Unit 20: Grass and Forage Crop Production

Delivery guidance

Approaching the unit

Unit 20: Grass and Forage Crop Production is an optional unit for learners taking the Level 3 International Diploma in Agriculture. The unit is designed to give learners the opportunity to investigate the life cycle of a wide range of forage crop species; explore the production of commercially produced forage crops; and carry out practical forage crop grazing management tasks. With this unit learners will benefit from the careful planning of the delivery. This unit gives learners the opportunity to apply their knowledge of plant science within a practical setting, for example, when studying plant life cycles. There are also a number of opportunities for learners to engage with employers, such as visiting sites to observe crops being conserved in a commercial environment.
Researchers, growers or merchants' representatives could be invited to the centre to discuss forage crop production with learners, and to demonstrate new technology within the field.

A variety of delivery methods can be used when teaching this unit. Delivery is likely to include visits, practical tasks and tutor presentations, together with individual and group work. Learners will benefit from practical experience of working with forage crops and with associated equipment, such as forage handling machinery.

Delivering the learning aims

Learning aim A

This unit gives learners the opportunity to work with a large number of commercially important forage crops, and to develop an understanding of practical grazing and forage conservation techniques.

Learning aim A has been written to provide a background to grass and forage crop production. In particular, the factors that influence the growth and development of grass and forage crops are explored; the establishment of grass and forage crops is studied; and the digestibility and nutrient value of grazed forage crops is considered. This learning aim can be further developed within the following two learning aims and can be delivered at any time of the year.

Learning aim B

Learning aim B is the most practical of the three learning aims that comprise this unit, as it concerns the practical grazing management of forage and grassland crops. Learners will be involved in the maintenance of healthy forage crops and their management during the grazing season. Throughout the delivery and assessment of this learning aim, tutors will need to make reference to health and safety considerations, relevant legislation and the appropriate codes of practice. The nature of this learning aim means that it must be delivered and assessed during the grazing season.

Learning aim C

Learning aim C focuses on the conservation of forage for feeding livestock in the winter, or for use as supplementary feed during the grazing season. Learners will have the opportunity to study all the common systems for conserving forage crops. They will develop their understanding of the digestibility and nutrient value of conserved forage crops (which was introduced to them in learning aim A), in order to apply this knowledge to practical diet formulation scenarios.
Learners will also study the processes in relation to harvesting and storing conserved forage crops. This learning aim could be delivered in the summer or autumn, when forage is being conserved, and/or the winter, when the forage is being fed to livestock.

It is important to note that in this context, conservation is defined as 'conserving crop products for feeding at a later date'. However, it is recognised that grazing and conservation of forage can be integral in certain habitat management plans. Such habitat management plans could be incorporated into the assessment and delivery of this unit, particularly if suitable local examples are available.

Assessment model

Learning aim	Key content areas	Recommended assessment approach
A Investigate requirements for the growth and development of commercially produced forage crops	**A1** Key biological and physical factors in the growth and development of forage crops **A2** Establishing forage crops **A3** The digestibility and nutrient value of grazed forage crops	An illustrated report or presentation examining forage crop production, and relating this to plant growth and development
B Undertake tasks to maintain healthy forage crops for grazing	**B1** Maintaining healthy forage crop production throughout the grazing season **B2** Key procedures and issues associated with managing forage crops during the grazing season **B3** Legislation and codes of practice	A report and/or presentation examining the production of forage crops for grazing and conservation, supported by a portfolio of evidence relating to the management of forage crops during the grazing season
C Investigate the conservation of forage crops for animal feed	**C1** Common systems for forage crop conservation **C2** The digestibility and nutrient value of conserved forage crops **C3** Processes for harvesting and storing conserved forage crops	

Assessment guidance

This is an internally assessed unit, involving independent learner work. It is suggested that the assessment would take place using two different assignments. The first assignment would focus on covering learning aim A and could be assessed via a report(s) of an appropriate format. Slides, diagrams, posters and/or photographs would provide useful supporting evidence. The assessment could be structured around the science found within the contents of learning aim A, starting with a short task (or sub-task) where learners can demonstrate their knowledge of key terms relating to grassland and forage crops. Learners can then demonstrate that they can contrast the life cycles of annual, biennial and perennial crops in a forage crop context. Suitable examples to cite might be forage maize and fodder beet grown for livestock winter feed, and perennial grass crops grown for grazing. The merit and distinction learners will be able to acknowledge that the digestibility of crop products changes with progression through the species' life cycles. The underlying principles of carbohydrate production, and the influence that physical and environmental factors have upon grass and forage production, could form a task, which could be assessed via posters, graphs and annotated diagrams embedded within a presentation. The themes in this task could be developed, possibly by completing a sub-task, so that learners can demonstrate what effect the correct and timely establishment of forage crops has upon future crop growth and development. This latter suggestion could be a useful theme to allow

differentiation between merit and distinction criteria. There is no particular time of the year when this assessment needs to be set, so timing is not critical.

