron methyl, aminopyralid + metsulfuron methyl and picloram caused considerable mortality over the observed period, this being twenty-four weeks. Although the results of the biological herbicide (BH001) were not wholly conclusive, the prospects were very promising. Future studies should aim to optimise the dosage rate of the encapsulated chemical herbicides, as well as focus on initiating systemic infection with the biological herbicide (BH001).

Probiotic supplementation and the amelioration of stress in weanling horses

Name: Amy Bentley
Supervisor/s: Dr Anne Beasley, Professor Wayne Bryden

Abstract: Probiotics have been shown to be beneficial for human mood disorders through the 'gut-brain axis', however their role in equine behaviour is yet to be elucidated despite product claims of stress reduction. We examined the effect of regular probiotic supplementation on stress responses of Australian Stock Horse weanlings. Twelve weanlings aged 8 months were paired on the basis of temperament, genetics and weight to form a probiotic supplement group (PB+; n=6) and a control group (PB-; n=6). A probiotic supplement containing *Lactobacillus* spp, *Saccharomyces* spp and fermented herb extracts was administered to the PB+ group twice daily for 42 days, while the PB- group received the same volume of water. After the supplementation period, the weanlings were subjected to a series of stress challenges including isolation, walking over a novel object and loading onto a two-horse trailer. Blood cortisol, eye and body temperature, behavioural responses, heart rate and heart rate variability were measured throughout the stress challenges. An ACTH challenge was administered to each horse at the conclusion of the stressor events. Faecal pH was also measured weekly as a proxy for gastrointestinal microbial communities. Preliminary results suggest that probiotic treatment did not have an additive effect over time on pH ($p > 0.05$), suggesting functional microbial communities under normal conditions were stable. Probiotic supplementation did not affect pH after 28 days ($p > 0.05$), further suggesting that microbial communities remained unchanged. The hypothesis under examination is that the PB+ weanlings will display a lower level of stress, by the way of the measured traits, in response to the stress challenges and will have a more rapid recovery. Young horses face a range of stressful challenges in industry and probiotics may be a useful tool to ameliorate stress in these animals. This work contributes to the currently limited knowledge in this field and has the potential to create safer working environments through calmer horses and better horse welfare through simple management strategies.

The effects of using the lunge and automated horse walker as exercise techniques on the *splenius* and *biceps femoris* muscles in the horse

Name: Brittany Nurse
Supervisor/s: Dr Rebeka Zsoldos, Dr Anne Beasley

Abstract:

Context: Understanding the muscle activity of horses when routinely exercised on the lunge and on the automated horse walker.

Aim: This study aimed to determine whether there was a difference in neck and hindlimb muscle activity in the *splenius* and *biceps femoris* when horses are being exercised on the lunge and on an automated horse walker.

Methods: Nine adult horses (7 to 14 years of age that weighed 470 to 590kg) were used for surface electromyography measurements, with sensors placed bilaterally over *splenius* at level of the second cervical vertebra, and approximately halfway between the third trochanter and patella and 6cm cephalad to the cranial margin of the *semitendinosus* for the *biceps femoris*. Markers were placed on the withers, point of shoulder, point of elbow, stifle joint, highest point of croup, hip joint, hock joint and fetlocks to determine motion cycles.

Preliminary results: The *splenius* will show higher muscular activity during a trot compared to the walk on both the lunge and horse walker, with more activity on the lunge than on the horse walker. This aligns with evidence that the *splenius* supports the balance of the atlanto-occipital joint against the full weight of the head during a free and gathered position. It is predicted that in both gaits the *biceps femoris* will have higher activity on the lunge due to the lateral flexion maintained on a smaller circle. The activity pattern of the *biceps femoris* suggests a supportive roll during hip extension and prevention of flexion of the stifle joint.

Key conclusions: As a mode of exercise, the lunge creates greater muscle activity in the *splenius* and *biceps femoris*. These muscles are more active in the trot during both modes of exercise.

Implications: Surface electromyography provides valuable information about neck and hindlimb muscle activity during commonly used exercise and training practices. This information advances the knowledge on the function of these muscles and could ultimately result in more refined training regimens in the equine industry.

Impacts of heat stress on growth performance, ileal nutrient digestibility and meat quality on broiler chickens fed standard vs reduced crude protein diets

Name: Darwin Horyanto
Supervisor/s: Dr Elham Assadi Soumeh

Abstract: Broiler production has increased rapidly all over the world due to high population and economic growth. Heat stress is a major challenge in poultry production, resulting in suffering, death and production lost. Moreover, protein metabolism is producing high metabolic heat production in broilers. It is predicted that adding crystalline amino acids (AA) to meet ideal protein profile, while reducing crude protein (CP) in diets is going to reduce metabolic heat production, while maintaining broiler performance. The experiment is a 2x2 factorial design by two factors, which is: temperature (thermoneutral vs heat stress) and feed (standard vs reduced CP, but supplemented with crystalline AA) in a randomised complete block design in a total of 32 cages (8 cages/treatment and 8 birds/cage). Crystalline AA (highly digestible) was tested to meet ideal protein profile, while reducing CP (19% CP vs 17% CP), which is provided mainly by soybean meal (SBM) during the finisher phase (day 29 to 42). It is predicted that the reduced CP, but supplemented with crystalline AA diets will minimise metabolic heat production, while maintaining broiler performance, including meat quality and nutrient digestibility. If this project is successful, it will be a reliable and affordable strategy to alleviate the impacts of heat stress on broilers in tropical and subtropical countries, and hopefully it will help to promote sustainable broiler production and food security.

Note: This project is not yet complete, as we have not done some laboratory works, and still waiting for the statistical analysis of the raw data.

Super-dosing of multi-enzymes in reduced energy diets of broiler chickens: impacts on growth and gut health

Name: Jacoba Madigan-Stretton
Supervisor/s: Dr Elham Assadi Soumeh, Dr Nick Hudson

Abstract: The global population is expected to rise from 7.2 billion as of 2019, to 9.7 billion in 2050, putting significant pressure on farmers to increase production capacity to ensure food security, whilst simultaneously improving food sustainability (United Nations, 2015). Poultry is a particularly important protein as it has a high feed efficiency and short production cycles compared to other animal proteins, making it an affordable, nutritious source of animal protein. Therefore, methods to improve production performance of broilers will require significant research as this is key to future food security. One method to improve sustainability of poultry production systems is the addition of exogenous enzymes into broiler diets thereby improving the efficiency of feed utilisation. Identifying an optimal enzyme dose-rate through an energy matrix validation study for commercial products is vital to ensure that farmers get the best response in terms of production performance and cost savings. This study aimed to identify the optimal multi-enzyme (phytase, amylase, protease, NSP enzyme combination) dose-rate at three energy levels based on production performance, gut health, and dietary cost-savings. A 3x4 factorial design of 12 dietary treatment (576 birds, 6 reps/treatment, 8 birds/pen) was implemented over a 42-day broiler growth trial, with weekly weights and performance data recorded. Diets were primarily corn-soybean meal with reduced-energy levels (no reduction, -150 and -200 kcal) and four enzyme inclusion levels (0, 350, 700, and 1050 g/ton). One bird per pen was slaughtered at 42 days (n=72), where organ weight, tibia, breast meat, ileal content, caecal content, duodenum, jejunum, and ileum samples were taken. Meat quality analysis were performed using breast meat, where pH, colorimetry determined colour, water holding capacity, and cooking loss were measured 18 hours post-mortem. Small intestine samples were processed in paraffin wax and stained with hematoxylin and eosin, to be microscopically analyzed for villi abundance, crypt depth, height, and presence of blood. Performance data revealed that an increase in multi-enzyme dose-rate without any energy reduction significantly improved feed conversion ratio and body weight gain (P<0.05). However, preliminary data reveals that super-dosing (1000g/t) with and without energy reduction created bloody lesions in the small intestine. It is hypothesised that this is due to an overdose of exogenous protease digesting the intestinal wall – the results are still being processed further. Similarly, the effect of the treatments on the meat quality of the chicken breasts are in the process of analysis. Preliminary conclusions are thus that super-dosing multi-enzymes can significantly improve performance parameters and thus profitability for producers and improve sustainability of production; However the formulation of the protease enzymes may need to be altered to maintain gut health and integrity.

Reference

United Nations. (2015). World population projected to reach 9.7 billion by 2050 | UN DESA | United Nations Department of Economic and Social Affairs. [online] Available at: <https://www.un.org/en/development/desa/news/population/2015-report.html> [Accessed 29 Mar. 2019].

The relationship between BioCondition, small and medium-sized mammals and other landscape variables

Name: Thomas Lally
Supervisor/s: Associate Professor Peter Murray, Dr Megan Brady

Abstract: Rapid vegetation condition assessments have become commonplace in native vegetation and conservation management, mainly due to their ease of implementation. However, their accuracy in explaining the nature of faunal populations is poorly understood and potentially significantly limited. To determine this predictive capability of one such assessment, Queensland's BioCondition assessment, I conducted BioCondition surveys and collected species richness and abundance data of small and medium-sized mammals across 18 sites within a property near Grandchester, South East Queensland. I also collected additional landscape spatial data not included in the BioCondition assessment to determine what influence these variables may have on the populations and if they could be used in conjunction with the BioCondition assessment to produce a more robust and reliable indicator of mammal populations. Preliminary data suggest that insufficient mammal data were collected to accurately determine what relationships were existing between them and vegetation condition. It is likely that feral predators and other land management practices not quantified in this study have historically had and continue to have a significant impact on the mammal populations of this area.

