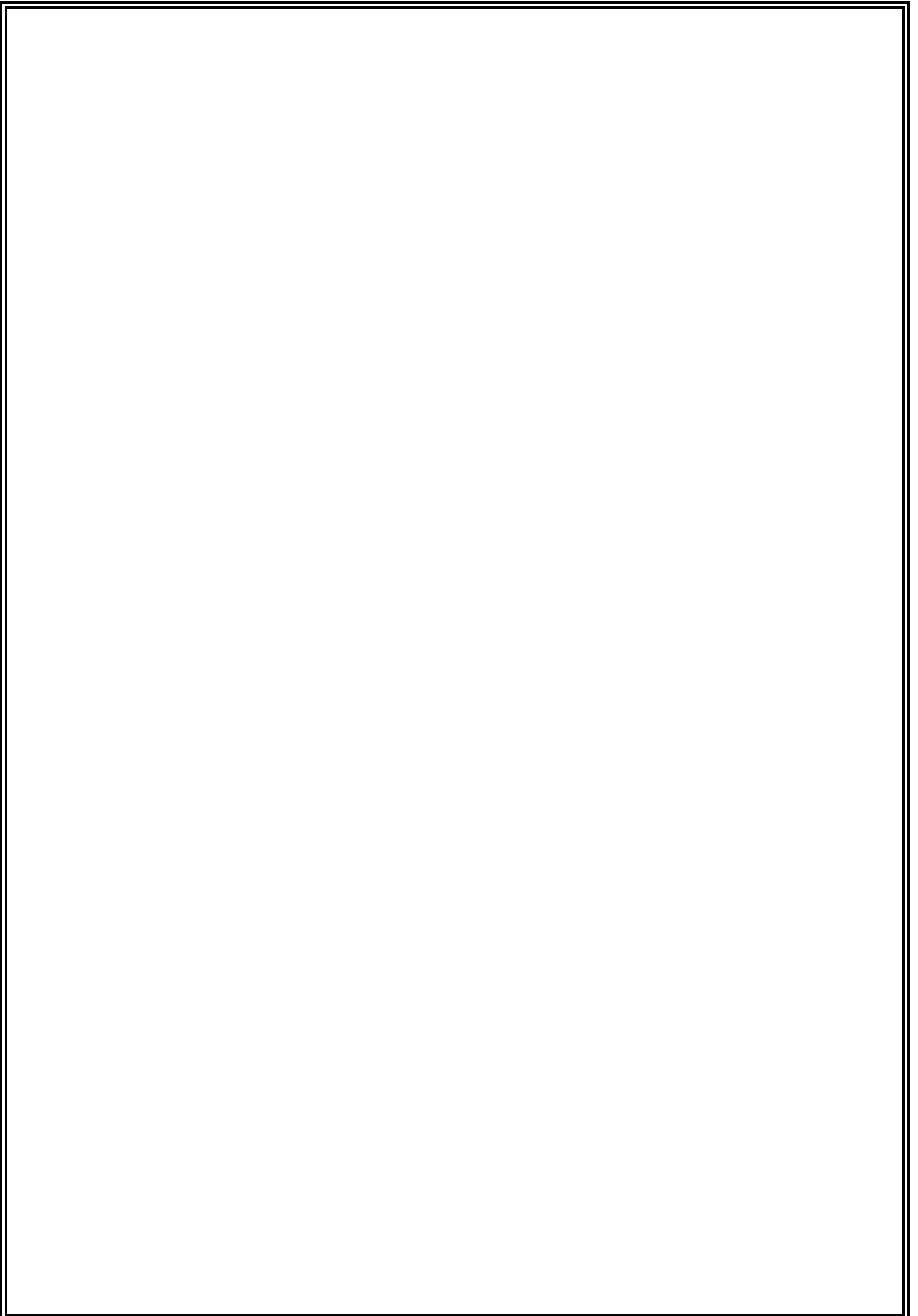


RUSC490

**Honours
Projects**

2011



Introduction

All students wishing to be considered for award of the BRurSc or BLivSc with Honours must undertake and complete this unit in their final year of candidature. The award of Honours is based on the student's performance in the second, third and fourth years of candidature including the thesis.

Potential topics are listed after this introduction, many of which have scholarships attached. Please don't select a topic simply because a scholarship is attached to it, it is essential you select a topic that is of INTEREST to you. There is considerable risk associated with choosing something for financial reasons, as motivation to complete is critical in what is essentially a self-driven course and unit. In many instances, even those topics that are not listed as directly offering scholarships may be able to provide one upon request – so ensure you seek a topic that is of interest to you!

Learning outcomes:

By the end of this unit students have developed:

- ❖ • expertise and increased knowledge in a given field
- ❖ • ability to conceive, conduct and report original research
- ❖ • ability to correctly review and reference scientific material
- ❖ • ability to critically assess own and other scientific work
- ❖ • ability to communicate findings in professional manner and in accordance with national and international standards

Assessment

RUSC 490 is assessed on the basis of two marks. The first mark, worth 80% of the final mark, is based solely on the submitted Honours thesis. Two examiners, one of whom is the supervisor of the project, independently assess the thesis using the marking criteria set out below. If the grades vary too greatly and the two examiners can't agree on a final mark, it is referred to a third examiner. The Unit coordinator asks the supervisor for advice in selecting examiners and sends out theses (bound copies) for examination, with advice on the nature of the thesis and the grading scale.

The second mark, worth 20% of the final mark, is based on a seminar undertaken in the fourth term and assessed by both peers and academics in a public forum. The principal supervisors (or their nominee) of the presenting Honours students for that year, will be required to attend and grade seminars. All Honours students will be part of the Panel, and peer-assessment will make up 40% of the final Symposium grade. Each seminar will be presented in an allocated 20 minute time slot (15 minute presentation + 5 minutes for questions). Attendance at Symposia presentations is compulsory. For those unable, (for significant reasons), to complete the presentation at the designated time, slots can be made available within the standard Rural Science Seminar sessions on Wednesdays at 1pm.

Enrolment

Students are required to be accepted by a member of academic staff for approval of the project topic and supervision. You are not able to enroll directly until after the Unit Co-ordinator has confirmed your supervisor and topic and sent an email to Student Admin confirming this. Supervisors will be available to discuss the work and provide as much guidance as necessary on the presentation of the material. It is the responsibility of the student to maintain contact with his/her supervisor.

Students are to send an email to the RUSC490 Unit Co-ordinator indicating they have located a supervisor/s and project topic. The email needs to be copied to the potential supervisor who also needs to reply that he has been approached and is willing and available to supervise the project.