In contrast to learning aim A, learning aim B (being largely a practical aim) is constrained to a time of the year when animals will be grazing grass, or a forage crop. It is acknowledged that the grazing season varies considerably with location, soil type etc, but the assessment of this learning aim is likely, therefore, to take place in the late spring, summer or early autumn. Tutors must consider what forage crops and classes of livestock are available, together with the likely grazing season, when planning the assessment of this learning aim.

The same assignment can be used to assess both learning aims B and C, with learners building a portfolio of assessment evidence to record the practical tasks undertaken across two contrasting forage crops (as required to achieve learning aim B). The contrasting crops could be grass and a catch crop, such as stubble turnips, or an intensively grazed pasture and a sward managed as part of a habitat management scheme. The assessment evidence for learning aim B could take the form of a report that an agronomist and/or stockperson may make, and could be written, verbal or a combination of the two. An 'agronomist report' format would be the most suitable for recording practical aspects such as the health of the crops monitored, together with fertiliser recommendations (B.P3). A verbal 'stockperson's report' would be the most suitable format for assessing the amount of forage available for grazing, in a given situation (B.P4). If an agronomist's report is chosen as a format, the learners should outline the pests, weeds and diseases that require controlling, but not the active ingredients of any control measure. Any appropriate recording documentation, such as fertiliser records, must be completed accurately as part of the assessment. If there is any requirement to move fences or make minor repairs, this can be assessed as part of this unit, but major repairs or maintenance would be more appropriate to assess as part of *Unit 2: Estate Skills*. An assessor's observation stating that learners have worked safely, competently, efficiently and accurately will form an important part of the assessment evidence.

Learning aim C could be assessed as part of the same assignment as learning aim B. For learning aim C1, learners must provide evidence for two contrasting conservation methods (e.g. wrapped and clamped silage). The learners will need to demonstrate an understanding of how forage quality can be optimised, while using the two methods chosen. This can be further developed for the task written for learning aim C2, where the analysis of forage is investigated, and learners can explain how the quality of conserved forage might affect ration formulation. Tutors can assist learners by supplying forage analysis for crops from different sources, and providing a scenario with each data set. Learners can use these data in ration formulation calculations for different classes of livestock and relate the results back to the conservation and storage regime. Distinction learners will be able to relate all the relevant issues in a coherent manner. This part of the assignment is not dependent upon weather or season, so it could be assessed at any appropriate time of the year, although, ideally, it will follow on from the assessment of learning aim B.

Getting started

This provides you with a starting place for one way of delivering the unit, based around the recommended assessment approach in the specification.

Unit 20: Grass and Forage Crop Production

Introduction

While delivering this unit, opportunities exist to engage learners with the science underpinning the growth and development of grass and forage crops. Learners will have the opportunity to engage in practical grazing management tasks and study the production of conserved forage. During the delivery of the unit, forage crops should be followed logically through the production cycle, from establishment to harvest, storage, and preparation for feeding to livestock.

Learning aim A – Investigate requirements for the growth and development of commercially produced forage crops

- For the delivery of learning aim A1, the unit could be introduced by determining the learners' existing knowledge of grassland and forage crops.
- Key terminology associated with forage crop growth and development (e.g. rough grassland, permanent grassland, pasture, meadow) could be delivered through peer tutoring in small groups.
- A formal tutor presentation of the differences between vegetative and reproductive growth, together with the life cycles of annual, biennial and perennial crops, could be used to introduce this topic. This presentation could be reinforced by independent learner research and a farm walk, where different forage crops are seen growing in the field.
- A tutor-led group discussion could be used to explore the effect of physical factors and environmental factors on forage crop production. This discussion could be supported by a visual map of a country, with tutors illustrating the distribution of a certain crop type e.g. forage crop production (particularly forage maize and rough grazing).
- A guest speaker such as an agronomist or the representative of a seed or fertiliser company could be invited to the centre to explain agronomic influences on grass and forage crop production.
- Learning aim A2 could be introduced by the tutor facilitating a farm walk, where learners can observe the preparations required to establish a forage crop. If this is not possible (e.g. due to the time of the year), suitable slides or photographs could be used instead.
- Facilitate a class discussion concerning how the establishment and the choice of crop, cultivar and/or seed mixture can influence the quality and quantity of forage over the growing season.
- Learners to conduct independent research to find a definition for 'germination' and the emergence in different types of forage crops.
- Tutors could also introduce the role of grass and forage crops in a rotation, and learners could form into small groups to explore the effect that this may have on the control of weeds, pests and diseases in a farm situation.
- For learning aim A3, learners could conduct independent research into the nutrient value of grass and forage crops at various growth and development stages throughout the grazing season.
- Tutors could introduce the concept of 'palatability', and how this affects grazing management (this also provides an introduction to the next topic).