Further results will be presented and discussed in the presentation. Identifying relationships between vegetation condition assessments and actual faunal populations will allow us to improve upon them and make them more effective conservation management tools.

Impact of fallow frequency on soil aggregation and water stability

Name: Liao Ying Hsu
Supervisor/s: Dr Alwyn Williams

Abstract: The fallow periods is a traditional farming technique that is widely used by farmers for replenishing soil water storage and soil nutrient. Most farmers believe it is a natural way to enhance soil quality by letting farmland to rest. Soil quality is determined by several factors, such as organic matter, fertility, structure, aggregate distribution, and others. While soil fertility is one of the most discussed factors in soil quality, the structural factors like aggregate distribution are equally important as it has a significant influence on water storage and water permeability.

Since farming technology is improving with the progress of civilisation, the fallow periods become a passive and inefficient way for soil amendment. This research will focus on how fallow period affects soil structure by examining the soil aggregation from different farming practices. Theoretically, compared to other farming practices, the fallow periods provide zero economic output. At the same time, it leaves the farmland unprotected, which resulted in soil erosion and increase soil breakdown on the surface. Therefore, farming practice with reducing fallow periods should present a higher quality of soil structure.

In this study, six farming systems were tested: conventional cropping, cover crop, double cropping, four-year grass-legume ley, four-year grass-legume ley with tillage practice, and four-year fallow. Two soil depths were tested in each system: from 0-10 cm and 10-30 cm. There were four replications for each system to achieve statistical accuracy. The collected soil was air-dried, oven-fried, and sieved to record its water storage and aggregate distribution. The collected aggregate was classified into three groups: micro- (>53 μm), macro- (>250 μm), and mega aggregate (>2 mm) for statistical analysis. Finally, macro- and mega aggregate was wet-sieved, and the remaining was collected to analyze the soil water stability.

The result shows a high correlation between soil aggregate distribution and the two main tested factors: length of fallow period and soil depth. Notably, a significant correlation was found between fallow periods and overall aggregate distribution ($p < 0.01$). The two-way factorial analysis shows low correlation, which indicates the two main factors influence soil structure independently. Long-term fallow periods present a more unstable soil structure with higher micro-aggregate, while the system with constant protection, like cover crops and conventional cropping, present higher macro- and mega aggregate, which help increase soil stability.

Evaluating the effects of crop row spacing and weed control treatments on the management of turnip weed [*Rapistrum rugosum* (L.) All.] in wheat [*Triticum aestivum* L.]

Name: Roy Govinden
Supervisor/s: Associate Professor Bhagirath Singh Chauhan, Dr Gulshan Mahajan

Abstract: Turnip weed is one of the most serious and costly broad-leaved weeds of winter cropping systems in the northern grain-growing region of Australia. It is a highly competitive weed which is well adapted under the current wheat production practices. Currently, the control of turnip weed in wheat is heavily reliant on the use of herbicides, which has resulted in the evolution of herbicide-resistant populations. Therefore, more sustainable alternative strategies are required to effectively control turnip weed in wheat. The objective of this study was to evaluate the effect of crop competition using narrow wheat row spacing and weed control treatments on turnip weed suppression and wheat yield. A field experiment was conducted at the University of Queensland Crop Research Unit located at Gatton between May to October 2019 using the wheat cultivar Spitfire. The experiment was laid out in a split-plot design with three replicates arranged in a randomised complete block design. The main-plot factor comprised of two levels of wheat row spacings set at 25 cm and 50 cm, whilst the sub-plot factor consisted of four weed control treatments comprised of a weedy check, a weed-free check, application of a pre-emergence herbicide (prosulfocarb + S-metolachlor) only and the application of both pre-emergence (prosulfocarb + S-metolachlor) and post-emergence herbicides (metsulfuron-methyl). It was hypothesised that increased crop competition using 25 cm narrow row spacing would significantly reduce turnip weed density, growth and seed production, whilst increasing wheat yields as well as decreasing the reliance on repeated herbicide applications compared to the use of wider (50 cm) row spacing. The results of this study will help develop a better understanding of the interaction effect between wheat row spacings and weed control measures on turnip weed and wheat development. Furthermore, it will identify the best combination of wheat row spacing and weed control tactic that could be incorporated into an integrated weed management strategy for the sustainable management of turnip weed in wheat.

The effect of stubble management on aggregated distribution and associate wind erodibility

Name: Munkhjargal Nyamsuren
Supervisor/s: Dr Gunnar Kirchhof, Dr Alwyn Williams

Abstract: Unavailable

Identification of new maize single cross testers for CIMMYT heterotic group B maize germplasm adapted to mid-altitudes

Name: Arisede Chisaka
Supervisor/s: Dr Mark Dieters, Dr Vivi Arief

Abstract: Maize provides 95% of calories in diets of people living in sub-Saharan Africa. However, many maize yields in this region are often low due to drought and low soil nitrogen. The development of higher yielding maize hybrids adapted to low input smallholder farming systems is required. The cost of producing single cross hybrid seed is generally high. Three-way hybrids (i.e. F1 tester from heterotic group B crossed to line from group A) can be produced at lower cost for smallholder farmers, but to achieve this it is crucial to identify high yielding single cross testers with high combining ability for CIMMYT-Zimbabwe maize breeding program. The current single crosses CML395/CML444 and CML489/CML444 (heterotic group B) have been used for over 20 years and are now obsolete; new testers better adapted to current climatic, soil and management practices are required to support development of new high yielding hybrids for this region. Data was collected on the performance of F1 and three-way hybrids from a total of 25 multi-environment trials (MET) located in South Africa (three trials), Zambia (four trials) and Zimbabwe (eighteen trials) grown across two seasons during the period from 2015–2018 to: (i) evaluate testcross performance under optimum, drought and low N conditions (ii) assess the single cross (F1) hybrids and as parents of three-way hybrids (iii) identify potential new single cross testers; and (iv) explore patterns of genotype x environment interactions. Analyses were conducted using a two-stage approach whereby individual trials were first analysed to adjust for spatial variation within trial and to estimate genotype means (stage 1). These means which were then combined in the second stage across sites analyses. Clustering based on yield data grouped sites into three environment types (ET); low (LY) < 3 t ha⁻¹, medium (MY) 3–6 t ha⁻¹ and high (HY) 6–13 t ha⁻¹ yielding groups. The general combining ability (GCA) of both the inbred parents and the selected F1 crosses used as parents, were highly significant ($P < 0.01$) and higher than specific combining ability (SCA) of hybrids for grain yield across ETs. This indicates that additive genetic effects were more important than non-additive genetic effects. Strong genotype x environment interactions on yield, anthesis date and plant height were observed which affected selection of hybrids adapted to all environments. It was concluded that there is a need to develop hybrids adapted to contrasting environments and F1 crosses CZL461/CZL15085 and CZL1461/CZL1465 had best GCA effects for grain yield and so have potential to replace CML395/CML444 and CML489/CML444 for CIMMYT heterotic group B maize germplasm. F1 hybrids EBH0551 and EBH0545 demonstrated high yield across all environment types, and it is recommended that these be also evaluated as potential new testers.

The effect of heat treatment (hot water and dry heat) and drip-line placements on the yield and quality of garlic (*Allium sativum*)

Name: Alina N.D.A. Djanie
Supervisor/s: Dr Robyn Cave, Dr Stephen Harper

Abstract: Garlic (*Allium sativum*) is a crop of significant economic value in many parts of the world. However, the crop has severe productivity constraints and challenges that contribute to low yield and quality. One of the main difficulties in garlic production is *Fusarium* basal rot (FBR) caused by *Fusarium oxysporum formae speciales cepae* (FOC). The soil-borne fungus infects the roots and basal plates of alliums causing delayed emergence and bulb rot at pre- and postharvest stages. The incidence of the pathogen is increasing and is expected to increase further due to growth being promoted under warmer temperatures associated with climate change. Management of the pathogen is difficult because it produces chlamydospores that can survive for years in the soil. The current study investigated the impact of controlled irrigation and heat treatment of cloves on FBR prevalence as well as its effect on yield and quality of garlic. Potential practices for reducing FBR in garlic are hot water or dry heat treatments applied to cloves at 50°C or 45°C, respectively, for 30 minutes prior to planting, and controlling irrigation using single or double drip line placement on a 1.5m wide bed with two rows of garlic. Data was collected on growth and yield parameters of the crop and results were analyzed using Minitab statistical software. The experiment was laid out in a replicated split-split plot factorial design with 4 replications and 12 treatments. General field observations indicated that plants from large bulbs comprised of 20–25 cloves, hot water and dry heat treated showed more foliage, thicker stems and grew taller while plants from small bulbs comprised of 10–15 cloves were characterised by thin stems, less foliage and short plant height under the same treatments. However, plants from untreated cloves from both large and small bulbs exhibited less foliage with most appearing yellow in colour, thin stems and short plants. Plants grown 10 cm away from a single drip line placement showed better crop development as compared to plants grown 30 cm away from double drip line placement which showed less vigorous growth. These chemical-free practices are relatively easy to apply and could be effective for managing FBR in conventional and organic grown garlic which would also enhance crop development, better garlic quality and high yields.