Critical dates

- 1) Students are to deliver an informal 3 minute introduction seminar early in the semester.
- 2) **JUNE 3, 2011** - RUSC490 students will deliver a completed first draft of their literature review to their supervisor, and if not completed 5% will be deducted from their final thesis grade. The literature review is to be submitted directly to the supervisor who will endeavor to provide feedback within 2 weeks. The review is ALSO to be copied by email to the RUSC490 Co-ordinator to determine completion. The literature review is not assessable at this stage.
- 3) **OCTOBER 10 2011** – Seminar presentations commence on Monday at 1pm for 4 hours. This is worth 20% of RUSC490 final grade as indicated in the assessment section.
- 4) **OCTOBER 28 2011** - the student will submit two soft bound copies of their thesis and a CD containing all data (and a PDF of the Thesis) to the Administrative Assistant in Agronomy and Soil Science. Both copies will be returned by the examiner's without being written upon; one to be given to the supervisor and a second to be stored in the School library. Corrections to the thesis are not required following examination.

There is a sliding scale of penalties for late submission of Theses. The scale is 5% for every increment of 4 days late up to 12 days and 30% thereafter. Honours is like any other unit and will be graded accordingly from HD through N. A failure (N) can be given not only for a poor standard of work but also if the report is not submitted within one month of the due date. Re-enrolment in the Project requires a new topic for investigation and report. Students who believe that they have a valid reason to explain late submission of project reports should prepare, in consultation with their supervisor(s), a substantial case in writing for consideration by the School TLC. If extension of time is granted, a grade of SET is given to the student. In such circumstances, the thesis must be submitted before 30 January in the following year.

Calculation of Honours grades

Final honours grade is calculated by the Unit coordinator. In 2010 the following protocol in RUSC490 will be used. Weighting is based on years and units according to the level that they are taught.

BRURSC					
% weighting	10%	15%	20%	20%	35%
Unit cluster	2 nd yr core	3 rd yr core	Electives	AGSY410, AGEX310	Project

BLISC				
% weighting	10%	30%	25%	35%
Unit cluster	2 nd yr core	3 rd and 4 th yr core	3 rd and 4 th yr elective	Project

The point scoring system awarded to each grade is set out below:

Grade	Point	Total Point Score
N	-3	
P	0	
C	1	100
D	2	200
HD	3	300

To increase sensitivity for the thesis point score, ½ points will be attributed e.g. 2.5 for > 81 but < 85. Each unit grade is awarded a point, these are added per unit cluster multiplied by % weighting and divided by number of units in cluster, for example (3rd year core RUSC):

ECON22	AGRO31	AGRO32	ANUT22	ANPR32	SOIL31	GENE35	ENVE33	TOTA
3	1	1	1	1	0	1	5	L
3	2	2	1	2	2	1	1	14

The 14 points are then multiplied by 15 (weighting %) and divided by 8 (units) to give 26.3 points. Honours grades are based on a combination of total coursework and thesis point score as follows:

Honours	Coursework and thesis total point score
Pass	<150
2b	150-174
2a	175-199
1	200-240
UM	>240

Only coursework units completed at UNE will be considered for Honours grading.

Thesis presentation

The thesis style and presentation should be as follows:

Typed, A4 paper, one side only; wide left-hand margin of 2.5-3.0 cm; 1.5 spacing; 12 font

A good thesis is concise, proof-read and consistent with respect to labeling and language. Aim to keep them short, under 10000 words, and reference them according to the CSIRO Journal Style (AJAR) if using Endnote, which you are all encouraged to use! Please consult UNE's *Referencing Guide*-

<http://www.une.edu.au/tlc/students/publications/referencing.pdf> when writing your thesis for correct referencing, formatting, etc.

Theses may not be longer than 14 000 words (excluding References, Appendices, Figures and Tables) and penalties will apply for theses that are longer. A penalty of 5% of thesis grade for every 2000 words over the limit will be enforced. To give you some idea of the importance of each aspect of the thesis, the following scheme will be used as a guideline for the marking of your thesis.

MARKING SCHEME FOR HONOURS THESIS

1. Literature Review - scientific content (~6000 words)

- Correctness of citing references
- Critical assessment of literature cited
- Adequacy of coverage of literature
- Incorporation of suggestions for future work
- Presentation/writing style/overall organization

2. Materials and Methods - appropriate to task able to be followed by others

- Suitable controls
- Sufficient replicates
- Appendices

3. Experimentation - appropriate strategies/experimental designs

- Logical sequence
- Presentation of results
- Suggestions of next step

4. Results/Discussion/Conclusion - observations of all results

- Interpretation of results
- Discussion of results
- Connecting results obtained in different sections
- Relating student's results to published work

5. Presentation - logical presentation

- Presentation of results (figures, tables)
- Writing style

Animal Science Projects

Supervisor: Professor Geoff Hinch

Dairy Production - possible topics on nutritional management and milk production in collaboration with NSW DPI

Supervisor: Geoff Hinch

Maternal behaviour differences in Merino and Crossbred ewes (Sheep CRC project)

Considerable resources are being allocated by the Sheep CRC to improving the survival of lambs and weaners in Australia. Poor maternal behaviour is one component of lamb loss and this project would attempt to quantify measurements that could be used for selection for improved maternal behavior.

Creating aversions to reduce cannibalism in laying hens (Poultry CRC project)

This project is presently in process and is looking at whether exposure to aversive substances in early life can be used as a means to reduce pecking in layer hens later on. The project would need to be completed in the latter half of 2009.

Measures of welfare of farm animals using motivation or emotions (collaboration with CSIRO)

Experimentation on use motivation or cognition as a means to determining welfare state of farm animals is presently being conducted at CSIRO Chiswick. There are a number of potential experiments that you could be involved in usually with sheep and cattle.

Improved measures of animal welfare

Assessment of the welfare of livestock involves determining the physiological, behavioural, immunological and emotional status of the animal. The student will work in CSIRO's internationally recognized Animal Welfare Science team to develop improved measures of animal welfare in sheep. The project will provide training in cutting edge research that will underpin the development of new methods for assessing the welfare of livestock.

Measurement of sheltering behavior and paddock use by sheep (collaboration with Assoc Prof David Lamb and Mark Trotter)

We are presently using GPS tracking systems to help define the use of shelter by sheep for shade or shelter from cold. Projects using this technology as a means to further understanding the factors determining utilization of paddocks and how we can manipulate this are open for discussion.

Lamb survival - measures of cold resistance (with CSIRO) Lamb survival - twins and the likelihood of survival

Considerable resources are being allocated by the Sheep CRC to improving the survival of lambs in Australia. We are presently interested in determining if there is genetic variability in lamb survival or causes of lamb loss and if so how we can manage this. Projects to answer this question can be developed around utilizing the Information Nucleus flock at Kirby. This project is possibly best started in 2009 so discuss this earlier rather than later.

Artificial Breeding technologies - possibilities with CSIRO

The group at CSIRO are interested in the interface between molecular biology and reproductive technologies and particularly in the manipulation of gametes. If you are interested in a project in this area I can put you in contact with the relevant people to identify a project

See Geoff for more details on any of these projects. (Note any of the projects associated with CSIRO can often be linked to summer scholarships based at Chiswick. Ask for further details if you are interested.)