Learning aim B – Undertake tasks to maintain healthy forage crops for grazing

- For learning aim B1, ask learners to form into small groups to produce a 'year planner' for managing given grassland and forage crops.
- The class could then research the nutrient requirements of grassland and forage crops, such as macronutrients (nitrogen, phosphate, potassium), minor nutrients (molybdenum, magnesium etc) and pH. This can also include research into the control of weeds, pests and diseases. (This could follow on from the control of pests etc when establishing the crop.)
- The remainder of this learning aim could be delivered through practical sessions, so it would be appropriate to brief learners regarding the correct personal protective equipment (PPE) and necessary health and safety requirements when undertaking practical tasks.
- These practical sessions can be based on the monitoring of fields that are being, or will be, grazed by livestock. It is therefore very important that this aspect of the unit delivery coincides with a time of year when it can be guaranteed that there will be suitable grassland or forage crops available for livestock to graze.
- Tutors should ensure that the grassland and forage crops are monitored for weeds, pests, diseases and disorders by learners in these sessions. Learners may wish to take photographs during this practical session as evidence for their summative assessment.
- For learning aim B2, learners will need to demonstrate that they know how to estimate the amount of forage available for grazing, and are to identify any potential animal welfare risks (e.g. damaged fences, poisonous plants, and livestock worrying). Again, learners may wish to take photographs for their summative assessment.
- Tutors can demonstrate to learners how to undertake monitoring tasks, such as measuring grass height, through practical sessions.
- For learning aim B3, tutors are to deliver a presentation reminding learners of their legal and ethical responsibilities via Codes of Practice, while managing grassland and forage crops for grazing, e.g. Nitrate Vulnerable Zones (NVZs) and Local Environment Risk Assessment for Pesticides (LERAPs).
- Learners can be given a grazing management plan for a specific habitat, and then asked to interpret the plan in practice. Alternatively, the learners could visit a site that is grazed as part of a habitat management scheme, or a guest speaker from an organisation such as a wildlife trust could be asked to talk to the learners.
- A guest speaker from a quality assurance organisation, such as 'Red Tractor' in the UK, could visit the centre and introduce learners to the recording documentation required such as operator certification requirements associated with forage crop production. The guest speaker could also be asked to mention conserved forage. This approach would form an appropriate introduction to the next topic.

Learning aim C – Investigate the conservation of forage crops for animal feed

- For learning aim C1, introduce the unit by asking learners about the forage conservation methods with which they are familiar. The discussion could be supported by delivering a presentation, using appropriate photographs or images to ensure that all relevant methods (e.g. silage, haylage, hay and dehydration) are covered.
- Tutors could arrange a visit or farm walk in order for learners to study the methods of forage conservation in the area. This would help to reinforce the knowledge gained in classroom sessions.
- This section could be concluded with a tutor-led discussion regarding the factors that

influence the quality of forages, e.g. sugar concentration, pH adjustment, additives and wilting.

- Learning aim C2 can be introduced by showing learners samples of different forages in order to demonstrate the various forage qualities, e.g. colour, texture, taste and smell. Discuss the importance of dry matter and how to recognise its quality. This can be followed by a Q&A session, so that learners can ask questions regarding the learning aim so far.
- Learners can then investigate the methods behind how to sample stored forages effectively, in order to determine forage quality, feed value and suitability of forage for specific classes of livestock.
- Tutors can demonstrate to learners how to interpret the nutrient value of forage samples by holding a practical session using worked examples. Learners can then practise interpreting results of routine forage analysis data, e.g. D value, metabolisable energy (ME), ash and protein and examine how this might relate to ration formulation.
- Learning aim C3 could be introduced by referring to the quality of stored forage crops, so that learners can determine which factors can affect quality (e.g. chop length and/or spoilage in silage).
- Tutors could then establish the learners' existing knowledge of forage crop harvesting and storage facilities through a tutor-led discussion, covering silage production and hay production, including drying methods and other forage crops (see specification).
- Tutors could then arrange for learners to go on a farm walk or site visit, providing an opportunity to discuss the relevant health and safety requirements of working with stored forage crops, harvesting techniques and storage facilities at a specific location. This farm walk could also introduce learners to forage crop-handling equipment and machinery used for harvesting, loading and unloading forage crops, such as grabs, elevators and conveyors and chopper blowers.
- Tutors could deliver an illustrated presentation in a classroom-based session, to familiarise learners with the various handling and storage equipment available commercially.
- The final session can be used to summarise the unit, covering any new innovations and minor crops, or any other conservation techniques not explored earlier.