The effect of air nanobubble in distilled water on the growth of hydroponic lettuce

Name: Yimeng Li
Supervisor/s: Dr Robyn Cave

Abstract: Maintaining oxygen levels in the nutrient solution of hydroponic systems, particularly those using the deep flow technique (DFT), is essential for root uptake of water and nutrients, and cellular respiration. However, more frequent, extreme, and longer heatwaves, as a result of climate change, are posing a threat to outdoor hydroponic growers because of oxygen levels in the nutrient solution decrease as temperature increases. Low dissolved oxygen (DO) levels can adversely affect growth rates and yield, making it difficult for growers to meet customer's demand. Current strategies for increasing DO include cooling the nutrient solution, introducing ozone or pure oxygen into the nutrient tank. However, nanobubbles could be another effective solution for raising the DO level in the nutrient solution. Nanobubbles (<200nm in diameter) are generated using a nanobubble generator and can exist in liquid for several weeks to several months due to a negative surface charge and high gas solubility in water. This study investigated the oxygen solubility of air nanobubbles (Stoney Series, Nanobubble technologies, Sydney, Australia) in distilled water at 14–48°C for 12 days and in nutrient solution with pH levels of 5.8 and 6.6 for six days at 22, 30 and 38°C. Compared with distilled water, air nanobubble in distilled water increased the dissolved oxygen concentration of water around 0.64 ml/L at 22, 30, 38 and 48°C. Over the 12 days, the dissolved oxygen concentration in both liquids gradually decreased, but appeared to be slightly higher in air nanobubble water than in distilled water, particularly at 22 °C. The DO was 9.4ml/L in air nanobubble water and 8.6ml/L in distilled water. The dissolved oxygen concentration in air nanobubble nutrient solution at pH 6.6 was 8.7ml/L, and 8.5ml/L at pH 5.8 after 24 hours at 22 °C. The DO in air nanobubble nutrient solution at pH 6.6 was 7.1ml/L, and 3.7 ml/L at pH 5.8 after 24 hours at 30 °C. The DO in air nanobubble nutrient solution at pH 6.6 was 6.6ml/L, and 3.4 ml/L at pH 5.8 after 24 hours at 38 °C. Air nanobubble water could be a useful alternative tool for managing DO levels in conventional and hydroponic systems in regions where temperatures and pH are predicted to rise.

Farmers' perception on pesticide use practices and poisoning in India

Name: Paawan Sood
Supervisor/s: Dr Severine van Bommel

Abstract: As the title of the research project suggests, this research is aimed at finding out the way a farmer perceives thought about using pesticides and pesticide poisoning which is spreading at a very alarmingly rate. Although, a lot of work has been done on the dangers associated with the use of pesticides, but a very few studies have been carried out on identifying the farmers' perception on pesticide use and poisoning. The reason behind selecting India for this project is that it is my home country. Moreover, the use of pesticide in agriculture has increased to such an extent that without applying pesticides growing crops now a days seems impossible. To explore more about this issue, I planned to conduct a semi-structure interviews of the farmers near by my locality in India. To gather more information on identifying farmers' perception on this issue, a case study on farmers involved in growing cotton crop was selected for the collection of information. The farmers were chosen at random by snowball sampling method. As far as the outcomes of this study are concerned, the exact outcomes are still not known as I am still working on the project. But according to me so far, the preliminary results that have identified from the interviews is that, first, according to the farmers, the main reason for the increased use of pesticides is the changes that are occurring in the environment. Secondly, the lack of support from the government in setting up the low prices for the commercial crops that farmers produce. This was the most common reason given by the farmers that leads the farmers to bear the expenses. At last, the major finding of the study so far which I have come across is that farmers in India are aware of the pros and cons of using pesticides and they are also aware of the solutions that can be implemented to reduce the impacts of the pesticides. To conclude, this study is crucial and will help the government in setting up the policies in favor of the agriculture. Moreover, it will also help in development and implications of the safe and sound strategies to bring the sustainability in agriculture. Also, poisoning from pesticide has become a global problem these days and this study will lay down the basis of further research on this issue and is therefore interesting and worth investigating further.

Using pre-treatments to improve seed-based restoration outcomes

Name: Liu Shi
Supervisor/s: Professor Stephen Adkins

Abstract: In recent decades, a large parts of Australian native habitats has been cleared for the purposes of agriculture, graze and other human activities, which certainly resulted in a series of the environmental issues, such as soil erosion and soil degradation. As a result, habitat restoration has been attracted attention by more and more people nowadays. However, directly sowing as one of the main revegetation methods exists low germination rate and dormancy problems; meanwhile, soil seedbank as a source for the subsequent plants generations have a majority of unwanted weed seeds that compete nutrients and interfere with revegetation species. Therefore, the objectives of present project lie in that finding out the ideal approaches to improve seed-based restoration outcomes, assessing how different pre-treatments can affect seed germination and exploring revegetation trial of species richness and density in soil seedbank. Two native grass species, *Lomandra longifolia* and *Lomandra hystrix*, due to long germination time was selected to do pre-treatment test in Petri dishes via approaches, seed priming, leaching, scarifying and combination. A total of 8 pre-treatments group was incubating in 25/15°C, dark and full light condition to explore its germination. In terms of soil seedbank trial, collecting soil samples from a previous revegetation trail, then combined it with pot media and maintained with irrigate water. After 8 week period observation, *L.hystrix* had improved germination results compared to control group as well as *L. longifolia*; it also found out that *L. hystrix* with pre-treatments mainly germinating around the third week, both species seed has fungi problem impacting seed viable. Moreover, there were 24 different species currently found in soil samples, which had exotic weed and native plant species. Consequently, by this project, it could have a better understanding of how to overcome seed dormancy and improve germination, as well as potential soil seedbank size, compositions and diversity, which be useful and meaningful for further restoration programs.

Encapsulated probiotics using a double emulsion and the impinging aerosols method in thickened skim milk and yogurt

Name: Shiyi Li
Supervisor/s: Professor Bhesh Bhandari

Abstract: Palm oil and alginate are encapsulation materials that can potentially improve the survivability of probiotics after heat treatment. This study mainly focused on the survivability of pasteurised and unpasteurised encapsulated probiotics in skim milk and yogurt over a 4-week storage at room temperature and 4 °C. Two strains of probiotics used in this study are *Lactobacillus rhamnosus* GG (LGG) and *Bifidobacterium animalis* subsp. *lactis* (Bb-12). The double emulsion method employed sodium caseinate solution and palm oil form a water-in-oil-in-water ($W_1/O/W_2$) emulsion. Probiotics were dissolved in sodium caseinate solution as W_1 and sodium caseinate solution performed as W_2 . Based on the double emulsion method, W_2 was replaced as a mixture of sodium caseinate solution and alginate solution in the impinging aerosols method. Then, an aerosol of alginate-containing double emulsion forms cross linking when exposed to another aerosol of $CaCl_2$ solution. Microcapsules were incorporated into thickened skim milk and yogurt and went through pasteurisation process (75 °C, 30s). The number of viable probiotics, pH of milk and yogurt, size of microcapsules were checked weekly during the storage. The structure of microcapsules was also observed under microscope. It was found that encapsulated probiotics did not survive the pasteurisation since no desired colonies grew on agar plates. However, probiotic movement inside the microcapsules was observed under microscope. It is possible that these probiotics were viable but nonculturable (VBNC) after heat treatment. The loss of microcapsules during pasteurisation processing and dilution may also be a factor due to microcapsule stickiness. Another problem is due to the contamination occurred throughout the experiment, which can possibly inhibit probiotic growth and affect the results. Further research should find out more about the culturability of probiotics. It is also essential to find a fully aseptic environment to prepare samples to avoid any contamination.

How does Australian pork taste? A project to improve the flavour of pork for Asia-Pacific consumer

Name: Jia Wen Tey
Supervisor/s: Dr Eugeni Roura

Abstract: Unavailable

New product development of bushfood confectionery: Desirability and commercial viability

Name: Thomas Hay
Supervisor/s: Professor Melissa Fitzgerald

Abstract: Unavailable

3D printing Sea Cucumber

Name: Kang Wei Cher
Supervisor/s: Dr Sangeeta Prakash

Abstract: This research study is about 3D Printing of food using Sea Cucumber as the main source of the medium. The addition of hydrocolloids and water will be necessary to achieve the texture that will suitable for printing while also being pleasing for the consumer to consume. Sea cucumber is used in this study as it is a source of protein that is rarely consumed in the western diet even though it contains high levels of protein, essential amino acids, vitamins and minerals and has been seen to have medical properties. The reason for this study is to reduce the overall food waste, food that does not meet the suitable requirements are usually discarded, by researching the technique of 3D printing and further understanding this method of processing we will be able to repurpose food that once would have been thrown away and turn it to something pleasing for the consumer.

Dual-nozzle 3D printer was used in this study to analyse the printability of the different formulation of sea cucumber mixtures created. The rheological properties of the mixtures were tested to identify the different gelling properties to find the most suitable hydrocolloid to use for this research. The sensory attributes were tested by a texture analyser on the raw sea cucumber samples and a printed sample to identify if there was any significant difference between the raw product and the printed samples, this was also to identify if there is any difference in the hydrocolloids used between the samples. Colorimeter was used to figure out if the colour of the product would change after the processing steps were completed.

From the several tests done using different type and combination of hydrocolloids, it is concluded that a mixture of kappa and iota carrageenan at a ratio of 40:60 at a total hydrocolloid content of 2% with the addition of 0.5% calcium chloride would create a gel structure that was stable enough to be 3D printed. The most suitable setting on 3D printer was also identified with the printing speed being 10mm/s for a nozzle diameter size of 1.2mm and the extruder temperature at 45°C.

The findings from this study have provided a better understanding of 3D printing of seafood which was not investigated previously and shows the different types of hydrocolloids that are usable and how it affects the texture of the printed sample. This knowledge can be useful for the food processing industry and can help maximise the overall yield and reduce food wastage.

