



# City & Guilds Level 3 Advanced Technical Extended Diploma in Agriculture (1080) (0171-33)

**September 2023 Version 5.5**

(For delivery from September 2023)

**Qualification Handbook**

## Qualification at a glance

<b>Industry area</b>	Agriculture
<b>City &amp; Guilds qualification number</b>	0171-33
<b>Age group</b>	16-19 (Key Stage 5), 19+
<b>Entry requirements</b>	Centres must ensure that any pre-requisites stated in the <i>What is this qualification about?</i> section are met.
<b>Assessment</b>	<p>To gain this qualification, candidates must successfully achieve the following assessments:</p> <ul style="list-style-type: none"> <li>• Two externally set, internally marked, externally moderated synoptic assignments</li> <li>• Three externally set, externally marked exams, sat under examination conditions</li> <li>• Two or three externally set, internally marked, externally verified unit assignments</li> <li>• Portfolio of evidence</li> <li>• Optional unit assessments, externally set, internally marked, externally verified</li> </ul>
<b>Additional requirements to gain this qualification</b>	Employer involvement in the delivery and/or assessment of this qualification is essential for all candidates and will be externally quality assured.
<b>Grading</b>	<p>This qualification is graded</p> <p>For more information on grading, please see Section 7: Grading.</p>
<b>Approvals</b>	This qualification requires full centre and qualification approval
<b>Support materials</b>	<p>Sample assessments</p> <p>Guidance for delivery</p> <p>Guidance on use of marking grids</p>
<b>Registration and certification</b>	Registration and certification of this qualification is through the Walled Garden, and is subject to end dates.
<b>External quality assurance</b>	This qualification is externally quality assured by City & Guilds, and its internally marked synoptic assignments are subject to external moderation. Additional internally assessed units / optional assessments are subject to external verification. There is no direct claim status available for this qualification.

Title and level	Size (GLH)	TQT	City & Guilds qualification number	Ofqual accreditation number
City & Guilds Level 3 Advanced Technical Extended Diploma in Agriculture	1080	1800	0171-33	601/7459/6

Version and date	Change detail	Section
V1.1 May 2016	Small typographical errors	Throughout
	TQT added for qualifications	1. Introduction
	Assessment component titles amended	
	Employer involvement guidance updated throughout	4. Employer involvement
	Summary of assessment methods and conditions	5. Assessment
	Moderation and standardisation of assessment updated throughout	6. Moderation and standardisation of assessment
	Awarding individual assessments Awarding grades and reporting results	7. Grading
V2 July 2016	Enquiries about results	8. Administration
	Re-sits and shelf-life of assessment results	
	Malpractice	
	Access arrangements and special consideration	
V2.1 August 2016	834 removed from list of portfolio units (page 23)	5. Assessment
	Order of assessment objectives amended (page 27)	
V2.2 February 2017	Amendment to theory test component number from 004 to 002.	5. Assessment
V3.0 June 2017	301 assessment methodology updated	Introduction
		5. Assessment
	308 added to assessment table	5. Assessment
	Assessment component numbers updated	Introduction
		5. Assessment
V3.0 June 2017	Minor typos and formatting	Throughout
	Addition of the examination paper based module number	1. Introduction – Assessment requirements and employer involvement
		5. Assessment
		5. Assessment – exam Specification
		7. Grading – Awarding grades and reporting results
		5. Assessment – Assessment Objectives
	Removal of AO 6-8 from Synoptic Assignments and the readjusted approximate weightings	
	Addition of Provisional Grade Boundaries for the Synoptic Assignment	Section 7

Version and date	Change detail	Section
	Revised Exam Specification and AO weightings	5. Assessment – Exam Specification
	Branding Changes	Throughout
V3.1 December 2017	Livestock pathway ROC clarified	Introduction
V4.0 August 2018	Update to grading details	Section 7
V4.1 November 2018	Assessment method for unit 301 amended	1. Introduction 5. Assessment
V5.1 May 2019	Wording changed regarding retakes	5. Assessment – Summary of assessment methods and conditions 8. Administration – Re-sits and shelf-life of assessment results
V5.2 May 2019	Amendments to AO weightings for Level 3 Advanced Technical Extended Diploma in Agriculture (1080) (Farm mechanisation)	5. Assessment
V5.3 September 2020	Wording updated in Unit 331 learning outcome 2, topic 2.1	Unit 331
V5.4 May 2023	Amended assessment method for unit 301 Component number for assessment unit changed from 301 to 300	5 Assessment
	Clarified moderation and external verification processes	5 Assessment 6 Moderation and standardisation of assessment
	Updated website links and references	3 Delivering Technicals qualifications - Support materials 8 Administration
V5.5 September 2023	Revision to the exam specification for the health and safety test component (300)	5 Exam specification