Projects with Working Dogs

Supervisor: Wendy Brown (Ext 5125; Email: wbrown@une.edu.au)

Project 1: Simply a case of doggy bad breath – or something more sinister?

Did you know that 80% of dogs over three years of age have some degree of periodontal disease? When was the last time that you checked your dog's teeth? Dog owners do not normally inspect their dogs' teeth, but they do notice when their dog has bad breath (halitosis). In this study, the student will assess oral malodour to determine whether halitosis is an accurate indicator of periodontal disease in dogs.

Project 2: Improving performance in detector dogs.

In collaboration with the Australian Quarantine Inspection Service, there are opportunities to be involved with research aimed at improving performance in detector dogs. Student projects will examine the potential to increase performance through optimal nutrition, evaluate the effect of fitness and exercise regimes on detection ability, or determine the volatile components that distinguish one target odour from another.

Student scholarships available.

Steve Walkden Brown

Is soil a significant reservoir of infectious sheep worm larvae?

Our investigations into the free-living ecology of sheep nematode larvae to date have focussed on larval availability on herbage, although we know that migration of larvae is non-directional and significant numbers are recovered from soil in climate chamber experiments. This project would utilise field and climate chamber studies to identify the proportions of larvae that are found in various soil strata under different environmental conditions. An important aspect of the work will be to determine whether larvae in soil constitute an effective reservoir of infective larvae, or whether they are "lost" from the system if they enter the soil phase.

Drenching failure and refugia.

When sheep are drenched for worms normally, what proportion are effectively drenched? Surprisingly we don't know this and always assume that all animals are treated. This project would measure this, and explore the epidemiological consequences of leaving varying proportions untreated, particularly with regards development of resistance. It would involve using marker methodology to test drenching efficacy under a range of conditions on farm, ideally with operators blinded to the treatment. The consequences of leaving varying proportions of untreated animals would be explored using epidemiological modelling and existing large WEC datasets.

Molecular detection and quantification of poultry viruses in broiler litter and correlation with loss of infectivity following heat treatment of the litter.

This project would take litter samples from a previous experiment in which viral infectivity of litter for chickens before and after heat treatment was measured using a bioassay. This project would involve working up real-time PCR assays for two additional poultry viral pathogens, DNA/RNA extraction from stored litter samples, and attempted measurement of viral load in the extracted DNA/RNA. The ultimate goal is to assist with the development of molecular measurement of poultry viruses in environmental samples such as litter and dust.

Wool, Fibre and Sheep

Supervisor: Emma Doyle

Ph: 02 6773 3094, **email:** edoyle3@une.edu.au

Evaluation of the efficacy of sheep and wool units, mode of delivery and destination of students studying sheep and wool science

The sheep and wool units offered at UNE are the only specialised wool units offered in Australia. UNE is the hub for 10 other Universities to study wool science. The Australian Wool Education Trust have been supporting these units for four years and would like to obtain market research and evaluate the success of the units and how to attract more students. The study will also assess the employment opportunities within the industry.

Skin comfortmeter for knitted wool fabrics

The Sheep CRC have developed an instrument for direct measurement of skin comfort (prickliness) of wool knitted fabrics. The instrument requires calibration with human responses using a 'wearer trial'. The instrument also needs evaluation of skin comfort on a range of fabric samples to support the commercialisation of the comfort instrument.

Co-supervisor: David Crowe at Australian Wool Testing Authority, with possibility to do research and be paid over the Christmas break).

Mechanically Assisted Staple Preparation (MASP).

A prototype staple preparer will become available for testing in December 2010. Trial work would consist of comparing staples prepared from wool tufts by operators with those prepared by the MASP. Previous studies have shown that weak wool is difficult to prepare and this new device has a novel method of overcoming this problem. The prepared staples will be compared by evaluating the measurement performance of the resultant ATLAS (Length & Strength) measurements.

Automatic sampling of 150g subsamples for Yield & Diameter testing.

Prototype machinery has been built to determine the feasibility of automating the sub-sampling of 150g sub-samples for Yield and Diameter testing of greasy wool core samples. Trial work would include comparing weights of sub-samples to confirm that they meet test requirements. Sub-samples would also need to be tested as standard yield and diameter tests are compared with normal preparation procedures.

Automated Measurement of Dark and Coloured Fibres and Vegetable Matter (FibreGEN)

A new device (FibreGEN) has been developed to measure Dark and Coloured Fibres and Vegetable matter in samples of wool top. This project will investigate the potential to use this instrument to measure core samples of Australian Wool. Trial work would include the development of preparation procedures, measurement protocols and comparison with current test methods. Work would also include investigation of alternate fluids for the samples.

A number of Australian Wool Education Trust Honours scholarships will be available for 2011 (\$6,000 each). Applications available at www.woolwise.com close end of November 2010. Consult your supervisor to apply. These will be awarded in any discipline linked to sheep and wool production.

Please contact Emma Doyle for further details.

David Cottle is also available to supervise Honours projects but will only be available to communicate with students by email prior to enrolment as he is on Study Leave at present.

Animal Nutrition

Supervisor: A/Prof. Paul A. Iji (Room 20, Woolshed Building)

Phone: 02 6773 2082; email: piji@une.edu.au

How much litter material do chickens consume?

Broiler chickens are known to consume litter material, which is routinely placed on the floor on which they are raised. The reasons behind this habit are unclear but litter intake is believed to aid the development of the gastrointestinal tract (GIT), particularly the gizzard. It has also not been established how much litter material chicks consume and if consumption varies between litter types. Such knowledge would inform the choice of material that is used for litter, to aid the development of the GIT, and possibly to improve health and productivity. It is our belief that litter consumption by birds can be quantified through an adaptation of methods used to quantify forage selection and intake in ruminant animals as well as through redevelopment of existing techniques in poultry science. The proposed study will set the scene for larger scale studies into a greater understanding of litter preferences by poultry. This project is designed to provide proof-of-concept data for future research. It is not meant to assess the effect of litter on productivity and gut function. The specific objectives will be to quantify litter consumption by broiler chickens, and evaluate reliability of methods that can be used for quantifying litter consumption.

Stimulating the early development of the gut in broiler chickens

There is a current drive towards early feeding of broiler chickens, to enhance subsequent body growth and final body weight. A variety of products and feeding systems are being tested but the mechanisms associated with the response to many of the products are still unknown. An early development of the intestinal function may be one such mechanism. Butyric acid is known to be utilized as a fuel by intestinal cells but it is only recently that products based on this acid have been introduced as supplement for early feeding of chickens. The aim of this project is to examine the effects of such a product on intestinal development, body growth and health of broiler chickens.