The characterisation of the Bunya nut and its functional properties for new product development

Name: Joseph Nastasi
Supervisor/s: Professor Melissa Fitzgerald

Abstract: Unavailable

Effect of carotenoids content and 430-nm LED array photosensitisation on inactivation of *Aspergillus flavus* and aflatoxin B1 formation in maize

Name: Rafael Jose Nguenha
Supervisor/s: Dr Yasmina Sultanbawa

Abstract: Unavailable

Genome analysis of the cheese fermenting bacterium *Lactococcus*

Name: Mengfan Cao
Supervisor/s: Professor Mark Turner

Abstract: Unavailable

Investigation into stress in the cheese fermenting bacterium *Lactococcus*

Name: Wen Shi
Supervisor/s: Professor Mark Turner

Abstract: *Lactococcus lactis* is an economically important primary starter culture bacterium used in a variety of cheese fermentations. During food processing, the environment around the bacteria may change, such as the availability of nutrients and variation of physical conditions such as heating and drying. An important adaptive mechanism of bacteria is to synthesise alter the level of intracellular second-messenger molecules to adapt to these changes in order to survive or grow better. The cyclic di-adenosine monophosphate (c-di-AMP) is a bacterial second-messenger found in most Gram-positive bacteria including *Lactococcus* which affects cell growth, cell wall metabolism and resistance to different stressors such as salt and antibiotics (Commichau et al. 2018). Previous studies in our laboratory identified a strain (OR1), which contains a very low c-di-AMP level and is highly sensitive to the cell wall acting antibiotic cefuroxime (CEF). In this project, to identify the reason why OR1 is highly CEF sensitive, I plated this strain onto agar containing inhibitory levels of CEF and isolated CEF resistant colonies. These were confirmed as being suppressor mutants since they retained CEF resistance following subculture in media not containing CEF. Dilution drop plate and disk diffusion assays were used to confirm CEF resistance. Resistance to lysozyme and autolysis assays were also carried out to determine general changes to the cell wall structure. All suppressor mutants were less autolytic than the parent OR1, however variability to lysozyme resistance between strains was observed. Genomic DNA from 6 CEF resistant suppressor mutants was purified and submitted for whole genome sequencing using the Illumina NovaSeq platform. Upon receiving the whole genome sequencing results, the gene(s) which have mutated will be identified. The results will provide insight into how c-di-AMP affects cell wall structure and antibiotic resistance which has implications for controlling bacteria in food fermentations and disease control.

Reference

Commichau, FM, Gibhardt, J, Halbedel, S, Gundlach, J & Stulke, J 2018, 'A delicate connection: c-di-AMP affects cell integrity by controlling osmolyte transport', *Trends in microbiology*, vol. 26, no. 3, pp. 175-185.

Comparing the quality of different rice varieties from the wet season in Queensland grown on research station

Name: Runzhe Li
Supervisor/s: Professor Melissa Fitzgerald

Abstract: Unavailable

Comparing physical qualities of rice grown in North Queensland

Name: Xing Xin
Supervisor/s: Professor Melissa Fitzgerald

Abstract: This program is to detect some physical properties of rice grown in North Queensland. Four different species are in tested. They are treated with different factors that may infect the quality. Planting density, nitrogen amount and the time for fertiliser are controlled to see if some physical properties are influenced. Viscosity, Amylose amount, protein content and Q-sorter are tested. According to the final results, an optimal environment for rice grown in a specific spot may be found.

Survival of probiotics in the localised microenvironment of 3D printed food

Name: Wei Li
Supervisor/s: Professor Bhesh Bhandari

Abstract: Unavailable

Multiple-foaming properties of milk

Name: Yu-Jen Lu
Supervisor/s: Mr Minh Thao Ho

Abstract: Unavailable

Acid gelation of camel milk

Name: Jiadi Zhao
Supervisor/s: Mr Minh Thao Ho

Abstract: Unavailable

Effect of heat and pH-treatment conditions on properties of rehydrated whey protein powder

Name: Jinlei Zhu
Supervisor/s: Mr Minh Thao Ho

Abstract: Unavailable

Defining the texture of the food by 'softness' and 'stickness' and industrial methods

Name: Ruiliang Fan
Supervisor/s: Dr Sangeeta Prakash

Abstract: Unavailable

3D printing of broccoli and pumpkin seed

Name: Kirti Mittal
Supervisor/s: Dr Sangeeta Prakash

Abstract: Unavailable

3D printing of French fries from potato and tapioca starch

Name: Yuanyuan Xie
Supervisor/s: Dr Sangeeta Prakash

Abstract: Unavailable

The development of *Nannochloropsis* sp. in food area

Name: Yixiao Wu
Supervisor/s: Dr Yasmina Sultanbawa

Abstract: Unavailable

Interaction of polyphenols with soluble dietary fibres

Name: Shanmugam Alagappan
Supervisor/s: Dr Sushil Dhital

Abstract: Unavailable

Prevalence of endophytes in macadamia plants in Australian nurseries

Name: Julie Sosso
Supervisor/s: Dr Olufemi Akinsanmi

Abstract: Macadamias are a delicious, high value tree-nut crop endemic to subtropical Australia yet grown worldwide. Problems for this expanding global industry are looming as commercial orchards are experiencing escalating incidences of pathogen-induced crop losses. In order to ascertain the pathogen pathways in macadamia plants, this project focussed on establishing the baseline fungal endophytes or microbiome within root, stem and leaf tissues of healthy 3-month-old seedlings and potted 18-month-old open pollinated H2 (Hinde) plants. Using traditional laboratory culturing techniques, culture characteristics and sequencing of the internal transcribed spacer (ITS) region of the cultured fungi, the identity and diversity of the fungal genera in the plant tissues was established. Data analysis comparing plant age and fungal endophyte composition revealed nine fungal genera in seedlings and 26 in the potted plants. Fungal endophyte diversity in seedlings was higher in the stem than root and leaf tissue. In the potted plants grown in two different potting media, endophyte diversity differed between the plant parts with leaves showing the greatest diversity. Key findings suggest a wealth of endophytic diversity exists within young macadamia plants. Known latent pathogens such as the Botryosphaeriaceae family and Phomopsis/Diaportha genera are present in young, healthy, nursery-grown plant tissue and are therefore considered to be acquired vertically from the seed. However, the results suggest horizontal acquisition of fungal endophytes from the environment is the most likely pathway of most endophytic colonisation of macadamia plants. This new baseline information contributes to our overall understanding of how the endophytic community could influence emerging disease trends. In addition, because <1% of fungal endophytes are culturable under laboratory conditions, further studies using Next Generation Sequencing will ascertain overall community diversity of both culturable and non-culturable endophytes.

Effects of nitrogen fertiliser on growth and nodulation of *Millettia pinnata*

Name: Celina Lim
Supervisor/s: Associate Professor Brett Ferguson, Ms Lisa Xian

Abstract: *Pongamia pinnata*, also known as *Millettia pinnata* (and commonly known as pongamia) is a hardy tree native to Northern Australia and southern Asia. The seeds of pongamia produce oil suitable for biofuel production, which has led to interest into developing the tree into a renewable energy source. As pongamia is a legume tree, it can fix atmospheric nitrogen through a symbiotic relationship with rhizobia bacteria. This project investigates the growth of pongamia under different amounts of nitrogen and whether the ability to fix nitrogen can translate to reduced nitrogen fertiliser usage, therefore, minimising environmental impact. Pot trials were conducted in the glasshouse using pongamia saplings, which were irrigated with 100 mL of nitrogen free fertiliser solution 2-3 times a week. The saplings were treated with an additional 0 mM, 2 mM, or 15 mM potassium nitrate. These same treatments were repeated with saplings inoculated with rhizobia. Chlorophyll content, chlorophyll fluorescence, stomatal conductance, photosynthetic rate, shoot height, shoot and root biomass, nodule number, and leaf nitrogen content were measured and compared to indicate overall performance of the plant. Preliminary results show pongamia saplings, which were not inoculated with rhizobia and were fertilised with 15 mM of potassium nitrate, grew the tallest and had the highest chlorophyll fluorescence and relative chlorophyll content. Higher chlorophyll content and fluorescence implies greater capability for photosynthesis and growth. Saplings inoculated with rhizobia and fertilised with 2 mM of potassium nitrate were the shortest in height and had the lowest chlorophyll fluorescence and relative chlorophyll content. In addition to the glasshouse experiments, the chlorophyll content, chlorophyll fluorescence, stomatal conductance, leaf nitrogen content and soil macronutrients were measured from four mature pongamia trees located at unique sites in South East Queensland over the course of the project. These sites include the UQ St Lucia campus, UQ Gatton campus, Graceville and Toowong. Initial findings show the St Lucia pongamia tree, UQ1, had the highest relative chlorophyll content and chlorophyll fluorescence. It is hypothesised that the macronutrient content of UQ1 soil might also be higher than the other sites and the nitrogen content of its leaves might also be higher. The data gathered from both the glasshouse experiment and mature trees may prove useful in future research to develop pongamia into a renewable and environmentally benign energy crop.

