M A S S E Y  U N I V E R S I T Y
COLLEGE OF SCIENCES
Paper Outline 2009

Paper Number and Title: 117.342 Animal Nutrition

Credits value: 15  Semester: 1
Campus: Turitea  Mode: Internal

Calendar Prescription:
The principles of animal nutrition as related to ruminant and monogastric livestock. An in-depth coverage of
the processes of feed intake, digestion, absorption and metabolism, and the factors affecting them. The
determination of the nutritive value of feedstuffs, with particular emphasis on forages. Schemes for
estimating animal requirements for energy, protein and minerals. The principles of ration formulation and the
use of computer programmes. Practical feeding regimes; design, implementation and interpretation of
nutrition trials.

Pre-requisites:
Pre-requisite: 117.254 Principles of Animal Production or Permission Academic Director

It is assumed that students will have an understanding of the basic principles of nutrition, as provided in
117.254 Principles of Animal Production, together with a sound knowledge of biology, chemistry and
mathematics. An understanding of basic livestock feeding practices would be a decided advantage.

Restrictions: none

E-Learning Category: Web supported

Paper Coordinator:
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Other Contributing Staff:
Dr Ian M.Brookes, IFNHH, AH2.51, extn 7824, email: I.Brookes@massey.ac.nz
Dr David Thomas, IFNHH, 2.54, extn 5513, email: D.G.Thomas@massey.ac.nz

Aim:
This paper provides an in-depth study of the principles of nutrition, applied to monogastric and ruminant
animals. The processes of feed intake, digestion, absorption and metabolism, and the factors affecting these,
are discussed. Methods for obtaining quantitative nutritional information are described and evaluated.

Students completing this paper will be in a position to progress to post-graduate papers in animal nutrition.

Learning Outcomes:
On successful completion of this paper, a student should be able to:
1. Explain how typical diets for monogastric and ruminant animals differ in their chemical composition.
   Outline the laboratory methods of feed analysis.
2. Compare and contrast the ways in which monogastric and ruminant animals digest, absorb and
   metabolise nutrients. Provide examples of how the digestive process may be manipulated to improve
   the efficiency of nutrient utilisation.
3. Define Forage Feeding Value. Discuss how this may be affected by feed composition, anti-
   nutritional factors and the processes of digestion and metabolism.
4. Describe systems of measuring nutritive value in monogastric and ruminant animals. Evaluate the
   usefulness of alternative measures for the prediction of nutritive value.
5. Describe and evaluate methods for estimating feed requirements and show how results can be incorporated into predictive models. Provide quantitative estimates of feed requirements for a variety of productive states.
6. Evaluate diets for adequacy in meeting requirements. Understand the principles of formulating diets by performing simple exercises, and be aware that computer programmes are available for more complex operations.
7. Discuss, using appropriate examples, the likely responses to the provision of extra nutrients and identify nutritional factors limiting animal production.

Assessment:
1. A one-hour part-final examination on feed composition and monogastric nutrition (20%).
2. An assignment on monogastric digestion (12.5%)
3. An assignment on forage feeding value (12.5%)
   Groups of students conduct a chicken feeding experiment and present a written summary of the experimental data (10%).
   Individual students write a final report in form of a scientific paper (15%).
5. A two-hour final examination on ruminant nutrition and practical material. (30%)

Alignment of Assessment to Learning outcomes

<table>
<thead>
<tr>
<th>Assessment Description</th>
<th>Contribution to Paper</th>
<th>Mark</th>
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<tbody>
<tr>
<td>1</td>
<td>1 to 7 for Monogastric</td>
<td>20%</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>12.5%</td>
</tr>
<tr>
<td>3</td>
<td>3, 4, 5</td>
<td>12.5%</td>
</tr>
<tr>
<td>4</td>
<td>6, 7</td>
<td>25%</td>
</tr>
<tr>
<td>5</td>
<td>1 to 7 for Ruminant</td>
<td>30%</td>
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Deadlines and Penalties:
- Monogastric digestion assignment (12.5%) Due Friday March 21st
- Monogastric part-final examination (20%) Wednesday April 8th
- Forage feeding value assignment (12.5%) Due Friday May 15th
- Nutrition Trial
  Data Presentation -Group Report (10%) Due Friday May 8th
  Final Report (15%) Due Friday May 29th
- Two-hour final examination. (30%) Tuesday June 16th am

An extension to the deadline for written reports may be granted for reasons genuinely caused by matters beyond the students’ control. A penalty of up to 50% of the available marks may be imposed when no satisfactory reason for lateness can be provided.