Feeding effects on sheep methane production

Supervisors: Roger Hegarty, Darryl Savage, John Goopy

Summary: Two thirds of Australia's agricultural greenhouse gas emissions are released as methane from the gut of ruminant livestock. Methane emissions are typically measured using sheep or cattle fed once daily while in respiration chambers. This feeding pattern is not representative of what occurs in grazing livestock and so it is important to discover how feeding pattern affects daily methane output. A study is required to assess the change in daily methane output associated with feeding frequency and this can be undertaken using the open circuit respiration chambers (5) at UNE.

Title: *Comparative fermentative capacity of divergent herbivores.*

Supervisors: John Goopy, Ian Godwin,

Summary: While numerous microbial studies indicate macropods have few if any methanogens in their sacciform forestomach, there is a dearth of studies in which methane

production (or its absence) has been monitored in live macropods. This study will examine the fermentive capacity of the rumen (sheep), forestomach (macropods) and caecal (Koala) fermenters, with special attention to methane production and the role of tannins in vitro.

Title: *Novel antiprotozoal compounds*

Supervisors: Roger Hegarty, John Goopy and Simon Bird

Elimination of protozoa from the rumen typically increases protein supply to the intestine by 15%. Commercial defaunation (elimination of protozoa) has proved extremely difficult, but a new project is underway to test a suite of potential antiprotozoal compounds. There is opportunity to be part of this initiative & study the biology and control of these rumen anaerobes.

Meat Science Projects

Supervisor: Dr. Geert Geesink (Meat Sci. Building)

Phone: 02 6773 3257; e-mail: geert.geesink@une.edu.au

Enzyme tenderizers for red meat

The possibility to tenderize meat using exogenous enzymes is well known, but difficulties in controlling the extent of tenderization has resulted in limited adoption in the Australian beef industry. This contrasts to the US where meat tenderizing strategies, like enzymatic treatment, is more common for food service products. The current project aims to characterize a range of commercially available tenderizing enzymes. The characterization involves determination of degradation patterns of their protein substrates, tenderizing effect and determination of optimal combinations of enzymes for practical application. The first phase of this project involves experiments on laboratory scale. The second phase involves testing of optimal enzyme combinations under processing conditions.

A mechanistic model for meat tenderness

The Meat Standards Australia (MSA) grading system predicts the eating quality of beef cuts based on a number of carcass characteristics, processing conditions, aging time and cooking options. This grading system is based on large scale consumer testing of factors affecting palatability of beef. However, consumer testing is very costly. Therefore, any refinement of the current grading system, or the uptake of new factors affecting palatability would need a large investment. For one of the main factors affecting palatability of beef, e.g. tenderness, it is known that it is affected by three components: muscle contraction, connective tissue content and amount of tenderization during chilled storage (aging). All of these can be measured objectively in the laboratory at lower costs than consumer testing. The current project aims to develop a mechanistic model to predict meat tenderness which can be used to refine, and add new factors to the current MSA grading system.

Characterization of the effect of gene markers for tenderness

Within the current Beef CRC gene markers for tenderness have been extensively tested for their effect, but the mechanism through which they exert their effect is largely unknown. The gene markers are based on polymorphisms in the genes for enzymes involved in tenderization (calpains) and their inhibitor (calpastatin). The current project aims to purify

these enzymes and their inhibitor from muscle tissue and characterize their activity and interactions in a series of in vitro assays. The person taking on this project will gain experience in a broad range of laboratory techniques including chromatography, electrophoresis, immunological techniques and enzyme assays.

Animal genetics and breeding projects

Inbreeding and inbreeding depression in the Angus breed

Supervisor: Julius van der Werf and David Johnston (AGBU)

Modern breeding programs use across herd genetic evaluation and artificial insemination to enable wide usage of the best sires. However, intensive usage of only a few sires might lead to inbreeding. Inbreeding is undesirable as it leads to a decrease in genetic variation and possibly inbreeding depression. The extent of inbreeding can be derived from the pedigree and inbreeding trends can be plotted. The amount of inbreeding depression can be derived by relating individual inbreeding coefficient to performance data.

Genetic correlations between sexes in Merino sheep (rams and ewes)

Supervisor: Julius van der Werf and Andrew Swan (AGBU)

Selection for wool production traits is usually based on performance evaluation of potential breeding rams. However, the majority of wool is produced by ewes or wethers. This project will investigate whether wool production of rams is based on the same set of genes as wool production of ewes (and wethers). If this is not the case, selection of rams would be more efficient if it was more based on ewe and wether performance, i.e. on relatives of the male selection candidates.

Genomic variation between and within breeds for sheep production traits

Supervisor: Julius van der Werf

This project will use data from the Sheep CRC information nucleus flock. A few thousand animals from one hundred sires are tested every year at different sites across Australia, and sires are from different breeds and breed types. A large number of traits is measured on these animals e.g. weights and scan traits, visual traits, wool traits and meat traits, as well as detailed information about their genomes (using SNP chips). You can analyse some data from this invaluable source allowing you to answer many questions about sheep production traits and get some idea about the underlying architecture of genetic variation. You can also look at genotype by environment interactions and check whether sires rank differently in different environments?

The potential benefit of whole genome selection

Supervisor: Julius van der Werf and Cedric Gondro

Modern molecular technologies provide now the potential to genotype individual animals for a large amount of dense SNP markers. This gives the potential to predict more accurately the breeding value based on more detailed information of the whole genome as inherited

from parents. The potential benefit of whole genome selection can be assessed through modelling and using first results of whole genome scans. Modelling can be at population level, and you can do a cost benefit exercise for an individual breeder about whether to invest in DNA testing.

Estimation of Genetic Variability in Sheep

Supervisor: Cedric Gondro

Using SNP genotypes obtained from the Illumina 50k Ovine Bead Chip you will analyze SNP patterns to determine genetic diversity within and between sheep breeds. Patterns of SNPs can be used to detect signatures of selection that may help us understand the evolutionary processes of natural and artificial selection that has created this genetic diversity. The aim will be to determine methods to infer historical SNP patterns and to predict future SNP patterns (in essence a history of LD and its decay). Understanding the genetic diversity, in particular the linkage phase between the marker and the QTL may help to estimate the effect of each marker across breeds. The selection signatures may also help identify genes or genetic candidate regions under selection.

Evaluation of Methods to Estimate Breed Composition from SNP Genotypes

Supervisor: Cedric Gondro

Being able to determine the percentage contribution of a breed in an animal is important for branded products (e.g. 'pure Angus') and is also relevant in crossbreds for prediction of heterosis. In this project you will evaluate and compare different approaches to estimate breed composition using simulated and real data.

Cross platform integration of microarray data

Supervisor: Cedric Gondro

Gene expression studies provide parallelized measurements of thousands of genes at the same time. Many of these gene studies have been conducted on various different platforms but it is unclear how to use this data in cross experiment studies. This project will work on the development of computational and statistical methods to integrate the results from different platforms.