Induction of Novel CLE peptide Hormones in response to pathogen infection of *P. vulgaris*

Name: Alexandria Mattinson
Supervisor/s: Associate Professor Brett Ferguson

Abstract: CLAVATA3/EMBRYO SURROUNDING-related (CLE) peptide hormones are involved in an array of plant signalling pathways that regulate and optimise development in response to biotic and abiotic stimuli. CLE peptides have also been identified in the genomes of non-plant organisms such as mycorrhizae and plant-parasitic nematodes. This research aimed to identify and functionally characterise novel CLE peptide signals involved in plant pathogen infection response. *Phaseolus vulgaris* (common bean) seedlings were infected with the soil-borne pathogens *Macrophomina phaseolina*, *Sclerotium rolfsii*, *Sclerotinia sclerotiorum* and *Phytophthora capsici*. Following infection, root and shoots were harvested, and expression of the complete family of CLE peptide encoding genes of *P. vulgaris* (46 total) were assessed using qRT-PCR. Bioinformatic analysis of the four pathogen's genomes were also conducted to identify potential CLE peptide encoding genes.

Techniques for culturing the *M. phaseolina*, *S. rolfsii*, and *S. sclerotiorum* fungi on Potato Dextrose Agar media, and *P. capsici* on V8 media were implemented, and novel and efficient usage of Japanese Millet as a transfer medium to infect the *P. vulgaris* seedlings was developed and refined. Initial studies also identified that disease symptoms for *P. vulgaris* infected with *S. rolfsii*, and *S. sclerotiorum* appeared within four days post inoculation, before which is an ideal time point to harvest and analyse CLE peptide expression levels. It was found that *M. phaseolina* and *P. capsici* are not suited to the Millet inoculation method, and thus require future re-evaluation. These results are important for developing effective pathogen inoculation techniques for legume molecular and physiological research, and this research offers new insight into the role of CLE peptides and infection responses in legumes.

Identification, genetic characterisation and phylogenetic analysis of CLE peptides in algae, mosses and chickpea using bioinformatics tools

Name: Arzoo
Supervisor/s: Associate Professor Brett Ferguson, Dr April Hastwell

Abstract: CLAVATA3/ ENDOSPERM SURROUNDING REGION- related (CLE) peptides are short peptides which have been detected in plants controlling the meristematic cell division. CLE peptides have roles in short and long-distance signalling mechanisms but their functionality is not yet well understood. Even more limited knowledge of CLE peptides of algae, fungus, nematodes and mosses. In this research project, CLE peptides have been identified in lower plants such as algae and bryophytes in order to understand their origin and mechanism in controlling cell proliferation. The CLE peptides identified from *Arabidopsis thaliana*, soybean and lotus were used to locate similar peptides in algae, mosses and chickpea. The typical CLE-peptide contain 3-4 domain which includes a signal peptide, variable region, the CLE domain and C-terminal domain out of which CLE domain is the conserved sequence predominately used for gene identification. Software, bioinformatics tools and databases such as BLAST, NCBI, Phytozome, PhyML, Clustal W, MEGA and Geneious were used to locate the CLE peptides encoding genes of these species. The CLE domain and signal peptide were located using known CLE peptides as query sequence against the whole genome of the plant species. 30 CLE peptide- encoding sequences were identified in chickpea containing all the four domain of peptide. CLE peptides were identified from two moss species *Physomitrella patens* and *Selaginella* with 20 CLE peptides- encoding genes which were generally smaller in length but contained a similar in structure. However, the CLE-peptides obtained from moss species had less sequence conservation in comparison to the higher plant CLE peptides except for the conserved CLE domain. The results obtained were further used to construct multiple sequence alignment and subsequent phylogenetic trees of the sequences. The trees were examined for the identification of the homologous or orthologous genes. Examination of the tree will explain the evolution of types of CLE peptides which will help in understanding the function in further studies.

Relationship between Fusarium crown rot resistance and drought tolerance at gene levels in wheat and barley

Name: Zhouyang Su
Supervisor/s: Professor Chunji Liu, Professor Elizabeth Aitken

Abstract: Fusarium crown rot is a common disease of wheat and barley in cereal-growing regions worldwide and it can bring about yield reduction and economic loss. The impact of this disease is highly environmentally dependant with significant yield losses only observed where soil moisture becomes limiting late in the growing season. To date, the impact of this disease has been addressed through management practices such as inoculum reduction and rotation into non-host crops. Management techniques only provide a partial solution and so it is critical to improve resistance to this disease in wheat and barley varieties through breeding. Previous work has identified and mapped several sources of partial genetic resistance to different chromosomal regions. The mechanisms underpinning these resistance loci are yet to be discovered; however, given the link between drought stress and Fusarium crown rot severity, one hypothesis is that these loci might confer improved resistance through improved drought tolerance. Therefore, the aim of this study is comparing gene expression responses during infection in isogenic plants differing for presence or absence for one of three resistance loci with known responses which provide drought tolerance. Global differential gene expression and gene ontology enrichment analyses were performed on previously produced transcriptomic data comparing resistant versus susceptible near isogenic lines in barley and wheat. Results from this analysis suggest several gene functions related to drought stress were enriched in both resistant and susceptible isolines. In a targeted, complementary approach, expression patterns for a subset of genes with known drought tolerance function were observed to test if they were induced more highly in resistant compared to susceptible lines. Drought tolerance related genes were found to be more highly expressed in the resistant wheat line carrying the 3B locus while in barley these genes were more highly expressed in the susceptible isolines lacking the 4H and 1H resistance loci. These results provide preliminary indication that resistance provided by the 3B resistance locus in wheat may be mediated through drought tolerance mechanisms whereas this may not be the case for the barley resistance genes tested. Further study into how the 3B resistance locus interacts with drought tolerance mechanisms will help shed light on the relationship between Fusarium crown rot and drought stress and guide future breeding approaches.

Impact of Rootstock on early growth in macademia

Name: Yiyang Xiao
Supervisor/s: Dr Craig Hardner

Abstract: Unavailable

Assessing pathogenicity of *Fusarium oxysporum* on watermelon

Name: Yang Ang
Supervisor/s: Professor Elizabeth Aitken, Dr Jay Anderson

Abstract: Fusarium wilt of watermelon, caused by *Fusarium oxysporum f. sp. niveum*, is one of the most pervasive soilborne pathogens all over the world. There are considerable impacts of Fusarium wilt on watermelon production annually and great economic losses are caused in many countries. Pathogenic isolates of *Fusarium oxysporum f. sp. niveum* can generate effectors called *Secreted In Xylem*, which can be detected in the xylem sap of host. It has been confirmed that *Secreted In Xylem* genes play an essential role in *Fusarium oxysporum f. sp. niveum*. Therefore, the hypothesis that there are correlations between the *Secreted In Xylem* genes of isolates of *Fusarium oxysporum f. sp. niveum* and different watermelon varieties has been tested in this paper. The root dipping method has been used to inoculate five unknown Fusarium fungi on cultivars Sugar Baby, Charleston Gray and SP-6. After 3 to 4 weeks, the symptoms of plants were assessed and tissues were cultured to confirm the presence of *Fusarium oxysporum f. sp. niveum* by Koch's postulates. Based on the differences in virulence, these five isolates were categorised into race 0, 1, 2 and 3. The results could be beneficial to study the profile of the *Secreted In Xylem* genes in watermelon-infecting strains.

Analysis of SIX gene expression of endophytic *Fusarium oxysporum*

Name: Shubhdeep Kaur
Supervisor/s: Professor Elizabeth Aitken

Abstract: Fusarium wilt is the most devastating disease of banana caused by the fungal pathogen *Fusarium oxysporum*. Secreted in Xylem (SIX) genes present in the *F. oxysporum* genome have been associated with the pathogenicity. The differences in SIX gene profile between different host specific forms of *F.oxysporum* allows SIX genes to be useful targets for molecular diagnostics. However, *F. oxysporum* can also be endophytic, where it is found in plants without causing disease. These endophytic strains may possess SIX genes. This project is looking at two main aims; firstly to identify the strains of endophytic *F. oxysporum* that possess SIX genes and secondly to look at the SIX gene expression of endophytic *Fusarium oxysporum in planta* and comparing that with the SIX gene expression of pathogenic *F. oxysporum*. Endophytic *F. oxysporum* obtained by culturing asymptomatic banana plant tissue onto nutrient media was grown on potato dextrose broth (PDB). Standardised spore suspensions were prepared for these endophytic isolates, as well as for a known pathogenic strain of *F. oxysporum*, from the PDB cultures. Glasshouse grown banana plants (3-months post tissue culture) of cultivar Williams Cavendish were inoculated by dipping roots in the spore suspension of each isolate; additionally a set of plants with no *F. oxysporum* treatment were used as negative controls. Fourteen days after inoculation the plants were harvested and RNA extracted from the roots. There were six plants for each treatment group: five endophytic and one pathogenic *F.oxysporum* and negative control. The expression *in planta* will provide indication whether SIX gene expression is relevant for host colonisation even in endophytic interactions. Studies are ongoing using RT-PCR to determine such. This will further help in understanding what mechanisms are important in plant-pathogen interactions and potentially assist in controlling the threat to banana industry by such a devastating disease of Fusarium wilt.

Characterisation of a series of endophytic *Fusarium* species on Banana plants

Name: Zhendong Liu
Supervisor/s: Professor Elizabeth Aitken, Dr Jay Anderson

Abstract: *Fusarium oxysporum* is a species of Ascomycete fungi which is pathogenic to a wide range of plant hosts. However, different *formae speciales* of *Fusarium oxysporum* can only parasitise particular plants. The host range of the different special forms is related to the presence of different Secreted in xylem genes. *Fusarium oxysporum* and other *Fusarium* species can also colonise plants endophytically. Fungi that have been isolated from plants and cause no obvious disease symptoms are recognised as endophytes. However, whether they have any influences on the plant is still unknown. This research utilised root dipping method to inoculate a series of *Fusarium* fungi on William banana plants and observed how the plants' growth. Control groups included plants inoculated with water only and those inoculated with the banana specific pathogen *Fusarium oxysporum forma specialis cubense*. The aim was to determine how selected endophytic *Fusarium* isolates will influence plants and provide a general hypothesis of their physiological effects. At last, the fungi will be re-isolated from the plants and their DNA will be tested with Secreted in xylem primers to verify the Koch's postulates.