Requirements to Successfully Complete the Paper:
Achieve a passing grade as determined from the combined marks of all internal assessment and the final examination. Failure to complete any of these requirements will lead to a DNC unless covered by the Aegrotat Regulations.

Learning Programme and Schedule:
- Feed composition, feed analysis and characteristics of some common feeds
  3 lectures; Week 1-2 Dr. I. Brookes and Dr. P. Morel.
- Monogastric animals: Digestion and absorption of carbohydrates, proteins and lipids. Efficiency of nutrient utilisation.
  5 lectures; Weeks 2-3 Dr. D. Thomas
• Students will conduct a chicken feeding experiment during weeks 4-6. The practical class time in week 4 will be used to formulate diets and set up the experiment. In week 6, the class will complete the experiment, and in week 8 undertake data analysis, during the scheduled practical class time.

• Monogastric animals: Prediction of nutritive value; Voluntary feed intake and mechanisms of intake control; Minerals, vitamins and water.
  4 lectures; Weeks 4-5 Dr. P. Morel.

• Monogastric animals: Energy and protein requirements. Recommended feeding allowances. Formulation of monogastric diets.
  6 lectures; Weeks 5-7 Dr. P. Morel.

• Ruminant animals: Rumen microbiology. Digestion in the rumen and intestines. Outflow from the rumen and digestion in the lower intestinal tract. Efficiency of nutrient utilisation.
  5 lectures; Weeks 8-9 Dr. I. Brookes.

• Ruminant animals: Prediction of nutritive value; Voluntary feed intake and mechanisms of intake control; Minerals, vitamins and water.
  3 lectures; weeks 9-10 Dr. I. Brookes.

• Ruminant animals: Energy, protein, fibre and mineral requirements.
  4 lectures; weeks 10-11 Dr. I. Brookes.

• Feeding value of forages for ruminant animals. Pasture, conserved forages, cereal straws, forage crops. Balanced rations for grazing ruminants. Feeding systems for ruminant livestock.
  4 lectures; Weeks 12-13 Dr. I. Brookes.

• A computer based laboratory class will be held in week 12 to illustrate ration balancing programmes for ruminant livestock.

Student Time Budget:

<table>
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<tr>
<th>Assessment Related</th>
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<tbody>
<tr>
<td>Part-final examination (study time)</td>
<td>15.0</td>
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<tr>
<td>Monogastric Assignment</td>
<td>10.0</td>
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<tr>
<td>Forage Feeding Value Assignment</td>
<td>10.0</td>
</tr>
<tr>
<td>Feeding Experiment Assignments</td>
<td>24.0</td>
</tr>
<tr>
<td>Final examination (study time)</td>
<td>20.0</td>
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Formally scheduled learning

| Lectures                                                | 38.0  |
| Practical                                              | 12.0  |

Non-scheduled learning

| Personal study and reading (4.5 hours/week)             | 58.5  |

Total 187.5

Proposed Feedback and Support for Student Learning:

The turnaround time for assignments will be no more than three weeks from the due date. It is important to note that the specified timeframe applies only to those assignments submitted by the due date, and does not necessarily apply to those submitted late.

Textbook and Other Recommended Reading:

Textbooks are expensive and need not be purchased for this paper, particularly as no single text covers all the areas dealt with here. However, for those who wish to delve move deeply into particular issues, a suitable text is:


This is a comprehensive text covering the fundamentals of animal nutrition. The more practical feeding aspects relate primarily to UK rather than NZ systems.

We suggest you obtain a library copy for inspection before deciding to outlay a substantial sum of money.
**Additional Costs:**
None anticipated.