Replication of classic population genetics experiments using Artificial Life

Supervisor: Cedric Gondro

Artificial Life concerns mimicking the processes of life in silico (on a computer). In this project you will use Artificial Life agents to generate population data to replicate classical population genetics experiments that were conducted in *Drosophila*.

CSIRO

Identification of immunogenic parasitic antigens from sheep challenged with gut parasites by screening a large phage display library

Supervisor: Cedric Gondro and Nick Andronicos

This is a biotechnology-based project. Hypothesis: Anti-parasite antibodies generated in sheep challenged with live gastrointestinal nematodes will recognize a discrete set of

peptide antigens which are expressed in a large phage display library. The aim of this project is to define the peptide antigens that sheep generate antibodies against during a protective immune response by screening a phage display peptide library. Plasma antibodies from sheep which have been challenged with gut parasites will be used to screen a phage display peptide library to determine the peptide antigens. The sequences of the peptides will be blasted against worm libraries to determine the identity of the peptides and if any of the peptides resemble helminth proteins. These candidates will form the basis of novel vaccine candidates against gastrointestinal parasites. Techniques: Phage display technology, cloning, sequencing, ELISA and bioinformatics.



A \$5000 scholarship is available for these projects for students with at least distinction average in their first three years.

Analysis of fibre diameter profile traits in Merino sheep

Supervisor: Daniel Brown

The fibre diameter profile describes the changes in fibre diameter throughout the year for each sheep. This project will use data from a large Sheep CRC database which contains fibre diameter profiles from several ram breeding flocks across Australia. The project would involve calculating traits to describe the shape of the fibre diameter profile and then conducting genetic analysis of these traits to estimate their heritabilities and correlations with other traits.

Relationship between heifer calving rate and BREEDPLAN EBVs for Days to Calving

Supervisor: David Johnston and Hans Graser

Beef cattle breeders regularly record the start of a mating season and the birth dates of the resulting calves. BREEDPLAN, Australia's genetic evaluation system for beef cattle, uses this data to calculate an EBV for Days to Calving (DC). Our hypothesis is that this EBV is an excellent selection criterion to genetically increase the calving rate of heifers and cows. In addition, the daughters of sires with low EBVs for DC will have a more condensed calving season, which provides for a more even line of progeny. This project will test this hypothesis on field data from a number of breeds. Required: affinity to computer work.

High density DNA chip genotypes in beef cattle- how useful are they?

Supervisor: David Johnston and Hans Graser

With the advent of high density DNA chips there is genomic data available for a student to gain unique experience in analysing such data and determining the parts of the bovine genome associated with economically important traits. This project would contribute to the emerging field of genetic evaluation and selection called genomic selection in beef cattle.

I & I NSW – Beef Centre of Excellence

Development of fat depots in cattle

Supervisor: Malcolm McPhee and Paul Greenwood

malcolm.mcphee@industry.nsw.gov.au (6770 1838)

A scholarship may be available.

This study will test the hypothesis that short-term, strategic, high energy and starch feeding of cattle during the post-weaning period alters the development of fat depots. The study will assess the development of the subcutaneous fat depot from weaning to completion of backgrounding in cattle genotypes differing in their fat distributional characteristics. The amount of subcutaneous fat (kg) has been determined using CT-scan and image analysis. Samples obtained from 3 different subcutaneous fat depot sites will be prepared for histological analyses, and the size of fat cells will be measured, which will also allow for the number of fat cells in the depot to be estimated.

This Honour's project will specifically assess the subcutaneous fat depot at weaning, at the completion of the nutritional treatments, and at the end of backgrounding, in three genotypes differing in their fat distributional characteristics:

- 1) High marbling and high subcutaneous fat (Angus);
- 2) High marbling and lower subcutaneous fat (Wagyu x Angus);
- 3) Lower marbling and high subcutaneous fat (Hereford)

The project forms part of a larger project within Program 1 (High Quality Beef for Global Consumers) of the Beef CRC, that is assessing the development of subcutaneous, intramuscular, intermuscular and internal fat depots from weaning until the completion of long-feeding (300 days in feedlot).

The effect of climate change and an estimate of methane produced from sheep on the Northern Tablelands

Supervisor: Malcolm McPhee, Roger Hegarty and Clare Edwards

malcolm.mcphee@industry.nsw.gov.au (6770 1838)

Honours Cicerone scholarship is available

An exciting opportunity exists to undertake a project that is on site here at UNE. A MLA/DAFF funded sheep production demonstration site at UNE, Trevenna has been established to demonstrate the sources and magnitudes of methane emissions from livestock farming systems. The UNE demo site is 1 of 4 state-of-the art regional sites across Australia. The study will run Merino ewes on low and high fertility landscapes and use whole-farm systems and carbon budgeting models to predict methane production. The site will run over 2 years. Pasture (total biomass, botanical composition) and production data [live weight gain, fat score, fecundity, wool and lamb carcass weights at slaughter] will be collected each year. An analysis at the end of the second year will be conducted to estimate the production of methane from whole farm systems and C budget models for low and high fertility landscapes.

This honours project will examine the pasture herbage mass and the resulting influences on animals in the first year of the project. The AusFarm or EcoMod, simulation package will be used to conduct simulations of the pastures on 2 different landscapes (low vs. high fertility). The student will then enter production data into AusFarm or EcoMod perform a simulation on 50 years of weather data, modify temperature, re-run the simulation and compare the 2 simulations.

PIIC

All candidates are encouraged to apply for the Beef CRC scholarship:
<http://www.beef.crc.org.au/default.asp?page=/education/scholarships>

Gene expression study of white blood cell in cattle selection lines with low and high feed efficiency

Supervisor: Yizhou Chen and Cedric Gondro

Feed efficiency is an economically important trait in beef cattle and it is affected by several physiological systems such as basal metabolic rate, generation of ATP, regulation of growth and development and homeostatic control of body mass. Previous studies of global gene expression of liver tissue with bovine long oligo microarray have identified number of differentially expressed genes between animals with high and low net feed intake. Cluster analysis of differential expressed genes provides evidence of the potential use of gene expression profiles as predictor of net feed efficiency phenotype. As the complicated procedure of taking liver biopsy limited the practical use of such technology in beef industry, the proposed project will study the global gene expression profiles of white blood cells (WBC) with bovine long oligo microarray to identify set of differentially expressed genes in WBCs between cattle selection lines with high and low net feed intake.

Real-time quantitative RT-PCR analysis of genes differentially expressed in cattle with high and low net feed intake

Supervisor: Yizhou Chen and Cedric Gondro

DNA microarray analysis in cattle selection lines with high and low net feed intake has revealed more than hundred differentially expressed genes. However, extraction and understanding the underlying biological processes involved in net feed intake remains a significant challenge. By gene network and pathway analysis, we have identified several networks and canonical pathways linked to up and down-regulated differentially expressed genes. The objective of the project is to quantify gene expression of selected candidate genes from gene networks and pathways involved in net feed intake and to elucidate the biology of net feed efficiency.