The role of *SIX7* gene in *Fusarium oxysporum* f.sp. *cubense* subtropical race 4 for virulence towards Cavendish banana

Name: Xiangyu Ni
Supervisor/s: Professor Elizabeth Aitken, Dr Andrew Chen, Dr Donald Gardiner

Abstract: *Fusarium oxysporum* species are fungal pathogens that cause wilt disease on many essential crops. *F. oxysporum* isolates are grouped into formae speciales (f. sp.) according to the specificity of hosts. *Fusarium oxysporum* f. sp. *cubense* (Foc) is the pathogen causing banana wilt disease and divided into four races based on the specificity of host cultivars. Isolates within Foc race 4 is further classified into 'tropical race 4' (TR4) and 'subtropical race 4' (STR4) groups. TR4 causes disease on Cavendish in tropical conditions, whereas STR4 cause disease in subtropical conditions. Pathogens deliver effectors to modulate plant's immunity system and facilitate establishment. The Secreted In Xylem (SIX) proteins are effectors realised by *F. oxysporum*. Of the 15 *SIX* genes confirmed in *F. oxysporum* formae speciales, 9 *SIX* genes have been detected in the genome of Foc TR4 and Foc STR4. Among these *SIX* genes, *SIX7* is only detected in Foc STR4, not identified in Foc TR4. It is hypothesised that the different virulence of Foc TR4 and Foc STR4 relates to the secretion of *SIX7* effector protein. This experiment is aimed to investigate the role of *SIX7* gene in the virulence of STR4 by analysing the *SIX7* knockout mutant. Limited work has focused on the full genome sequencing of Foc STR4. Alignment of amino acid sequences showed that Foc STR4 *SIX7* shows 90 % identities with that of *F. oxysporum* f. sp. *lycopersici* (Fol). The sequences of two-section untranslated regions (UTRs) of Foc *SIX7* were obtained by PCR amplification of 57 pairs of primers designed on that of Fol. The knockout vector is designed on the vector *PZPnat1* with nourseothricin acetyltransferase and aminoglycoside phosphotransferase as two selection markers. The *SIX7* knockout mutant will be obtained by agrobacterium-mediated transformation and be screened with diagnostic primers. This experiment is currently focusing on the construction of the knockout vector. After identification of successful *SIX7* knockout, the Foc STR4 mutant will be inoculated on the banana plantlet. This study will provide some clues and tools for further research on the mechanism of *SIX7* gene in regulating virulence of Foc STR4. The *SIX7* knockout mutant can be further labelled by fluorescent proteins to study the role of *SIX7* gene in plant-fungus interactions.

Impact of low and high temperature on the physiological characteristics and yield of rice under aerobic conditions

Name: Yongshen Wu
Supervisor/s: Dr Jaquie Mitchell

Abstract: Rice is susceptible to extreme temperatures during the young microspore stage and flowering stages. Both low (<17°C) and high (>35°C) temperatures may result in increased spikelet sterility and hence reduce the rice grain yield. Furthermore, rice grown under aerobic conditions tends to exacerbate spikelet sterility compared to permanent water, however limited research has been conducted examining the physiological response of genotypes under such conditions. The hypothesis of the project was that genotypes that were tolerant to low-temperature conditions were also tolerant to high-temperature conditions and are able to maintain transpiration during low- temperature exposure. To address this hypothesis, four objectives were examined: 1. the genotypic response to high temperature stress at heading stage and whether spikelet sterility was exacerbated; 2. whether genotypic differences in transpiration existed in warm and low- temperature conditions and determine the physiological basis for this (biomass); 3. whether the low-temperature tolerant genotypes maintained high transpiration compared with sensitive genotypes when exposed to low temperature during young microspore stage; 4. whether those low temperature tolerant genotypes were also tolerant to high-temperature under aerobic conditions. This study utilised four experiments conducted under controlled temperature glasshouse conditions to explore the relationship between temperature and physiological traits of 6 genotypes grown under aerobic conditions.

The average spikelet sterility of 6 genotypes was 48.6%, 16.1% and 7.5% when exposed to low- temperature at YMS and high-temperature at flowering compared to ideal-temperature, respectively. Significant genotypic differences existed for spikelet sterility in each temperature regime. YUA15=V037 produced low sterility (22.4%) at YMS, but relatively high sterility under high temperature at flowering (33.4%). 2MML-2171 was identified as relatively stable across temperature treatments.

Daily water use ranged from 39.5 – 77.7 ml/day differing significantly among genotypes in low- temperature treatment and was on average 48% lower than under warm conditions (114.7ml/day). Average daily water use was significantly associated with above ground biomass in the (warm $r=0.83^{**}$) and low-temperature ($r=0.75^*$). Average daily water use was positively related to SS% ($r=0.83^{**}$) in low-temperature and the change in biomass from YMS to in low-temperature ($r=0.79^*$) and warm ($r=0.87^{**}$). Furthermore, spikelet sterility was positively associated with leaf conductance in low temperature ($r=0.81^{**}$). In summary, 2MML-2171 was the tolerant genotype for both low- and high-temperature stresses and high daily water use was associated with biomass and change in biomass. In addition, the delay of heading of some genotypes may help them escaped from low- temperature stress. The limitation of this experiment was that underground biomass and leaf area when harvest were not recorded and require further experiment to confirm the relationship between biomass and low-temperature tolerance.

Root angle and early vigour in rice plants under aerobic conditions

Name: Xiaolu Zhang
Supervisor/s: Dr Jaquie Mitchell, Professor Shu Fukai

Abstract: Producing more rice with less water is a challenge for rice producers in Australia. Aerobic rice culture is a promising water-saving technology provided aerobic adapted varieties can be developed. Early vigour is considered to be one of the key characteristics that determine the successful establishment of crops under direct sowing. Furthermore, deep roots are important characteristics of improving drought resistance and minimising drought, while narrow root angles can lead to deeper roots and higher branching in depth under non-flooded conditions. However, the value of these root morphology and early vigour traits has not been explored for a temperate aerobic environment. The aim of this research was to identify genotypic variation for root angle and early vigour of 282 genotypes of Sherpa/IRAT109. Two experiments were conducted in a glasshouse using the clear pot method. A preliminary pilot experiment was conducted in February to compare root angles and early vigour traits of 12 selected genotypes, which showed genotypic variations in 9 agronomic traits and proved that the clear pot method was an appropriate protocol to utilise for the evaluation of genetic variation of 282 genotypes of Sherpa/IRAT109 in the second experiment. Significant genotypic difference existed for all the traits examined. Heritability was relatively high and ranged from 0.61 for plant height, 0.59 for early vigour and 0.58 for plant biomass, to lower heritability for leaf elongation rate (0.26) and root angle (0.39). Root angle was negatively correlated to early vigour, 3rd leaf breadth, tiller number, days to emergence and biomass, which indicated that rice genotypes with narrow root angle have greater early vigour and wider leaf breadth. Root angle was positively correlated to leaf elongation rate, plant height, leaf number and root number. Early vigour was positively correlated to biomass and the relation between them is significant directly. Seed weight was positively correlated to root angle, as well as to early vigour. The research identified 5 genotypes (602623, 602572, 602550, 602511 and 602553) that had a narrow root angle and high early vigour. Further research on these genotypes needs to be conducted in the field to determine whether these narrow root angle and early vigour genotypes are deep rooting and whether this contributes to the maintenance of high yield potential under aerobic conditions. Furthermore, the information can be utilised and explored further by the rice-breeding program to develop a variety that has adaptation to aerobic production systems in Australia.

Genotypic variation and relationships among morphological traits contributing to maintenance of rice yield exposed to abiotic stress

Name: Orita Faleatua
Supervisor/s: Dr Jaquie Mitchell

Abstract: Rice is traditionally grown in flooded and subtropical environments. The issue of water scarcity in Australia hinders the production of rice and aerobic production has been suggested to provide a water-saving opportunity. Two glasshouse experiments are underway to investigate the early vigour (leaf area development) and root cone angle (root system) attributes of diverse rice genotypes under both ideal and low temperatures regimes. The objective was to identify the most and least vigorous genotype(s) under low temperatures in an aerobic system. The experiments are yet to be completed but results so far have demonstrated genetic variation exists for root cone angle, visual early scores and leaf elongation rate. Indicates genetic variation in both root angle and early vigour. Under ideal conditions, cone root angle ranged from 63o – 116o with genotypes IRAT109, LANGI and YDP14=V044 demonstrating the narrowest angles. The advantage of narrow angle encourages deeper growth depth to access underground water banks. Genotype MML-2257 demonstrated the highest visual scores and leaf elongation rate. Genotype MML-2219 showed the smallest reduction in LER after exposure to cold temperatures which suggest they are cold tolerant. Cold tolerance genotypes can improve the development of rice under low temperatures and improve yield. The trait information can be utilised by rice breeders to develop genotypes more adapted to grow in aerobic conditions to help utilise Australian rice production.