**Conditions for Aegrotat Pass and Impaired Performance:**
If you are prevented by illness, injury or a serious crisis from attending an examination, or another compulsory assessment element that occurs at a fixed time and place, you may apply for an aegrotat consideration. To qualify for an aegrotat pass on the final examination, you must have attempted at least 40% of the total formal assessment and your performance must be well above the minimum pass standard, so that the examiners can be confident that you would have passed the paper if you had completed the final examination. You may also apply for aegrotat consideration for other compulsory assessment elements (such as Semester Tests) that occur at a fixed time and place if you are prevented by illness, injury or a serious crisis from attending. You must apply on the form available from the Examinations Office, the Student Health Service or the Student Counselling Service.

**Plagiarism:**
Massey University, College of Sciences, has taken a firm stance on plagiarism and any form of cheating. Plagiarism is the copying or paraphrasing of another person’s work, whether published or unpublished, without clearly acknowledging it. It includes copying the work of other students. Plagiarism will be penalized; it is likely to lead to loss of marks for that item of assessment and may lead to an automatic failing grade for the paper and/or exclusion from reenrollment at the University.

**Grievance Procedures:**
A student who claims that he/she has sustained academic disadvantage as a result of the actions of a University staff member should use the University Grievance Procedures. Students, whenever practicable, should in the first instance approach the University staff member concerned. If the grievance is unresolved with the staff member concerned, the student should then contact the College of Sciences office on his/her campus for further information on the procedures, or read the procedures in the University Calendar.

**LECTURE OUTLINE:**
1. Introduction to the paper (Dr. I. Brookes/Dr. P. Morel/Dr. D. Thomas)
2. Feeds: Analysis and Composition.
   3 lectures; Week 1-2 Dr. I. Brookes and Dr P. Morel.
3. Feed composition – carbohydrates; proteins; lipids; minerals.
4. Feed analysis – proximate analysis; detergent analysis of fibre components.
5. Characteristics of common feedstuffs – grazed pasture; conserved forages; forage crops; energy feeds; protein supplements; by-products.
6. Digestion and absorption in monogastric animals.
   5 lectures; Weeks 2-3 Dr D. Thomas.
7. Structure of the digestive tract – mouth; oesophagus; stomach; small intestine; caecum and colon. Factors affecting motility. Transit time.
8. Digestive secretions – saliva; gastric and pancreatic secretions; bile; intestinal epithelial secretions. Regulation of digestive secretions.
11. Efficiency of utilisation of digested nutrients. Digestible and metabolisable energy. Faecal and ileal amino acid digestibilities. Protein requirements for maintenance and deposition.

**Monogastric animals: Prediction of nutritive value; Voluntary feed intake and mechanisms of intake control; Minerals, vitamins and water.**
4 lectures; Weeks 4-5 Dr P.Morel.
11. Ileal protein digestibility - cannulation; slaughter technique; markers. Indirect methods - prediction from chemical characteristics.

**Feeding monogastric animals.**
6 lectures; Weeks 5-7 Dr.P.Morel.
15. Nutrient requirements. Energy - maintenance; energy deposition; body temperature. Protein and amino acids – protein turnover, protein deposition.

**Digestion and absorption in ruminant animals.**
5 lectures; Weeks 8-9 Dr.I.Brookes.
23. Rumen outflow. Fractional disappearance, outflow and degradation rates. Digestion in the small and large intestines.

**Ruminant animals: Prediction of nutritive value; Voluntary feed intake and mechanisms of intake control; Minerals, vitamins and water.**
3 lectures; weeks 9-10 Dr.I.Brookes.
25. Digestibility: Determination of in vivo and in vitro digestibility; Prediction of metabolisable energy concentration from digestibility and forage fibre concentration; Prediction of diet chemical composition and nutritive value using near infra-red spectroscopy (NIRS); Measuring rates of ruminal degradation.

**Ruminant animals: Energy, protein, fibre and mineral requirements.**
4 lectures; weeks 10-11 Dr.I.Brookes.
Feeding ruminant animals.
4 lectures; Weeks 12-13 Dr.I.Brookes.
32. Pasture as a balanced diet. Grasses and legumes; stage of maturity and feeding value. Deleterious effects of pasture.
33. Conserved forages. Pasture silage; maize silage; hay; cereal straws.
34. Forage crops – brassica crops; green feed maize; forage sorghums; sub-tropical grasses. Cereal grains.

Paper Outline submitted by Patrick Morel               Date 21/1/2009