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# 1 Introduction

## What is this qualification about?

The following purpose is for the **City & Guilds Level 3 Advanced Technical Extended Diploma in Agriculture (1080)**

Area	Description
OVERVIEW	
Who is this qualification for?	<p>This qualification is for you if you are 16 years or older and want to work in agriculture. It is designed to provide you with a very wide range of specialist technical practical skills and detailed knowledge and understanding which will equip you to seek a diverse range of employment opportunities, or to further learning and training within the agricultural industry.</p> <p>On successful completion of the qualification, you will be awarded with one of the following:</p> <p>Level 3 Advanced Technical Extended Diploma in Agriculture (Livestock) (1080) Or Level 3 Advanced Technical Extended Diploma in Agriculture (Arable) (1080) Or Level 3 Advanced Technical Extended Diploma in Agriculture (Farm Mechanisation) (1080).</p>
What does this qualification cover?	<p>This qualification gives you the opportunity to learn about and build on the essentials of working in farming such as safe working practices in farming, livestock husbandry and crop production, plant and soil science, estate skills and operating agricultural machinery as well as business skills.</p> <p>You will then choose to specialise in either <b>livestock, arable or farm mechanisation</b>.</p> <p>Students choosing the livestock option will go to study subjects such as farm livestock health and nutrition, pollution and waste control management, business improvement and farm animal science, plus you will learn about specialist dairy, beef, sheep, pig or poultry production. You will also study further topics such as grassland management or farm habitat management. This would be for you if you really enjoy the aspects of farming relating to animals and their husbandry and production.</p>

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If you chose the arable option, then you will learn those skills that are particularly important for working with agricultural crops such as pollution and waste control management, business improvement, agricultural spreaders and sprayers plus further subjects such as forage crop production, grassland management, harvesting, storage and marketing of root crops, field vegetable production and combinable crop production.

For the farm mechanisation pathway, you will focus on the agricultural machinery side. You will learn about land-based power units and workshop practice, plus you will study further topics such as repairing compression-ignition engines, mechanical power transmission systems, spark-ignition (petrol) engines, cultivation, planting and application machinery and harvesting machinery.

Centres and providers work with local employers who will contribute to the knowledge and delivery of training. Employers will provide demonstrations and talks on the industry and where possible work placements will also be provided by the employers. This practically based training is ideal preparation for gaining employment in the agricultural industry or specialist further study.

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#### WHAT COULD THIS QUALIFICATION LEAD TO?

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Will the qualification lead to employment, and if so, in which job role and at what level?

This two-year qualification exposes you to the whole industry, and the opportunities within it. On completion, it is likely that you will enter the industry by working for a farm business, or as a farming contractor. As you will have gained a breadth and depth of skills and knowledge over a very wide range of units, you could progress within work to become a:

##### **In livestock pathway**

- Herdsperson
- Shepherd
- Dairyman
- Contractor (livestock)
- Assistant Poultry Unit Manager

##### **In arable pathway**

- Contractor (crops)
- Agricultural technician
- Assistant head tractor driver
- Fixed plant manager
- Sprayer operator

##### **In farm mechanisation pathway**

- Machinery technician
- Farm mechanic.

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Why choose this qualification over similar qualifications?

You are likely to take this qualification full-time over 2 years. You have the option of three separate pathways which will enable you to prepare to enter the many diverse opportunities within agriculture,

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focussing on a broad basis of skills that employer's value, whilst studying in greater depth the areas that will enable you to seek specialised and more demanding job roles.

City & Guilds offers four sizes of Level 3 qualification in Agriculture: Certificate, Diploma (540), Extended Diploma (720) and Extended Diploma (1080).

You would take the Certificate if you want an introductory qualification to develop some of the core skills and knowledge required by employers in the agricultural industry. The Certificate is likely to be taken alongside other programmes such as GCSEs or AS Levels over a one-year course of study.

You would take the Diploma (540) if you want a qualification to develop some of the skills and knowledge that can lead to specific roles required by employers in the agricultural industry. The Diploma (540) is likely to be taken alongside other programmes such as GCSEs or AS Levels over a one-year course of study.