Anti-oxidation and feed efficiency in cattle

Supervisor: Yizhou Chen and Robert Herd

While molecular oxygen is essential for a wide array of organisms, O₂ and reactive oxygen species (ROS) can be toxic. Increased production of ROS and/or a decrease in the anti-oxidative capacity of cells causes oxidative stress which can compromise essential cellular functions. Gene expression studies of liver and mitochondria proteomic work in liver tissue have identified a couple genes/proteins differentially expressed in cattle with high and low net feed intake. The objective of the project is to measure the total antioxidant power (TAP) and key anti-oxidants in the serum from cattle selection lines with high and low net feed intake and to determine the association between anti-oxidation capacity and net feed intake in cattle.

Agronomy Projects

Supervisor: Dr. Chris Guppy

Phone: 02 6773 3567; email: cguppy@une.edu.au

Students with an interest in soil fertility, crop nutrition, plant nutrition, horticulture, or farming systems resource use efficiency or nutrient cycling can see me for ideas on topics. A few are listed below and I am also happy to co-supervise students on Scholarships. Some of the projects listed below may be able to attract a Scholarship also.

Possible research topics

μ-CT root scanning in response to phosphorus

Hyperspectral imagery to distinguish sulfur from nitrogen deficiency

Sulfur nutrition in pastures

Phosphorus and silicon interactions in highly weathered soils

Enhanced zinc uptake by grain in the presence of sulfur fertiliser

Cattle compaction effects on grain yield

New techniques for measuring soil and plant systems

Supervisor: Dr Matt Tighe and Dr Chris Guppy

Phone: 02 67732180, email: mtighe2@une.edu.au

On offer are 2 honours projects for development in new, cutting edge techniques for measuring physical and chemical properties of soils and plants:

Micro-CAT scanning of soil crusts

In the semi-arid rangeland zone of Australia, soil physical and biological crusts exert different and poorly understood influences on soil porosity and infiltration. How compacted is too compacted for a surface soil, and what effect does soil surface condition have just beneath the surface? This project will use a method widely applied in medical research and diagnosis to analyse physical properties of these soils. The new high resolution Computer Assisted Tomography unit at UNE will be used to construct 3-dimensional representations of soil surfaces for analysis of soil properties. Using this approach, this project will quantify the microstructure underneath several different soil surface conditions of these soils. The project is focused on the use of the research CAT scanner, which is rapidly being adopted in environmental research. Full training in the use of the research CAT scanner will be provided, and operating costs will be covered.

Portable system for soil and plant elemental analysis

This project will use the newly acquired portable x-ray fluorescence (PXRF) 'gun' to determine the range of elements that can be detected in selected soil and plant samples. Soil and plant analysis is costly and time consuming. The new generation PXRF system uses the basic physics of elements to detect their presence and abundance, and offers versatility, speed and convenience for soil and plant analysis. This project will calibrate the PXRF against agronomically important soils and plants, and determine the applications of the

equipment. Full training in the use of the new generation PXRF is provided, and operating costs will be covered.

Supervisor: Dr Paul Kristiansen

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Students with an interest in exploring new crop development (e.g. viticulture, olives, medicinal plants), complementary farming systems (e.g. organics, farm forestry), and agricultural impacts on the environment are encouraged to contact me. I am also working on projects associated with invasive weeds, soil fertility management and monitoring, environmental management systems and energy use in agriculture.

In addition to the project listed below, I'm happy to develop projects in areas of interest to students.

Possible research topics

Evaluation of non-chemical weed control methods (bioherbicides x weeds species x growth stages)

Inventory of weeds in organic broadacre farming

Interaction of tillage and soil amendments: effect on soil physical characteristics

Effect of soil management history on phosphorus cycling

Factors affecting growth of pine plantations in the New England

Allelopathic effects of soils in pine plantations

Modelling temperature changes in cold climate vineyards

Desktop study of energy flows in different farming systems

Clonal propagation of native medicinal plants

Supervisor: Isa Yunusa

Phone: 02 6773 2436; email: isa.yunusa@une.edu.au

Students interested in aspect of crop physiology, including plant growth and function and soil-plant interactions are encouraged to see me for project ideas. Some possible projects are listed below.

Possible research topics

Comparative water-use efficiency in mixed winter pastures and summer cereals

Testing the consistency of sapflow in trees in saline media

Root growth and soil-water extraction by cereals and pastures

Any topic of your interest

Supervisor: Chris Guppy and David Backhouse

Phone: 02 6773 3567; email: cguppy@une.edu.au

Link between flower colour and disease resistance/ organic matter breakdown in peas

Description: Research has identified that there is a link between flower colour and disease resistance in peas; those with white flowers succumb to diseases more readily than those with coloured flowers. This project will examine that link, related to anthocyanin production and tannin pathways, and assess both resistance to disease and breakdown rate of pea residues. The project will give you an opportunity to examine plant genetics, biochemistry and nutrient cycling and disease resistance using heirloom pea varieties.

Supervisor: Chris Guppy and Peter Gregg

Phone: 02 6773 3567; email: cguppy@une.edu.au

Identifying feed source using ^{15}N isotope and GCMS

Description: An interesting problem has arisen seeking to identify whether heliothis are eating the leaves of cotton or pigeonpea plants. This project will use depleted ^{15}N to spray onto cotton plants and analyse the insects after feeding to identify if they have consumed these cotton leaves. A cotton CRC scholarship may be applied for, for this project (\$6000)

Supervisor: Professor Brian Sindel

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Honours scholarships may be available

Competitive impact of fireweed and thistles on pasture production

Description: There is great debate amongst the farming community and researchers as to what impact fireweed has on pasture productivity in coastal pastures. But the few studies aimed at investigating this, were either not fully representative, or came up against the effects of drought. This project would involve a field study of fireweed either at Dorrigo or near Coffs Harbour comparing pasture productivity with and without fireweed, as well as livestock consumption of fireweed. The same issue could be researched for thistles in pastures around Armidale.

Herbicide resistance in fireweed?

Description: Most herbicide resistance has been shown to occur in cropping weeds but some pasture weeds that are sprayed often have also been found to possess resistance to certain herbicides. This project would involve growing fireweed in the glasshouse from different populations with a long history of herbicide use and testing their resistance to several herbicides. This information will be important for future management.

Fireweed seed longevity in the soil

Description: It is not clear how long fireweed seed survives in the soil. This is important information needed in the management of fireweed. This project would involve burial of fireweed seed in special seed bags at different depths and then exhumation and testing of viability of those seeds over a period of time to follow seed longevity.