Details of links to other BTEC units and qualifications, and to other relevant units/qualifications

This unit links to:

- Unit 1: Plant and Soil Science
- Unit 7: Work Experience in the Land-based Sectors
- Unit 12: International Sheep Production
- Unit 13: International Beef Production
- Unit 14: International Dairy Production
- Unit 16: Livestock Nutrition
- Unit 18: Crop Handling, Storage and Quality Assurance
- Unit 23: Land-based Machinery Operations.

Resources

In addition to the resources listed below, publishers are likely to produce Pearson-endorsed textbooks that support this unit of the BTEC Internationals in Agriculture/Horticulture/Land-based subjects. Check the Pearson website (http://qualifications.pearson.com/endorsed-resources) for more information as titles achieve endorsement.

Textbooks

Anon., *Recommended Grass and Clover Lists for England and Wales 2017-18*, Agriculture and Horticulture Development Board, 2017 – The publication contains tables listing cultivars of all the main species of grass and clover recommended for cultivation in the UK, and a commentary explaining the trials methodology and agronomic characteristics. Details are given of pest and disease resistance, together with the quality characteristics of the cultivars listed. This publication is part of a series covering all the main species of crops grown in the UK.

Anon., *Fertiliser Manual (RB209)* (8th Edition), Her Majesty's Stationery Office, 2010 ISBN 9780112432869 – This is the definitive text relating to fertiliser recommendations for the UK. The text explains how fertiliser recommendations are derived, and contains tables from which fertiliser requirements can be calculated for all the main crops grown in the UK. All the programs written to automatically calculate fertiliser requirements have been developed from the research reported in this text.

Anon., *Farm Standards*, Red Tractor Assurance, 2014 – The quality assurance standards for all crops and livestock produced in the UK. This publication is aimed at industry organisations and employees, but learners need to be familiar with its contents before they seek employment in the sector. As a reference source, it will also support delivery and assessment.

Bell B, *Farm Machinery* (6th Edition), Old Pond Publishing, 2016 ISBN 9781910456064 – A recently updated farm machinery textbook, which is appropriate for level 3 learners – The text is useful for all machinery topics, including the handling of forage crop products.

Humphreys LR, *The Evolving Science of Grassland Improvement*, Cambridge University Press, 2008 ISBN 0521038731 – A useful source of background information for the tutor

Journals

Farmers Guardian (Briefing Media Ltd) – general agricultural topics – A weekly newspaper for UK farmers, which is particularly useful for contemporary grazing and livestock updates

Farmers Weekly (Reed Business Information) – general agricultural topics – A weekly magazine for farmers in the UK, which often contains articles regarding grazing management, forage crop handling and storage

Future Farming (Proagrica, Reed Business Information) – agricultural technology – A magazine aimed at decision makers in the industry, containing articles regarding all aspects of the application of technology to agriculture, including forage crop handling, storage and monitoring

Videos

Tutors can access online video sharing sites and search for the following videos:

- 'Understanding soil structure – brought to you by AHDB Dairy' – A video (approximately 13 minutes long) that describes soil management in a grassland context. It is suitable for level 3 learners and could form a briefing for a grassland maintenance task. However, for health and safety reasons, tutors might wish to discourage learners from determining the soil texture by eating it, as illustrated towards the end of the video.
- 'Understanding soils' by AHDB Dairy – A complementary video to the 'Understanding soil structure' one as forage maize is also covered (but there is less information regarding soil texture)

Websites

'Agriculture and Horticulture Development Board' – a website containing information relating to the agricultural and horticultural industries in the UK, including forage crop product handling and grazing livestock. The website is aimed at professionals working in the agriculture and horticulture industries, but it also contains an educational and knowledge transfer section.

'Red Tractor Assurance' – this is the website of the main food assurance organisation in the UK. The website contains guidance regarding the quality assurance requirements of crops grown, directly or indirectly, to supply the food industry. Templates for the crop handling and storage recording documentation are included on the website.

Pearson is not responsible for the content of any external internet sites. It is essential for tutors to preview each website before using it in class so as to ensure that the URL is still accurate, relevant and appropriate. We suggest that tutors bookmark useful websites and consider enabling learners to access them through the school/college intranet.