You would take the Extended Diploma (720) if you want to specialise, to develop most of the skills and knowledge required by employers in the agricultural industry. The Extended Diploma (720) is likely to be taken as part of a full-time two year programme of study, or alongside other qualifications such as AS or A Levels over a longer period of time.

You would take the Extended Diploma (1080) if you want to specialise and develop the skills and knowledge required by employers in the agricultural industry. The Extended Diploma (1080) is likely to be taken as a full-time programme of study over two years. By taking this large qualification, you will be exposed to, and have the opportunity to gain experience in, the wider agricultural sector. This will enable you to progress to a diverse range of employment opportunities, as you will have gained hands-on experience over 2 years, which employers really value.

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Will the qualification lead to further learning?

You may wish to progress onto further learning within a Higher Education Institution. You could study courses such as:

- Agriculture Foundation Degree
- BSc (Hons) Agriculture
- Agriculture with Animal Science BSc (Hons) Degree
- Agriculture with Business Studies BSc (Hons) Degree
- Agriculture with Countryside Management BSc (Hons) Degree.

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#### WHO SUPPORTS THIS QUALIFICATION?

Employer/Higher Education Institutions

The National Farmers Union  
The British Growers Association  
Davies Pentra'lltddu Ltd.

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## Qualification structure

For the **City & Guilds Level 3 Advanced Technical Extended Diploma in Agriculture (1080) (Livestock)** the teaching programme must cover the content detailed in the structure below:

Unit number	Unit title	GLH
<b>Mandatory</b>		
301	Principles of health and safety	30
302	Undertake and review work related experience in the Land-based Industries	30
303	Land-based industry machinery operations	60
304	Agricultural crop production	60
305	Plant and soil science	60
306	Undertake estate skills	60
307	Livestock husbandry	60
308	Business management in the Land-based sector	60
309	Undertake a specialist project in the land-based sector	60
313	Farm animal health and nutrition	60
316	Pollution and waste control management	60
325	Exploring improvements, opportunities for diversification and new business initiatives with in the land-based sector	60
334	Farm animal science	60
335	All-terrain vehicles and rough terrain telescopic forklift	60
<b>Optional – Learners must be taught at least 300 GLH from units 310-312, 317-323, 326, 332. 120 GLH must come from units 319-323</b>		
310	Land-based power units	60
311	Forage crop production	60
312	The principles of grassland management	60
317	Farm habitat management	60
318	Undertake land based workshop processes	60
319	Dairy production	60
320	Beef production	60
321	Pig production	60
322	Poultry production	60
323	Sheep production	60
326	Spreaders and sprayers	60
332	Repair land based combinable or root crop harvesting machinery	60

For the **City & Guilds Level 3 Advanced Technical Extended Diploma in Agriculture (1080) (Arable)** the teaching programme must cover the content detailed in the structure below:

Unit number	Unit title	GLH
<b>Mandatory</b>		
301	Principles of health and safety	30
302	Undertake and review work experience in the Land-based Industries	30
303	Land-based industry machinery operations	60
304	Agricultural crop production	60
305	Plant and soil science	60
306	Undertake estate skills	60
307	Livestock husbandry	60
308	Business management in the Land-based sector	60
309	Undertake a specialist project in the land-based sector	60
316	Pollution and waste control management	60
317	Farm habitat management	60
318	Undertake land based workshop processes	60
325	Exploring improvements, opportunities for diversification and new business initiatives with in the land-based sector	60
326	Spreaders and sprayers	60
335	All terrain vehicles and rough terrain telescopic forklift	60
<b>Optional – Learners must be taught at least 240 GLH from units 310-312, 314-315, 324, 332, 336.</b>		
310	Land-based power units	60
311	Forage crop production	60
312	The principles of grassland management	60
314	Root crop production	60
315	Field vegetable production	60
324	Mechanised agricultural crop handling and storage	60
332	Repair land based combinable or root crop harvesting machinery	60
336	Combinable crop production	60

For the **City & Guilds Level 3 Advanced Technical Extended Diploma in Agriculture (1080) (Farm Mechanisation)** the teaching programme must cover the content detailed in the structure below:

Unit number	Unit title	GLH
<b>Mandatory</b>		
301	Principles of health and safety	30
302	Undertake and review work experience in the Land-based Industries	30
303	Land-based industry machinery operations	60
304	Agricultural crop production	60
305	Plant and soil science	60
306	Undertake estate skills	60
307	Livestock husbandry	60
308	Business management in the land-based sector	60
309	Undertake a specialist project in the land-based sector	60
310	Land-based power units	60
318	Undertake land based workshop processes	60
<b>Optional – Learners must be taught at least 480 GLH from units 311-312, 314-317, 324-333, 335-336. 240 GLH must be from 327-333.</b>		
311	Forage crop production	60
312	The principles of grassland management	60
314	Root crop production	60
315	Field vegetable production	60
316	Pollution and waste control management	60
317	Farm habitat management	60
324	Mechanised agricultural crop handling and storage	60
325	Exploring improvements, opportunities for diversification and new business initiatives with in the land-based sector	60
326	Spreaders and sprayers	60
327	Repair land based compression-ignition, diesel engines	60
328	Repair land based spark-ignition, petrol engines	60
329	Repair land based cultivation or drilling machinery	60
330	Repair land based application machinery	60
331	Repair land based forage harvesting machinery	60
332	Repair land based combinable or root crop harvesting machinery	60
333	Repair Land-based Mechanical Power Transmission Systems	60
335	All-Terrain vehicles and rough terrain telescopic forklift	60

**Total qualification time (TQT)**

Total Qualification Time (TQT) is the total amount of time, in hours, expected to be spent by a Learner to achieve a qualification. It includes both guided learning hours (which are listed separately) and hours spent in preparation, study and assessment.

Title and level	GLH	TQT
City & Guilds Level 3 Advanced Technical Extended Diploma in Agriculture	1080	1800

## Assessment and employer involvement

To achieve the **City & Guilds Level 3 Advanced Technical Extended Diploma in Agriculture (1080) (Livestock)** candidates must successfully complete **all** the mandatory assessment components **as well as** the optional assessment components for their chosen optional units.

Component number	Title
<b>Mandatory</b>	
001	Level 3 Agriculture - Synoptic assignment (1)*
002 or 502	Level 3 Agriculture - Theory exam (1)*
009	Level 3 Agriculture - Synoptic assignment (2)*
010 or 510	Level 3 Agriculture - Theory exam (2)*
300	Level 3 Principles of health and safety – Theory exam (evolve online)
302	Level 3 Undertake and review work related experience in the land-based industries - Portfolio
308	Level 3 Business management in the land-based sector –Assignment
309	Level 3 Undertake a specialist project in the Land-Based sector - Assignment
325	Level 3 Exploring improvements, opportunities for diversification and new business initiatives with in the land-based sector – Assignment
<b>Optional</b>	
310	Level 3 Land-based power units - Assignment
311	Level 3 Forage crop production - Assignment
312	Level 3 The principles of grassland management - Assignment
317	Level 3 Farm habitat management - Assignment
318	Level 3 Undertake land-based workshop processes - Assignment
319	Level 3 Dairy production - Assignment
320	Level 3 Beef production - Assignment
321	Level 3 Pig production - Assignment
322	Level 3 Poultry production - Assignment
323	Level 3 Sheep production - Assignment
326	Level 3 Spreaders and sprayers - Assignment
332	Level 3 Repair land based combinable or root crop harvesting machinery - Assignment

To achieve the **City & Guilds Level 3 Advanced Technical Extended Diploma in Agriculture (1080) (Arable)** candidates must successfully complete **all** the mandatory assessment components **as well as** the optional assessment components for their chosen optional units.

Component number	Title
<b>Mandatory</b>	
001	Level 3 Agriculture - Synoptic assignment (1)*
002 or 502	Level 3 Agriculture - Theory exam (1)*
011	Level 3 Agriculture - Synoptic assignment (2)*
012 or 512	Level 3 Agriculture - Theory exam (2)*
300	Level 3 Principles of health and safety – Theory exam (evolve online)
302	Level 3 Undertake and review work related experience in the land-based industries - Portfolio
308	Level 3 Business management in the land-based sector –Assignment
309	Level 3 Undertake a specialist project in the Land-Based sector - Assignment
325	Level 3 Exploring improvements, opportunities for diversification and new business initiatives with in the land-based sector – Assignment
<b>Optional</b>	
310	Level 3 Land-based power units - Assignment
311	Level 3 Forage crop production - Assignment
312	Level 3 The principles of grassland management - Assignment
314	Level 3 Root crop production - Assignment
315	Level 3 Field vegetable production - Assignment
324	Level 3 Mechanised agricultural crop handling and storage
332	Level 3 Repair land based combinable or root crop harvesting machinery - Assignment
336	Level 3 Combinable crop production - Assignment

To achieve the **City & Guilds Level 3 Advanced Technical Diploma in Agriculture (1080) (Farm Mechanisation)** candidates must successfully complete **all** the mandatory assessment components **as well as** the optional assessment components for their chosen optional units.

