Unit 16: Understanding Livestock Breeding and Nutrition

Unit code: D/600/9141

QCF Level 3: BTEC National

Credit value: 10

Guided learning hours: 60

Aim and purpose

This unit aims to introduce learners to the skills and knowledge needed for livestock breeding and nutrition, and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into the sector or onto further/higher education. This unit aims to give learners an understanding of the principles of livestock breeding and nutrition, and how these can be applied in practice.

Unit introduction

Modern day livestock farming focuses on animal performance, and this unit will enable learners to develop the knowledge and skills needed to enhance two of the most critical factors for success within this sector: breeding and nutrition.

Learners will gain an understanding of scientific advances in breeding, reproduction and nutrition, and investigate how these are applied to the practical livestock farming environment.

Learners will investigate the principles and science of animal breeding and genetics, and how they are affected by the environment and how they are managed. They will gain an understanding of how selection traits are chosen for breeding programmes, ways of enhancing livestock reproduction and how this can be achieved through good husbandry and the use of reproductive technology. Learners will develop the skills needed to formulate a ration, and gain an understanding of the range of feedstuffs available and the factors that affect an animal's nutritional requirements.

Learners will cover the practical application of a feeding plan, and develop their evaluation skills in assessing the effectiveness of a livestock feeding plan.

Learning outcomes

On completion of this unit a learner should:

1 Understand the principles of breeding farm livestock

2 Understand techniques used to enhance livestock reproduction

3 Be able to formulate a ration for selected livestock

4 Be able to evaluate the effectiveness of a feeding plan.

Unit content

1 Understand the principles of breeding farm livestock

Principles of animal breeding: Mendelian genetics (genetic principles including dominance, recessiveness, mutations); high and low heritability traits; environmental effects (genotype, phenotype, cross breeding, hybrid vigour)

Desirable selection traits: important breed features; factors affecting productivity

2 Understand techniques used to enhance livestock reproduction

Natural methods: heat detection; nutrition management; selection of male and/or female; timing of service

Technological methods: artificial insemination (AI); pregnancy diagnosis (PD); other techniques eg cloning, superovulation, synchronisation, multiple ovulation and embryo transfer (MOET)

3 Be able to formulate a ration for selected livestock

Factors which affect nutritional requirements: maintenance requirements; requirements for growth and production; requirements in pregnancy; age; sex; life stage; condition

Nutrient content: digestible energy (DE); metabolisable energy (ME); protein; trace elements

Range of feedstuffs: selection of feedstuffs eg seeds, roots, grass, hay, silage, legumes, fruits and vegetables, compound feeds and concentrates, by- products

Ration: balanced diet to meet identified nutritional requirements for specific life stage and production purpose

4 Be able to evaluate the effectiveness of a feeding plan

Effectiveness: animal behaviour and condition; quantity of food consumed/wasted; cost of feeding; practical considerations of implementing feeding plan; health and safety issues

Checklist: detailed checklist to enable full evaluation of all aspects of effectiveness

Assessment and grading criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria for a pass grade describe the level of achievement required to pass this unit.

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	**To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:**	**To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:**
P1 discuss the principles of animal breeding		
P2 explain desirable selection traits for a category of farm livestock	**M1** discuss factors affecting the choice of selection traits in breeding programmes	**D1** discuss factors affecting the success of a breeding programme
P3 discuss the benefits of enhancing livestock reproduction [IE]		
P4 review natural and technological methods of enhancing livestock reproduction [IE]	**M2** compare natural and technological methods to meet a given reproductive objective	**D2** justify the use of natural or technological methods to enhance livestock reproduction
P5 identify the factors which affect the nutritional requirements of selected farm animals		
P6 compare the nutrient content of a range of feedstuffs		
P7 create a ration for selected farm animals to meet their nutritional requirements [IE, CT]	**M3** independently create a ration for selected farm animals to meet their nutritional requirements	**D3** justify the use of the ration in a commercial livestock enterprise
P8 create a checklist for evaluating the effectiveness of a feeding plan		
P9 carry out feeding plan evaluation using checklist.	**M4** summarise the strengths and weaknesses of the feeding plan.	**D4** recommend changes to the feeding plan.