Physiological mechanisms contributing to low-temperature tolerance under aerobic conditions

Name: Rui Yan
Supervisor/s: Dr Jaquie Mitchell, Professor Shu Fukai

Abstract: Low-temperature stress at the young microscope stage in rice (*Oryza sativa* L.) leads to a high percentage of spikelet sterility and reductions in grain yield. Genotypic differences exist for low temperature stress which can be exploited to improve rice yield stability in a temperate aerobic production environment. However, it remains unclear what physiological mechanisms contribute to low-temperature tolerance under aerobic system. One hypothesis tested was whether genotypic differences in leaf transpiration exist under low temperature and if so whether maintenance of transpiration was associated with low temperature tolerance. Experimentation is underway, to investigate the performance of 19 genotypes grown under aerobic system in two controlled temperature experiments to explore the mechanisms associated with low temperature tolerance.

The average of leaf elongation rate (LER) was reduced from 4.25 cm/day under ideal temperature to 1.77 cm/day under low temperature. Genotypes susceptible to low temperature tended to have lower LER such as 2174 and Tachiminori at 1.20–1.40 cm/day compared to tolerant Lijianghegu (2.38 cm/day) and Sherpa (2.33 cm/day). Under low temperature the average of daily water use ranged from 51.25 ml per day (2179) to 137.68 ml per day (2122) and was 30% lower than under ideal temperature conditions (ranged from 61.90 ml to 188.75 ml per day). Except M205 and Sherpa, the reduction of daily water use of low temperature tolerant (ranged from 93.26 ml to 59.64 ml per day) was significantly higher than other genotypes ($p < 0.05$).

Thus, low temperature had an impact on rice transpiration and LER. All genotypes had reduced growth under low temperature stress, however, genotypes that have previously been identified as low temperature tolerant genotypes had higher LER and consumed significantly less water under low temperature stress. The experiments are still ongoing, but preliminary results have demonstrated that low temperature tolerant genotypes use more water than the susceptible genotypes when exposed to low temperature under aerobic system. Further research to examine the relationship between transpiration and floral traits in relation to low-temperature aerobic conditions is required.

Management of invasive Navua sedge (*Cyperus aromaticus*) using competition and simulated herbivory interactions of Humidicola grass (*Brachiaria humidicola*) and Rhodes grass (*Chloris gayana*)

Name: Abhishek Soni
Supervisor/s: Dr Shane Campbell, Dr Dhileepan Kunjithapatham

Abstract: Interspecific competition represents a noteworthy role in managing invasive weeds. Interactions of simulated herbivory under different densities can alter the outcome of the competition effect. Therefore, such studies can help in acclimatising a better management plan for invasive weeds. Navua sedge has been a growing concern for Pacific tropical areas including North Queensland where it has evaded into pastures, cane farms, bushwalks. Navua sedge is highly competitive which throttles pasture species by establishing monospecific strands within a short period. It affects the pasture carrying capacity and beef industry of the region. Weed is now controlled by spraying Glyphosate, Paraquat, Halosulfuron etc. which are, however, not reassuring measures because tiny seeds produced by older strands of weed remain dormant and intact from herbicides below the surface. Whereas, underground rhizomes also escape from chemicals and keep reproducing new plants asexually. Earlier research denoted competition from Humidicola grass effective in weed seed reduction. Considering Rhodes grass's biomass generation and resistance to grazing, it was hypothesised to be more competitive against Navua sedge than Humidicola grass. In a glasshouse experiment, both pasture species were intercropped with weed in pots using replacement series model of five ratios 0%, 25%, 50%, 75%, 100% in two different densities of 16 plants/pot and 4 plants/pot with simulated herbivory and non-herbivory treatments. Growth parameters as dry root and shoot biomass, maximum root and shoot length, tillers, crown diameter, number of flowers were recorded. Rhodes grass was more competitive than Humidicola grass in both grazed and non-grazed high densities. Rhodes grass recovered quickly after herbivory and produced more biomass than Humidicola grass. The highest weed biomass reduction was observed under non-herbivory and high-density conditions when intercropped with Rhodes grass. However, herbivory reduced the competition effect and an early and intense flowering was observed in weed. This may be linked to exudates secreted from grassroots having potential growth-enhancing effects. Since the weed has established densely in some areas, therefore, seed interactions and relative cropping should also be verified for further authentication of competition effect.

Isolation and characterisation of the core bacterial taxa associated with banana

Name: Chengxi Huang
Supervisor/s: Dr Paul Dennis

Abstract: Banana is an economically important fruit crop around the world. The microbiome of the banana is an essential factor of its overall health. The purpose of this project is to isolate and characterise some common banana bacterial endophytes, as well as investigate its interaction with various *Fusarium oxysporium* strains in vitro. The primary isolation of the bacteria was performed at the beginning of the project. Tryptic Soy Broth, MacConkey agar and Yeast mannitol medium were used to cultivate the fast-growing bacteria, the gram-negative lactose fermenting bacteria and the *Rhizobium* species respectively from a single banana plant. The 16s sequencing was used to identify those isolated bacteria. After identification, several bacteria isolates were selected for further characterisation because they are commonly presented in banana microbiome according the previous research of our research team. The bacteria were tested for several characteristics including phosphate solubilisation, ability of biofilm formation and production of IAA. The dual-culture assay was also performed to investigate the interaction between the bacteria and several pathogenic and non-pathogenic *F. oxysporium*. Here are some of my results. From primary isolation, I have isolated some targeted bacterial endophytes including a *Rhizobium* sp., a *Microbacterium* sp., a *Pseudomonas* sp., a *Novosphingobium* sp., and a *Xanthomonas* sp. The results of the phosphate solubilisation assay indicated that *Pseudomonas* sp. has a strong ability to solubilise the phosphorus in the solid medium. The dual-culture assay is close to completion, we speculate some of the banana endophytes will slow the growth of the *F. oxysporium*. Other tests such as biofilm and IAA are yet to complete. After the completion of my research, my successor will conduct a whole-genome sequence on those bacteria I have isolated, which allows us to understand some important functions of them within the banana plants. This project is a part of big research which investigates the banana microbiome. By understanding more about the banana microbiome, new measures can be developed to optimise the nitrogen uptake of the plant and control *F. oxysporium* f.sp. *cubense*.

Use of plant growth promoting Rhizobacteria for the biological control of *Phytophthora capsici* in Snap beans (*Phaseolus vulgaris*)

Name: Shruti Thapa
Supervisor/s: Professor Peer Schenk

Abstract: *Phytophthora capsici* L is soil borne, oomycete causing destructive effect in cucurbits, eggplants, tomatoes and most recently in beans. *P. capsici* in snap beans was observed first in 2013 in Michigan and is seen to cause water-logged lesions on the leaves and stem, blight in the pods, necrosis of branches and leaflets along with gradual decrease in plant growth and productivity. This study is conducted with an aim to understand the growth promoting roles of *Bacillus amyloliquefaciens* (UQ154), *Bacillus velezensis* (UQ156) and *Acinetobacter* spp. (UQ202) and their ability to suppress *P. capsici* in snap beans. To achieve this aim, snap beans are grown in rhizoboxes and treated with the bacterial isolates and then infected with the pathogen. After few weeks of infection, shoot length, root length, fresh weight is assessed to check for growth promoting activities and the antagonist role of bacterial isolates against *P. capsici* along with sporangia and zoospore count is evaluated. Furthermore, to assess pathogen repression, quantitative RT-PCR is carried out on the DNA extracted from the roots of snap beans. The results from measurement of root-shoot length and fresh weight shows slightly more growth promotion in bacterial isolate treated plants than in plants without treatments and the quantitative RT-PCR result will help in pathogen suppression evaluation. This could confirm the role of growth promoting bacteria as biofertiliser and biocontrol agent against this pathogen. Once a plant is infected by *P. capsici*, control is very difficult and time consuming and with chemical fertilisers being very expensive and damaging to environment, hence, studying the roles of these beneficial bacteria could lead to their use as biofertilisers and biocontrol medium to increase plant productivity, become resistant towards the pathogen and solve food crisis in the long run.

Seed bank dynamics of *Avena sterilis* ssp. *ludoviciana* under different tillage systems practices in the north-eastern grain region of Australia

Name: Sijia Xu
Supervisor/s: Professor Stephen Adkins, Dr Mohammad Ali, Dr Alwyn Williams

Abstract: Conventional tillage are widely adopted in the north-eastern grain region (NGR) of Australia to ensure the sustainable agriculture, however, weed issue has been a major problem in conventional tillage applied field, and one of the most prominent winter weeds in the NGR is wild oat (*Avena sterilis* ssp. *ludoviciana*). So far, there is limited study about the effect of different tillage on the growth and population of wild oat in NGR in recent years, this study will help us to understand the seed bank dynamics of wild oat under different tillage systems that are practicing in the NGR, as well as help to identify whether the occasional tillage can help to reduce the population of wild oats. The soil seed bank is measured through the 6-month germination experiment in the trays in the nursery, the growth of different wild oats is studied in the nursery, the growth and population of wild oats with 4 tillage practices (no-tillage (NT), strategic tillage 1 (ST1), strategic tillage 2 (ST2), conventional tillage (CT)) is conducted in the field in the Crop Research Unit in Gatton. In the soil seed bank study, the total number of the species is recorded. In the nursery wild oat growth experiment, the plant height, tiller number, leaf number, biomass and dry matter are recorded. In the field, the plant height, tiller number, leaf number and the growth stage of wheat are recorded. So far, the data show that there are at least 20 weeds found in the experimental plot, and this plot was wild oat-free. In the first 30 days after the wild oat seeds were introduced into the plot, more wild oat seedlings were observed in the CT and ST2 plot. In the next 30 days, the number of wild oats germination decreased, and more seedlings were found in the NT plot. This means tillage before the broadcast of crops is helpful to the germination of weeds and no-tillage can postpone the weeds emergence. More work will be done in the wild oat growth both in the nursery and in the field to demonstrate if tillage can enhance the wild oat growth. This study shows that tillage can help more wild oats to germinate before the emerge of crops and make more seeds to germinate thus reduce the soil seed bank.