City & Guilds component number	Title
<b>Mandatory</b>	
001	Level 3 Agriculture - Synoptic assignment (1)*
002 or 502	Level 3 Agriculture - Theory exam (1)*
013	Level 3 Agriculture - Synoptic assignment (2)*
014 or 514	Level 3 Agriculture - Theory exam (2)*
300	Level 3 Principles of health and safety - Theory exam (evolve online)

302	Level 3 Undertake and review work related experience in the land-based industries - Portfolio
308	Level 3 Business management in the land-based sector –Assignment
309	Level 3 Undertake a specialist project in the Land-Based sector - Assignment
<b>Optional</b>	
311	Level 3 Forage crop production - Assignment
312	Level 3 The principles of grassland management - Assignment
314	Level 3 Root crop production - Assignment
315	Level 3 Field vegetable production – Assignment
316	Level 3 Pollution and waste control management
317	Level 3 Farm habitat management - Assignment
324	Level 3 Mechanised agricultural crop handling and storage
325	Level 3 Exploring improvements, opportunities for diversification and new business initiatives with in the land-based sector
326	Level 3 Spreaders and sprayers - Assignment
327	Level 3 Repair land-based compression-ignition (Diesel) engines - Assignment
328	Level 3 Repair land based spark-ignition, petrol engines - Assignment
329	Level 3 Repair land based cultivation or drilling machinery - Assignment
330	Level 3 Repair land based application machinery - Assignment
331	Level 3 Repair land based forage harvesting machinery - Assignment
332	Level 3 Repair land based combinable or root crop harvesting machinery - Assignment
333	Level 3 Repair land based mechanical power transmission systems
335	Level 3 All terrain vehicles and rough terrain telescopic forklift - Assignment
336	Level 3 Combinable crop production - Assignment

In addition, candidates **must** complete the mandatory employer involvement requirement for this qualification **before** they can be awarded a qualification grade. For more information, please see guidance in *Section 4: Employer involvement*.

### Employer involvement

Component number	Title
<b>Mandatory</b>	
833	Employer involvement

\*Number of mandatory assessments per assessment type

## 2 Centre requirements

### Approval

New centres will need to gain centre approval. Existing centres who wish to offer this qualification must go through City & Guilds' full Qualification Approval Process. There is no fast track approval for this qualification. Please refer to the City & Guilds website for further information on the approval process: [www.cityandguilds.com](http://www.cityandguilds.com)

### Resource requirements

Centre staff should familiarise themselves with the structure, content and assessment requirements of the qualification before designing a course programme.

### Centre staffing

Staff delivering these qualifications must be able to demonstrate that they meet the following requirements:

- be technically competent in the areas in which they are delivering
- be able to deliver across the breadth and depth of the content of the qualification being taught
- have recent relevant teaching and assessment experience in the specific area they will be teaching, or be working towards this
- demonstrate continuing CPD.

### Physical resources

Centres must be able to demonstrate that they have access to the equipment and technical resources required to deliver this qualification and its assessment.

### Internal Quality Assurance

Internal quality assurance is key to ensuring accuracy and consistency of tutors and markers. Internal Quality Assurers (IQAs) monitor the work of all tutors involved with a qualification to ensure they are applying standards consistently throughout assessment activities. IQAs must have, and maintain, an appropriate level of technical competence and be qualified to make both marking and quality assurance decisions through a teaching qualification or recent, relevant experience.

### Learner entry requirements

Centres must ensure that all learners have the opportunity to gain the qualification through appropriate study and training, and that any prerequisites stated in the *What is this qualification about?* section are met when registering on this qualification.

### Age restrictions

This qualification is approved for learners aged 16 – 19, 19+.

## 3 Delivering technical qualifications

### Initial assessment and induction

An initial assessment of each learner should be made before the start of their programme to identify:

- if the learner has any specific learning or training needs,
- support and guidance they may need when working towards their qualification,
- the appropriate type and level of qualification.

We recommend that centres provide an introduction so that learners fully understand the requirements of the qualification, their responsibilities as a learner, and the responsibilities of the centre. This information can be recorded on a learning contract.

### Employer involvement

Employer involvement is essential to maximise the value of each learner's experience. Centres are required to involve employers in the delivery of technical qualifications at Key Stage 5 and/or their assessment, for every learner. This must be in place or planned before delivery programmes begin in order to gain qualification approval. See *Section 4: Employer involvement* for more detail.