PLTS: This summary references where applicable in the pass criteria, in the square brackets, the elements of the personal, learning and thinking skills. It identifies opportunities for learners to demonstrate effective application of the referenced elements of the skills.

Key			
	IE – independent enquirers	RL – reflective learners	SM – self-managers
	CT – creative thinkers	TW – team workers	EP – effective participators

Essential guidance for tutors

Delivery

Delivery of this unit will involve practical and written assessments, visits to suitable livestock enterprises and will link to work experience placements. Guest speakers could be used to illustrate the vocational and industry relevance of the unit, and might include representatives from breeding and feeding companies.

It is likely that learning outcome 1 will require classroom-based input to enable learners to develop an understanding of basic genetics. It also covers the practical application of genetic understanding, and an exploration of the influence of the environment on the final characteristics and traits of an animal. Desirable breed characteristics could be investigated through visits to a selection of livestock enterprises and a commercial breeding unit, and with guest speakers from breed societies. A visit to an agricultural show would provide an opportunity to witness many breeds and their desirable selection traits.

Learning outcome 2 looks at the different ways in which livestock reproduction can be optimised, through both natural methods, which effectively represent good husbandry, and technological methods. This should include coverage of techniques available to most farming enterprises, such as artificial insemination, as well as those more specialist techniques only used by breeding companies or in research. Delivery should include some practical activity, as well as demonstrations, visits and classroom-based input.

Learning outcome 3 is concerned with ration formulation, and learners will need to gain an understanding of the different nutritional requirements of animals at different life stages and kept for different purposes. Delivery will need to include sufficient time for learner to practise basic ration formulation techniques, and the use of spreadsheets would enhance this. Delivery could be further enhanced by a visit to a feed mill and/or a talk from a feed representative or nutritionist.

Learning outcome 4 covers the practicalities of feeding, and learners will need guidance in developing their evaluation skills. It is anticipated this would best be delivered through learners observing feeding methods at a range of livestock enterprises, including the use of machinery. Learners could develop their understanding further through the use of an appropriate work placement. It is particularly important that appropriate health and safety measures are in place, including wearing personal protective equipment, carrying out risk assessments, and observing good hygiene.

Outline learning plan

The outline learning plan has been included in this unit as guidance and can be used in conjunction with the programme of suggested assignments.

The outline learning plan gives **an indication of the volume of learning it would take the average learner** to achieve the learning outcomes. It is **indicative and is one way of achieving the credit value.**

Learning time should address all learning (including assessment) relevant to the learning outcomes, regardless of where, when and how the learning has taken place.

Topic and suggested assignments/activities and/assessment
Introduction and overview of the unit.
Assignment 1: Successful Livestock Breeding (P1, P2, M1, D1) Introduction to breeding and reproduction.
Theory sessions: genetics, including practice of Mendelian genetics, dominant and recessive genes.

Topic and suggested assignments/activities and/assessment
Visits to livestock enterprises to review important breed characteristics for at least two farm animal species.
Classroom session: impact of environment, difference between genotype and phenotype.
Classroom session: traits with high and low heritability, linked traits.
Personal study/assignment completion/individual support.
Assignment 2: Enhancing Reproduction (P3, P4, M2, D2) Tutor introduces brief.
Practical sessions – heat detection and AI.
Classroom session: discussing features of good reproductive husbandry for different livestock species.
Visit or guest speaker – breeding company – technological methods of reproduction.
Discuss moral and ethical viewpoints around use of technology.
Personal study/assignment completion/individual support.
Assignment 3: Evaluating Feeding Plans (P8, P9, M4, D4) Tutor introduces assignment and topic of feeding.
Methods of feeding and watering livestock.
Introduction to evaluative techniques.
Practical session: feeding livestock, followed by evaluation of methods used.
Visit to see alternative feeding methods.
Personal study/assignment completion/individual support.
Assignment 4: Ration Formulation (P5, P6, P7, M3, D3) Tutor introduces brief.
Theory: major nutrients, protein, energy and their measurement (DE, ME).
Theory: factors affecting dietary requirements of animals.
Visit to feed mill/talk by nutritionist.
Feed identification and comparison of nutrient content.
Methods of ration formulation, and practical exercises.
Use of IT to help ration formulation.
Other nutrient considerations – vitamins and minerals.
Personal study/assignment completion/individual support.
Unit review.