Emergence patterns of annual pasture weeds on the Tablelands of NSW.

Description: This project looks at the emergence patterns of a range of annual pasture weeds of agricultural importance on the Tablelands of NSW, e.g. *Vulpia*, thistles, Paterson's curse, Bathurst burr, St John's wort and horehound, as a basis for designing grazing strategies which promote strong pasture growth and competition at peak emergence times and so suppress weed growth and reduce the size of weed infestations.

The advantages and disadvantages of chipping versus chemical control of weeds.

Description: Hand-chipping of weeds is still widely practised in the pastoral industry in high rainfall environments and in the cotton industry where it is thought to help prevent the development of herbicide resistance in weed populations. However, some growers have opted for chemical spot spraying over manual methods. This project could either be carried out in a pasture trial at UNE or in a cotton cropping system at Narrabri and would compare the benefits and deleterious effects of hand-chipping of weeds with those of chemical spot spraying and combined with reseeding.

The effect of night cultivation and sowing on weed competition on cereals and grain legumes.

Description: Several recent honours projects have shown that cultivation and sowing of field crops at night in the dark can delay weed emergence and reduce weed competition. This project aims to extend that work to a poorly competitive legume crop such as chickpeas in comparison with a highly competitive cereal crop such as triticale.

Impact of the herbicide glyphosate on plant growth.

Description: Glyphosate (Roundup) is a very effective and commonly used herbicide for weed control in bare crop fallows. Glyphosate is typically applied to the foliage of plants. Controversy exists surrounding its ability to affect plant growth when applied to the soil. In this project we will conduct a glasshouse experiment to investigate whether glyphosate may impact on crop growth when in the soil.

Impact of fungal diseases on the fecundity of fireweed in Australia

Description: Fireweed is major pasture weed in eastern Australia. Currently, CSIRO is assessing the possibility of biological control of this weed by investigating the ecology of the weed in South Africa where it originates and looking for potential biological control agents. This research project aims to provide much needed information on the current impact of insect pests and diseases on fireweed in Australia.

Supervisor: Dr. Susan Wilson

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Soils in many areas of Australia are affected by contamination to some degree resulting in lost productivity or causing real hazards to human health and the environment.

Understanding the fate and behaviour of contaminants in the soil environment, including agronomic environments, is important for recognizing adverse effects and also for deciding on appropriate, effective management and remediation. In the New England area we have over 3000 derelict mine sites, many with major environmental impacts associated with mine derived metal contamination. Many agricultural areas are impacted by pesticides. Research into soil clean up/rehabilitation options is also needed. If a student has an interest within this area we can discuss specific projects - a number of possible project ideas are described below. Funding from the CRC in Contamination Assessment and Remediation of the Environment, DECCW and industry is available for certain projects.

Investigation of biochar additions to agricultural soil on contaminant load and contaminant risk.

Description: With the current interest in reducing impact on climate change, biochar is seen as a potential benefit for soils in terms of carbon additions. However, biochars can also add contaminants to the soils systems. Certain pollutants, such as pesticides, can be present in the source material and also originate in the biochar production process. Conversely biochars introduce a strongly sorptive surface to soils and will impact on the leaching and bioavailability of pollutants present. There is a real need to investigate the impact of biochar on contaminants in soil. There are a number of possible projects in this area.

The bioavailability of pesticides in NSW soils

Description: Pesticide use has been widespread in NSW. Many of the persistent pesticides such as DDT still remain in the soils and due to the unique nature and extent of degradation of many Australian soils may be relatively more bioavailable than expected. This project aims to investigate the bioavailability of a number of persistent pesticides in NSW soils.

Biological remediation of soil contaminated with petroleum hydrocarbons and PAHs.

Description: Biological remediation of petroleum contaminated soil is a well recognized clean up option. There are a number of projects in this area. The feasibility and optimum treatment conditions for treating specific contaminated soils in the Armidale area would be investigated.

Bioavailability and risk associated with contaminants in soils from mine site activities.

Description: There are a number of projects in this area. These include investigating uptake of mine derived metals into vegetable crops for the purposes of risk assessment, effectiveness of soil rehabilitation using plants and investigating metal mobility and bioavailability.

Benefits and risks associated with soil application of waste derived composted amendments in NSW

Description: Application of composted municipal waste to soil as a soil amendment is increasingly popular in Australia – it saves landfill space, is a sustainable use of a waste

product and can improve soil agronomic conditions. However, depending on the waste screening process, the final compost product can carry a significant contaminant load from visual plastic and glass to complex organic and metal toxic contaminants. This project would aim to understand the impact – positive and negative – of waste derived amendments on NSW soils. DECCW will be funding the project.

Can native plantings clean up contaminated sediments?

Description: Dumaresq Creek at the Armidale Parklands is contaminated with certain gasworks derived pollutants. Recently, the banks of the creek have been planted with native species to improve biodiversity and the creek cleared of weed species. This project would aim to investigate the impacts of these ecological management activities on the Creek sediment and water contaminants.

Primary Industries Innovation Centre

A \$5000 scholarship is available for these listed projects

Supervisor: Professor Bob Martin/Professor Brian Sindel
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Glyphosate-resistance status of barnyard grass (Echinochloa colona)

Description: Glyphosate was first widely used in cropping systems in northern NSW in 1983 and has been consistently used for control of grass weeds in no-tillage fallows ever since. After 20 years of glyphosate use around the world, resistance had not been detected and it was commonly thought that this would not happen. However, in recent years the number of weed species with resistance to glyphosate has increased rapidly. In Australia, the intensive use of glyphosate has resulted in resistance appearing in annual ryegrass (*Lolium rigidum*) and awnless barnyard grass (*Echinochloa colona*). This project aims to test for glyphosate resistance in barnyard grass plants grown from seeds collected from susceptible and suspected resistant populations. The experiments will be carried out in the glasshouse.

Supervisor: Dr Mike Sissons
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Interplay of protein and starch in the establishment of durum wheat (Triticum durum desf.) pasta quality

Description: The way the interplay between starch and gluten in the pasta controls pasta texture and cooking properties is poorly understood. A lot of emphasis is on the raw material but little work has looked at the processing and cooking and how this can determine the pasta texture. An "assay" for this could prove to be the definitive predictive test for pasta quality and is urgently needed.

Phase 1

Prepare semolina samples with potentially different starch-gluten matrix and make pasta by extrusion (fixed extrusion speed, temperature, die diameter, mixing conditions) but use different pasta drying regimes (LT, early HT, late HT) to alter the S-G matrix

Samples

- Good quality durum semolina (Bellaroi)
- Weak durum semolina (Bellaroi)
- Soft wheat semolina
- Non-gluten starch composite
- bran-semolina mixture-to interfere with a S-G formation
- CMC or HPMC -semolina to provide a mucilagenous layer over the S-G matrix
- *-Disrupt the S-S bonds in dough with additives (to weaken, strengthen, block)
- A selection of commercial pasta samples of similar diameter with varying quality

data [i have a range of samples for which there is a lot of data-quality, RVA, SE-HPLC which could be useful]

Analysis

examine semolina mixtures and uncooked pasta for swelling power, SDSEP, RVA, DSC, protein, microscopy to assess the starch gluten matrix (S-G matrix). What is the impact of these treatments relative to the Bellaroi control?