### Support materials

The following resources are available for this qualification:

Description	How to access
Sample assessments	Available on the qualification pages on the <b>City &amp; Guilds Website: <a href="http://www.cityandguilds.com">www.cityandguilds.com</a></b>
Technical Qualifications: Guide to Teaching, Learning and Assessment	Available on the City and Guilds website: <b><a href="#">14-19-teaching-learning-assessment-guide-pdf.ashx</a></b> <b>(<a href="http://cityandguilds.com">cityandguilds.com</a>)</b>
Quality Assurance Guide for Centres: Technical Qualifications and the Extended Project Qualification (EPQ)	Available on the City and Guilds website: <b><a href="#">technicals-quality-assurance-guide-for-centres-pdf.ashx</a></b> <b>(<a href="http://cityandguilds.com">cityandguilds.com</a>)</b>

## 4 Employer involvement

Employer involvement is a formal component of Key Stage 5 Technical qualifications. It does not contribute to the overall qualification grading, but is a mandatory requirement that all learners must meet. As such it is subject to external quality assurance by City & Guilds.

Department for Education (DfE) requirements state:

*Employer involvement in the delivery and/or assessment of technical qualifications provides a clear 'line of sight' to work, enriches learning, raises the credibility of the qualification in the eyes of employers, parents and students and furthers collaboration between the learning and skills sector and industry.*

*[Technical qualifications] must:*

- *require all students to undertake meaningful activity involving employers during their study; and*
- *be governed by quality assurance procedures run by the awarding organisation to confirm that education providers have secured employer involvement for every student.*

Extract from: ***Vocational qualifications for 16 to 19 year olds, 2017 and 2018 performance tables: technical guidance for awarding organisations, paragraphs 89-90***

City & Guilds will provide support, guidance and quality assurance of employer involvement.

### Qualification approval

To be approved to offer City & Guilds technicals, centres must provide an Employer Involvement planner and tracker showing how every learner will be able to experience meaningful employer involvement, and from where sufficient and suitable employer representatives are expected to be sourced.

Centres must include in their planer a sufficient range of activities throughout the learning programme that provide a range of employer interactions for learners. Centres must also plan contingencies for learners who may be absent for employer involvement activities, so that they are not disadvantaged.

As part of the approval process, City & Guilds will review this planner and tracker. Centres which cannot show sufficient commitment from employers and/or a credible planner and tracker will be given an action for improvement with a realistic timescale for completion. **Approval will not be given** if employer involvement cannot be assured either at the start of the qualification, or through an appropriate plan of action to address this requirement before the learner is certificated.

### Monitoring and reporting learner engagement

Employer involvement is a formal component of this qualification and is subject to quality assurance monitoring. Centres must record evidence that demonstrates that each learner has been involved in meaningful employer based activities against the mandatory content before claiming the employer involvement component for learners.

Centres must record the range and type of employer involvement each learner has experienced and submit confirmation that all learners have met the requirements to City & Guilds. If a centre cannot provide evidence that learners have met the requirements to achieve the component, then the learner will not be able to achieve the overall Technical Qualification.

### Types of involvement

Centres should note that to be eligible, employer involvement activities **must** relate to one or more elements of the mandatory content of this qualification. This does not mean that employer involvement in the optional units is not valuable, and centres are encouraged to consider this wherever appropriate.

As the aim of employer involvement is to enrich learning and to give learners a taste of the expectations of employers in the industry area they are studying, centres are encouraged to work creatively with local employers.

Employers can identify the areas of skills and knowledge in their particular industry that they would wish to see emphasised for learners who may apply to work with them in the future. Centres and employers can then establish the type of input, and which employer representative might be able to best support these aims.

To be of most benefit this must add to, rather than replace the centre's programme of learning. Some examples of meaningful employer involvement are listed below. Employer involvement not related to the mandatory element of the qualification, although valuable in other ways, does not count towards this element of the qualification.