Assessment

To achieve a pass learners must meet all the pass criteria.

For P1, learners need to describe the principles of animal breeding, including basic Mendelian genetics, and the reasons for differences between genotype and phenotype. Learners are expected to cover the unit content. Evidence could take the form of responses to short-answer questions, an assignment or a presentation. Questions should be set in a vocational context to maximise relevance for and interest to learners.

For P2, learners need to explain which traits are most desirable for a category of farm livestock. It will be important to identify why the category of livestock is kept, and to outline the reasons why the identified selection traits are desirable. Evidence could be a case study, annotated poster or presentation, and it is likely that pictures or diagrams will enhance learner explanations of the traits.

In P3 learners need to articulate the benefits of enhancing farm animal reproduction. This could be combined with the assessment for P4, where learners need to describe the features of natural and technological methods of enhancing reproduction. Enhancement would be any improvements seen compared to the unmanaged situation. Learners should include some technological methods which are accessible to a livestock producer, as well as those specialist methods predominantly seen in breeding and research centres. Evidence could take the form of an information leaflet, case study, assignment or presentation.

P5 requires learners to identify the factors that affect animals' nutritional requirements, and the unit content should be covered. This can best be achieved by using at least two categories of livestock as examples: one to contrast breeding and growth requirements, and one to contrast maintenance and production. Learners will find this most achievable if they study commonly farmed livestock, where the most literature on nutritional requirements is available. Evidence could take the form of an annotated poster, table, report or information leaflet.

P6 requires learners to compare the nutritional content of a range of feedstuffs. Tutors should identify the range of feedstuffs or agree them through discussion with learners. The feedstuffs selected should be those most commonly used in commercial enterprises. Consideration of nutritional content should include energy and protein content, and the presence of any important vitamins or minerals. Evidence could take the form of annotated samples of feedstuff, an annotated poster or chart, or a descriptive report.

P7 requires learners to formulate a basic ration for selected farm livestock. This can be achieved manually or by using a spreadsheet, but should not include the use of specialist ration formulation software. The livestock the ration is being formulated for and its purpose should be identified clearly and described by the tutor, so that learners are clear about the requirements of the ration. The ration should meet the energy and protein requirements of the selected livestock. Some tutor support is permitted for the pass grade. For example, help in calculating the animal's requirements before learners calculate the ration, help with identifying the most suitable ration ingredients, or suggesting an approach to take if initial calculations are some distance from the animal's requirements. Learners will still be required to complete the ration calculation without assistance.

It is expected that P8 and P9 will be assessed through the same assignment. P8 requires learners to create a checklist to evaluate a feeding plan. The checklist should be created so that feeding plans for different feeding methods can be evaluated, ie a checklist that could be used in a range of situations. The checklist should include the practical detail of all aspects shown in the unit content. P9 requires learners to use the checklist in order to carry out an evaluation. This could take place in a work placement setting or through a supervised visit led by the tutor, but a commercial feeding situation must be viewed and evaluated. It will be helpful for learners to have access to all aspects of the feeding situation, including feed storage and preparation.

To achieve a merit learners need to meet the four merit criteria in addition to meeting the pass criteria.