Identifying pastural species for local soil types for outcompeting and suppressing Fireweed

Name: Zhetian Zhang
Supervisor/s: Professor Stephen Adkins, Mrs Kusinara Wijayabandara

Abstract: Fireweed (*Senecio madagascariensis*) is one of the national significant weeds in Australia which causes chronic liver damage on livestock, such as horses. This specific toxic chemical is called Pyrrolizidine alkaloids (PA), which gives rise to animal death and low dairy product quality. Fireweed (*S. madagascariensis*) has widely spread in eastern pasture lands of Australia. Thus, it is essential to reduce the population of Fireweed (*S. madagascariensis*) and decline the losses. To achieve this objective, this article aims to figure out a pasture grass species to suppress Fireweed (*S. madagascariensis*) in the Fireweed growing season. Kikuyu grass (*Pennisetum clandestinum*), Couch grass (*Cynodon dactylon*), and Rhodes grass (*Chloris gayana*) are chosen. Seeds filled rate test with X-ray, germination test in incubators, and pot suppression experiment in glasshouse are applied during this experiment. By sowing different pasture grasses with Fireweed in pots separately under 10 different ratio, plants compete and suppress each other. After two months, by measuring the height of shootings, roots, fresh weight, dry weight, and the number of branches, the most competitive plant could be confirmed. For seed-filled rate, Kikuyu grass and Couch grass are fully filled, followed by Fireweed and Rhodes grass which are 96% and 54% respectively. In terms of the germination test, Fireweed and Kikuyu grass both exceed 80% germination rate, which are 87% and 82% respectively. While Rhodes grass is 52%, at the middle of the list. And Couch grass is 10% has the lowest germination rate. The main part experiment is still ongoing, Kikuyu grass and Rhodes grass are two potential competitive grass on prediction based on literature and observation. Once the competitive grass is confirmed, it could be tested in real fields. And if the species is still worked, farmers can suppress Fireweed by growing the species directly without any other applications. It can fulfill the fodder demand and reduce the damage from Fireweed at the same time.

Testing alternative host opuntia species as a potential target for biocontrol agents (*Dactylopius* sp.) previously established in Queensland

Name: . Shamli
Supervisor/s: Professor Stephen Adkins, Michael Day, Tamara Taylor

Abstract: Various Cactus species were introduced in to Australia in the late 1700's, for commercial use. Later on, other species were also introduced to Australia, both as a commercial and as ornamental plants. Since then, many cactus species have become environmental weeds by forming dense thickets, which affect both the economy and environment adversely. Consequently, 27 species of cacti have now been declared as invasive weed species in Australia. Cactus biocontrol has been in progress since the 1920s and has resulted in the release of several biocontrol agents targeting many of these weedy cactus species. However, there are still further cactus species present in Australia that have not been targeted for biocontrol, and among these there are some major threats to Australia. In this study we aim to test the existing *Dactylopius* biocontrol agents; cochineal (*Dactylopius ceylonicus* Costa 1835), which is currently used in Queensland as a biocontrol agent for cochineal prickly pear (*Opuntia monacantha* Haw.). In no choice host tests, the development of *D. ceylonicus* was tested on cladodes of various invasive cactus species [viz bunny ears (*Opuntia microdasys* (Lehm.) Pfeiff.), blind cactus (*O. rufida* (Engelmann.), Wheel cactus (*O. robusta* (J.C wendl.) Pfeiff.) and blind prickly pears (*O. puberula* (Hort.) Pfeiff.)] and was compared to that achieved on *O. monacantha*, the present target host for *D. ceylonicus*. , Although, previously released biocontrol agents released to control *Opuntia* have been successful, there has not been a dedicated study to determine if any of these released agents will attack any of the other invasive cactus species not previously targeted for biocontrol. This project aimed to test *D. ceylonicus*, the present biological control agent for *Opuntia stricta* and *O. tomentosa*, on the four alternative cacti species. In addition, several other species of Opuntoid cactus that are invasive in other Australian States will be tested for host suitability. This will allow an assessment of whether the currently released Queensland biological agent *D. ceylonicus* will be effective in preventing incursions of invasive *Opuntia* species in the future, and provide information to other States about the present bio control agent.

Fur seal and sea lion vulnerability and resilience to climate change

Name: Azalia Renee Rodriguez
Supervisor/s: Dr Nathalie Butt, Dr William Ellis

Abstract: The aim of this study is to understand how fur seal and sea lion (Otariidae) species' future distributions and populations will be affected by climate change, considering both intrinsic species' life history traits and extrinsic environmental threats. Both fur seals and sea lions are sentinels of the marine environment: birth, mortality, and growth rate are linked to oceanographic changes. All Otariidae species categorised as 'vulnerable' and 'endangered' on the IUCN Red List are decreasing in population size. The purpose of this study is to identify Otariidae trait-based vulnerabilities and resiliences to climate change, to inform and develop effective conservation plans. Using RedList data, life-history traits and environmental threats for 20 Otariidae species were collated in a database. I compared across species, ranked threats and assessed vulnerability for each species according to traits relating to reproduction (including body size and generation time), spatial distribution and dispersal (geographical ranges), and habitat niche (food source requirements). I also evaluated climate threats relating to sea surface temperature, sea level rise, ocean acidification, increased ambient temperature, storms/upwellings escalation, and prey distribution. I used Maxent, a species modelling software, to model current distributions and create a 2050 prediction of species distribution, based on observed current distribution and environmental threats. I then used ArcGIS to compile geographic data and distribution maps. Climate change is projected to cause shifts in Otariidae species' ranges; however, while the most common climate change threat to impact Otariidae is an increase in storm intensity, it is unclear if this will be the biggest environmental threat for these species. Overall, the most vulnerable species to climate change are the Galapagos fur seal and Galapagos sea lion, as they are at risk due to lack of suitable nesting area during the intensification of upwellings/storms, temperature sensitivity, and food reductions. The most resilient species, due to a combination of lower climate change exposure and traits such as lower body mass, shorter generation time, vast occupancy range, and increasing numbers in population, is the New Zealand fur seal. In terms of how conservation management can best mitigate impacts for the species most at risk, actions should include increased protected areas to maintain species representation and ensure adequate food supply, as well as the implementation of no take zones and sanctuary areas to protect species from storm impacts. Further biological conservation research is recommended to observe how successful trait-based management plans are for Otariidae species.

Towards the circular nutrient economy – recycling nutrients from wastes as next-generation fertilisers

Name: Michael Walsh
Supervisor/s: Professor Susanne Schmidt

Abstract: An increase in global food demand has led to a relative escalation in farming and phosphorus fertilisation. Conventional phosphorus is sourced from our rapidly declining global reserves of rock phosphate. Due to the large significance and implications of phosphorus in agriculture, humanity is facing four immediate threats: 1) Global food security and sovereignty, 2) Geographical monopolisation of phosphorus, 3) Depleting phosphorus reserves, and 4) Environmental degradation. Phosphorus frequently leeches into surrounding water bodies which is of great detriment to aquatic environments. Furthermore, the rapidly depreciating effectiveness of conventional phosphorus fertilisers causes excessive fertilisation practises and large reservoirs of impotent phosphorus within soils. The introduction of waste derived fertilisers ‘P-recycllets’ is an environmentally friendly alternative from the global dependency on rock phosphate. P-recycllets (hazenite, struvite, and “AshDec”) generated from sewage ash could become a sustainable, environmentally friendly, and phosphorus-rich substitute. Investigation into the fundamental processes involved on the application of P-recycllets within an agriculture setting is being explored to further understand its efficacy as a fertiliser. Growth responses of pre-screened phosphorus solubilising bacteria was used to measure the availability of phosphorus in materials. Bacteria, P-recycllets, and other soil-residing-phosphorus (phytate, superphosphate, and calcium phosphate) were respectively grown on a medium absent of other phosphorus. Bacteria with greater growth responses were cross referenced with their respective organic acid production. Q-TOF-MS analysis was used to identify and quantify organic acids which may contribute to P-recycllet solubilisation. Molybdenum-blue assay was conducted to identify the rate of phosphorus solubilisation relative to the key aforementioned organic acids. Furthermore, the growth relationship between pelletised AshDec and spinach (*Spinacia oleracea*) in the presence of bacteria was investigated.

Notes

Careers and employability

Prepare for employment

Your final years of study are a time to start thinking about next steps. Prepare to start your career, build networks and translate your skills into practice.

Whether you are seeking volunteer positions, internships, or industry and graduate opportunities, services and resources are available to assist you in your job searching journey.

Having strong job searching, networking and application writing skills will give you the best chance to demonstrate to prospective employers you are a noteworthy applicant.

Visit the UQ Employability website and find free online employment services for both local and international UQ students.

We provide you with a variety of opportunities and tools including:

- Communicating your employability
- Your application
- Search for a job
- Industry connections
- Interview tips
- Be an entrepreneur

Access online resources or attend workshops and events to help you prepare for the next step:

employability.uq.edu.au/