The DfE has provided the following examples of what does and does not count as meaningful employer involvement, as follows<sup>1,2</sup>:

#### ***The following activities meet the requirement for meaningful employer involvement:***

- *students undertake structured work-experience or work-placements that develop skills and knowledge relevant to the qualification<sup>3</sup>;*
- *students undertake project(s), exercises(s) and/or assessments/examination(s) set with input from industry practitioner(s);*
- *students take one or more units delivered or co-delivered by an industry practitioner(s). This could take the form of master classes or guest lectures;*
- *industry practitioners operate as 'expert witnesses' that contribute to the assessment of a student's work or practice, operating within a specified assessment framework. This may be a specific project(s), exercise(s) or examination(s), or all assessments for a qualification.*

*In all cases participating industry practitioners and employers must be relevant to the industry sector or occupation/occupational group to which the qualification relates.*

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<sup>1</sup> As extracted from: Vocational qualifications for 16 to 19 year olds  
2017 and 2018 performance tables: technical guidance for awarding organisations

<sup>2</sup>This list has been informed by a call for examples of good practice in employer involvement in the delivery and assessment of technical qualifications - **Employer involvement in the delivery and assessment of vocational qualifications**

<sup>3</sup> **DfE work experience guidance**

***The following activities, whilst valuable, do not meet the requirement for meaningful employer involvement:***

- *employers' or industry practitioners' input to the initial design and content of a qualification;*
- *employers hosting visits, providing premises, facilities or equipment;*
- *employers or industry practitioners providing talks or contributing to delivery on employability, general careers advice, CV writing, interview training etc;*
- *student attendance at career fairs, events or other networking opportunities;*
- *simulated or provider-based working environments eg hairdressing salons, florists, restaurants, travel agents, small manufacturing units, car servicing facilities;*
- *employers providing students with job references.*

### **Types of evidence**

For each employer involvement activity, centres are required to provide evidence of which learners undertook it, e.g. a candidate attendance register. The types of additional evidence required to support a claim for this component will vary depending on the nature of the involvement. Eg for a guest lecture it is expected that a synopsis of the lecture and register would be taken which each learner and the guest speaker will have signed; expert witnesses will be identified and will have signed the relevant assessment paperwork for each learner they have been involved in assessing; evidence of contribution from employers to the development of locally set or adapted assignments.

### **Quality assurance process**

As the employer involvement component is a requirement for achieving the KS5 Technical qualifications, it is subject to external quality assurance by City & Guilds at the approval stage and when centres wish to claim certification for learners.

Evidence will be validated by City & Guilds before learners can achieve the employer involvement component. Where employer involvement is not judged to be sufficient, certificates cannot be claimed for learners.

### **Sufficiency of involvement for each learner**

It is expected that the centre will plan a range of activities that provide sufficient opportunities for each learner to interact directly with a range of individuals employed in the related industry. Centres must also provide contingencies for learners who may be absent for part of their teaching, so they are not disadvantaged. Any absence that results in a learner missing arranged activities must be documented. Where learners are unable to undertake all employer involvement activities due to temporary illness, temporary injury or other indisposition, centres should contact City & Guilds for further guidance.

### **Live involvement**

Learners will gain most benefit from direct interaction with employers and/or their staff, however the use of technology (e.g. the use of live webinars) is encouraged to maximise the range of interactions. Where learners are able to interact in real time with employers, including through the use of technology, this will be classed as 'live involvement'.

It is considered good practice to record learning activities, where possible, to allow learners to revisit their experience and to provide a contingency for absent learners. This is not classed as live involvement however, and any involvement of this type for a learner must be identified as contingency.

### **Timing**

A learner who has not met the minimum requirements cannot be awarded the component, and will therefore not achieve the qualification. It is therefore important that centres give consideration to scheduling employer involvement activities, and that enough time is allotted throughout delivery and assessment of the qualification to ensure that requirements are fully met.

## 5 Assessment

### Summary of assessment methods and conditions

Component numbers	Assessment method	Description and conditions
001, 009, 011, 013	Synoptic assignment	<p>The synoptic assignment are <b>externally set, internally marked and externally moderated</b>. The assignment requires candidates to identify and use effectively in an integrated way an appropriate selection of skills, techniques, concepts, theories, and knowledge from across the content area. Candidates will be judged against the assessment objectives.</p> <p>Assignments will be released to centres as per dates indicated in the Assessment and Examination timetable published on our website.</p> <p>Where seasonality is a factor in the timing of the assignment the assignment will be released early to ensure that candidates can take the assignment to fit in with the seasonal requirements.</p> <p>Centres will be required to maintain the security of all live assessment materials. Assignments will be password protected and released to centres through a secure method.</p> <p>There will be one opportunity within each academic year to sit the assignment. Candidates who fail the assignment will have one re-sit opportunity. The re-sit opportunity will be in the next academic year, and will be the assignment set for that academic year once released to centres. If the re-sit is failed, the candidate will fail the qualification.</p> <p>Please note that for externally set assignments City &amp; Guilds provides guidance and support to centres on the marking and moderation process.</p>
002/502, 010/510, 012/512, 014/514	Externally marked exams	<p>The exams are <b>externally set and externally marked</b>, and will be taken either online through City &amp; Guilds' computer-based testing platform (002, 010, 012, 014) or as a paper based test (502, 510, 512, 514).</p> <p>The exams are designed to assess the candidate's depth and breadth of understanding across content in the qualification at the end of the period of learning, using a range of question types and will be sat under invigilated examination conditions. See JCQ requirements for details: <a href="http://www.jcq.org.uk/exams-office/ice--instructions-for-conducting-examinations">http://www.jcq.org.uk/exams-office/ice--instructions-for-conducting-examinations</a></p>