M1 requires a more in-depth explanation than P1 or P2, and learners need to go beyond the identification of desirable traits to the factors that influence the choice of selection traits for a breeding programme. Learners are expected to apply the theory outlined in P1 and P2 to actual application. This should link the desirable traits with factors such as heritability.

M2 extends the description in P4, and it would be expected that the relative advantages and disadvantages of at least two natural and two technological methods are discussed.

M3 requires learners to work independently in calculating the ration. This would include calculating the animal's requirements and selecting an appropriate choice of feedstuffs.

M4 requires learners to demonstrate a greater depth of understanding than in P9, by summarising and drawing out the key parts of the evaluation.

To achieve a distinction learners need to meet the four distinction criteria as well as meeting the pass and merit criteria.

D1 extends the application of knowledge from M1 into practical situations. It would be expected that this would include consideration of the environmental factors which impact on the success of the programme.

For D2, learners need to justify the use of natural or technological methods to improve reproduction. It is expected they would draw on the advantages and disadvantages identified in M2, and select one or two methods with a clear rationale for their selection. It should be clear that the benefits outweigh the disadvantages for the selected methods.

For D3, learners need to justify the use of their ration in a commercial situation. It is expected that this justification would include practical and cost considerations of sourcing the ingredients, creating and storing the ration and feeding livestock.

To meet D4 learners need to build on the strengths and weaknesses identified in M4 to suggest recommendations for improvement. These should be articulated clearly, with a logical rationale for how and why these improvements could take place.

Programme of suggested assignments

The following table shows a programme of suggested assignments that cover the pass, merit and distinction criteria in the grading grid. This is for guidance and it is recommended that centres either write their own assignments or adapt any Edexcel assignments to meet local needs and resources.

Criteria covered	Assignment title	Scenario	Assessment method
P1, P2, M1, D1	Successful Livestock Breeding	You are advising a livestock farmer on how they can best improve their herd/flock characteristics. Prepare a presentation which helps them in choosing desirable selection traits, and explains what might affect the success of the breeding programme. Produce a leaflet which summarises the theory behind the practice to give them a basic understanding of genetics.	Presentation. Information leaflet.
P3, P4, M2, D2	Enhancing Reproduction	Write an article for a technical farming publication explaining how livestock reproduction can be improved, both through good husbandry and the use of advanced technology. Include the features, benefits and disadvantages of the different methods, and advise the reader of your own recommendations.	Written article.
P8, P9, M4, D4	Evaluating Feeding Plans	Create a checklist to evaluate a feeding plan, and use the checklist to complete an evaluation and recommend improvements.	Completed checklist. Summary of evaluation and recommendations.
P5, P6, P7, M3, D3	Ration Formulation	You are creating a new ration for use on a farm. Create a visual display showing the nutrient value of different feeds, and the factors which affect nutritional requirements. Formulate a balanced ration, and justify its use on the farm.	Display eg poster, leaflet. Completed ration and justification.

Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

This unit forms part of the BTEC land-based sector suite. This unit has particular links with:

Level 2	Level 3
Introduction to Farm Animal Production	Business Management in the Land-based Sector
	Understanding Principles of Land-based Machinery
	Undertake Agricultural Crop Production
	Mechanised Agricultural Crop Handling and Storage
	Understand Grassland Management
	Element CU35.1 Specify diets and feeding regimes Element CU35.2 Monitor and evaluate the feeding of animals

Essential resources

Learners will need access to a range of farm livestock and feedstuffs. Sufficient library and IT resources will need to be available so learners can research the unit content, and suitable practicals and site visits would be beneficial.

Videos and DVDs showing common reproductive techniques such as artificial insemination are available and should be used to supplement any practical activity.

Employer engagement and vocational contexts

As learners are required to develop an understanding of the practical application of genetics, reproductive techniques and nutrition, it will be important that employer input is sought. This could be through guest speakers, but will ideally include farm visits. It will be beneficial if links can be established with feeding and breeding companies, as this will help learners to gain a better appreciation of cutting edge science in practice.