Phase 2

Cook pasta for different times-undercooked (one third of OCT, 2/3 of OCT), at OCT, overcooked (OCT+5min, OCT+10min) to look at the changes in the S-G matrix during cooking.

Measure -texture, cooking loss, water absorption, swelling power, SDSEP, RVA, DSC, protein, microscopy to assess the S-G matrix

Phase 3

Assess the starch hydrolysis rates in vitro reducing sugar release to see if the difference in the S-G matrix are related to predictive glycaemic index

Pasta brownness-an assessment and development of a rapid test

Pasta colour is an essential factor in assessing pasta quality made from durum wheat. It results from a desirable yellow component, an undesirable brown component and under some drying conditions, a red component. Pasta brownness is defined as 100-L (brightness) and is the result of an inherent brownness of the endosperm, the degree of bran contamination of the semolina and of Malliard reactions when pasta is dried at high temperatures. It is the first factor thought to be the most important with control over the other factors being possible. Inherent brownness is thought to be due to a water soluble copper protein and /or action of oxidizing enzymes produced during grain maturation. This project will investigate (i) relationship between semolina brownness and water soluble protein content in different genotypes grown at different locations (samples provided) to determine the best test (ii) to follow the production of polyphenol oxidase (PPO) and the water soluble protein content during grain maturation (samples provided) to determine any relationship (iii) determine if there is any genetic variation in PPO activity in three sections of the grain (aleurone, bran layer, endosperm) as potential selection tool for breeder's to produce a durum wheat with a lower PPO content in the bran as a means of lowering inherent browning. Technical assistance and samples will be provided to assist the student.

Supervisor: Carol Harris, Lester McCormick and Dr Suzanne Boschma, I&I NSW, Tamworth
Phone: 02 6730 1937; **email** carol.harris@industry.nsw.gov.au

Using leaf number as an indicator of tropical grass quality

Leaf number per tiller can be used as an indicator of time to graze a pasture to limit the production of stem and increase the leaf-stem ratio, so improving to forage quality for animal production. Fulkerson and Slack (1994) suggested this method as a simple plant-based indicator for the optimum time for grazing temperate pastures in dairy systems. Defoliating ryegrass (*Lolium* spp.) pastures when tillers have produced an average of 3 leaves per tiller can improve yield and pasture persistence. Delaying defoliation until after the 3 leaf stage results in a decline in nutritive value of the pasture and yield wastage through an increase in dead material (Fulkerson and Slack 1994) as older leaves senesce.

Similar results were achieved for cocksfoot (*Dactylis glomerata*) pastures at 4 new leaves/tiller (Turner et al. 2006). This technique has been used to develop optimum time of grazing of kikuyu (*Pennisetum clandestinum*) (Reeves et al. 1996) and Rhodes grass (*Chloris gayana* cv. Callide) (Pembleton et al. 2009) for the dairy industry in the tropics/subtropics, but could also have potential for extensive grazing systems in northern NSW and southern Qld.

Aim: to conduct a series of glasshouse experiments to:

1. determine the number of leaves produced per tiller before stem elongation commences for the commonly sown species. Does nitrogen rate affect the average number of leaves produced per tiller?
2. quantify the nutritive value of the leaf and stem components of the commonly sown tropical grasses at different defoliation intervals determined by leaf number per tiller.

Methods: Pots of the commonly grown tropical grasses used in NNSW and SQueid could be grown in the glasshouse. The grasses include:

1. Premier digit grass (*Digitaria eriantha*)
2. Bambatsi panic (*Panicum coloratum*)
3. Katambora Rhodes grass (*Chloris gayana*)
4. Swann forest bluegrass (*Bothriochloa bladii*)
5. Gatton panic (*Megathyrus maximus* var. *maximus*) and
6. Floren bluegrass (*Dichanthium aristatum*)

Aim 1 could be addressed by counting the number of tillers on multiple tillers per pot of the common tropical grasses until flowering. Nitrogen rates could be 50 and 100 kg N/ha.
6 species x 2 N rates x 3 replicates = 36 pots

Aim 2 could be addressed by assessing herbage production of the 6 grasses at a series of defoliation times based on leaf number/tiller (e.g. 2, 4, 6, 8 leaves/tiller). The herbage could be sorted into leaf and stem to determine the optimum leaf-stem ratio and the plant components analysed for nutritive value [e.g. metabolisable energy (MJ/kg DM), crude protein (%), dry matter digestibility (%), neutral and acid detergent fibre (%), ash content (%)] to determine the optimum defoliation time.

6 species x 4 leaf no. x 3 reps = 72 pots

Supervisor: Dr Heather M. Nonhebel
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AUXIN BIOSYNTHESIS AND GRAIN FILL IN RICE



Rice is the **world's number one food crop** and is the staple food of more than half the world's population. As a result of its relatively small genome as well as its importance as a food crop, the full genome sequence of rice has recently been completed. My lab is studying the role of genes/enzymes for the synthesis of plant hormone auxin in maximizing grain fill.

Specific projects:

Investigating the role of auxin in grain fill:

Large quantities of auxin are synthesized in developing cereal grains. Hormone levels correlate with; a) seed set after anthesis; b) grain fill (the accumulation of starch). Both of these processes are important determinants of crop yield. This project will investigate in detail the correlation between auxin and specific morphological and biochemical changes in the developing grain.

Characterization of enzyme activity of YUCCA:

"YUCCA" is a key rate limiting enzyme in auxin synthesis. However the reaction catalysed by this enzyme *in vivo* is unclear. This project will involve expression of two *YUCCA* genes in *E. coli* and characterization the enzyme kinetics and substrate specificity of the gene product.

Auxin catabolism in developing grains:

Auxin levels are controlled by a combination of synthesis, transport and metabolism. This project will investigate the catabolic inactivation of auxin by: analyzing rates and products of catabolism in developing cereal grains. In addition, a gene has been identified by bioinformatics as likely to encode an enzyme for IAA oxidation. This gene will be expressed in *E. coli* and its catalytic activity determined.

Methods used:

Projects will involve a combination of: molecular biology techniques such as PCR, insertion of genes into a cloning vector, transformation of *E. coli*, isolation and characterisation of recombinant proteins. Reverse transcriptase PCR, and real time PCR will be used to investigate gene expression. Projects may also involve microscopy, extraction and analysis of small organic molecules and the synthesis of stable isotope standards.