Indicative reading for learners

Textbooks

Chamberlain A and Wilkinson J – *Feeding the Dairy Cow* (Chalcombe Publications, 1996) ISBN 0948617322

Gillespie J – *Modern Livestock and Poultry Production, 6th Edition* (Delmar, 2000) ISBN 0766816079

Green N, Stout G and Taylor D – *Biological Science 1 & 2, 3rd Edition* (Cambridge University Press, 1997) ISBN 0521561787

Gregory J and Jones M – *Central Concepts in Biology* (Cambridge University Press, 1995) ISBN 0521485010

Hayward G – *Applied Genetics* (Nelson Thornes, 1991) ISBN 0174385110

Kent M – *Advanced Biology* (Oxford University Press, 2000) ISBN 0199141959

Peters A and Ball P – *Reproduction in Cattle, 3rd Edition* (Blackwell Publishing, 2004) ISBN 1405115459

Phillips W and Chilton T – *A-level Biology, 3rd Edition* (Oxford University Press, 1995) ISBN 0199146691

Pickering W – *Advanced Biology Revision Handbook* (Oxford University Press, 1998) ISBN 0199147205

Soffe R and McConnell P – *The Agricultural Notebook, 2nd Edition* (Blackwell Science, 2003) ISBN 0632058293

Taylor D – *Growth, Development and Reproduction, 2nd Edition* (Cambridge University Press, 2001) ISBN 052178721 1

Thickett B, Mitchell D and Hallows B – *Calf Rearing* (Farming Press, 2003) ISBN 186126643X

Toole G and Toole S – *Understanding Biology for Advanced Level, 4th Edition* (Nelson Thornes, 2000) ISBN 0748739645

Journals

Animal Science

Beef Farmer

Dairy Farmer

Farmers Guardian

Farmers Weekly

New Scientist

Pig Farming

Poultry World

Websites

www.appliedresearchforum.org.uk	The Agriculture and Horticulture Research Forum
www.dardni.gov.uk	Department of Agriculture and Rural Development Northern Ireland
www.defra.gov.uk	Department for Environment, Food and Rural Affairs

Delivery of personal, learning and thinking skills (PLTS)

The following table identifies the PLTS opportunities that have been included within the assessment criteria of this unit:

Skill	When learners are ...
Independent enquirers	investigating the benefits of enhancing livestock reproduction reviewing natural and technological methods of enhancing livestock reproduction formulating a ration
Creative thinkers	formulating a ration.

Although PLTS opportunities are identified within this unit as an inherent part of the assessment criteria, there are further opportunities to develop a range of PLTS through various approaches to teaching and learning.

Skill	When learners are ...
Independent enquirers	researching feedstuffs and factors affecting nutritional requirements researching principles of breeding
Self-managers	completing assignment tasks.

Functional Skills — Level 2

Skill	When learners are ...
ICT – Find and select information	
Select and use a variety of sources of information independently for a complex task	using the internet to research information on animal breeding and reproductive techniques
ICT – Develop, present and communicate information	
Enter, develop and format information independently to suit its meaning and purpose including: • text and tables • images • numbers • records	using a spreadsheet to carry out ration calculations
Present information in ways that are fit for purpose and audience	presenting assignment work using ICT
Mathematics	
Select and apply a range of skills to find solutions	formulating rations to meet animals' requirements
Use appropriate checking procedures and evaluate their effectiveness at each stage	formulating rations to meet animals' requirements
English	
Speaking and listening – make a range of contributions to discussions and make effective presentations in a wide range of contexts	discussing methods for enhancing reproduction completing a presentation on desirable selection traits
Reading – compare, select, read and understand texts and use them to gather information, ideas, arguments and opinions	carrying out research for assignment completion reviewing methods for enhancing reproduction
Writing – write documents, including extended writing pieces, communicating information, ideas and opinions, effectively and persuasively	completing written assignment work.