Component numbers	Assessment method	Description and conditions
		<p>The exam specification shows the coverage of the exam across the qualification content.</p> <p>Candidates who fail the exam at the first sitting will have a maximum of two opportunities to retake. If the candidate fails the exam three times then they will fail the qualification. (Note: the third and final retake opportunity applies to Level 3 only.) For exam dates, please refer to the Assessment and Examination timetable.</p>
302	Portfolio of evidence	This unit will be evidenced by a portfolio of evidence.
300	Evolve online on-demand exam	<p>This exam is <b>externally set and externally marked</b> and will be taken online through City &amp; Guilds' computer-based testing platform under invigilated exam conditions. The exam is available on-demand and can be taken at any time in the year.</p> <p>There is no maximum number of retake attempts for this exam , however, learners should be given sufficient time and tutor support before resitting.</p>
308, 309, 325	Unit assignment	<p>The unit assignment is <b>externally set, internally marked and externally verified</b>. The assignment requires candidates to identify and use effectively skills, knowledge and understanding from across the unit content area. Candidates will be judged against the unit grading criteria</p> <p>Arrangements for release, security and re-sitting assignments are the same as detailed for the synoptic assignment.</p>
Optional Units 310, 311, 312, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327 328, 329, 330, 331, 332, 333, 335, 336	Unit assignments	<p>The unit assignment are <b>externally set, internally marked and externally verified</b>. The assignment requires candidates to identify and use effectively skills, knowledge and understanding from across the unit content area. Candidates will be judged against the unit grading criteria</p> <p>Arrangements for release, security and re-sitting assignments are the same as detailed for the synoptic assignment.</p>

## **What is synoptic assessment?**

Technical qualifications are based around the development of a toolkit of knowledge, understanding and skills that an individual needs in order to have the capability to work in a particular industry or occupational area. Individuals in all technical areas are expected to be able to apply their knowledge, understanding and skills in decision making to solve problems and achieve given outcomes independently and confidently.

City & Guilds technical qualifications require candidates to draw together their learning from across the qualification to solve problems or achieve specific outcomes by explicitly assessing this through the synoptic assignment component.

In this externally set, internally marked and externally moderated assessment the focus is on bringing together, selecting and applying learning from across the qualification rather than demonstrating achievement against units or subsets of the qualification content. The candidate will be given an appropriately levelled, substantial, occupationally relevant problem to solve or outcome to achieve. For example this might be in the form of a briefing from a client, leaving the candidate with the scope to select and carry out the processes required to achieve the client's wishes, as they would in the workplace.

Candidates will be marked against assessment objectives (AOs) such as their breadth and accuracy of knowledge, understanding of concepts, and the quality of their technical skills as well as their ability to use what they have learned in an integrated way to achieve a considered and high quality outcome.

## **How the assignment is synoptic for this qualification**

The typical assignment brief could be to develop a business plan to takeover and improve a livestock and arable farm.

This will require the candidate to draw on their knowledge and understand of both livestock and arable enterprises to enable them to plan the use of farm land to ensure sound husbandry will be used, wildlife is enhanced and the land maintained. Candidate's decisions will be supported by their understanding of the value of Agriculture to the UK economy, the use of soil maps and research to successfully produce cropping plans, their understanding of the different crops and livestock and how best they are nurtured. Candidates will also demonstrate practical farm activities.

## **External exam for stretch, challenge and integration**

The externally set, externally marked exams (002/502 and 010/510 or 012/512 or 014/514) will draw from across the mandatory content of the qualification, using a range of shorter questions to confirm breadth of knowledge and understanding. Extended response questions are included, giving candidates the opportunity to demonstrate higher level understanding and integration through discussion, analysis and evaluation, and ensuring the assessment can differentiate between 'just able' and higher achieving candidates.

## **Optional unit assessments and integration into the synoptic qualification content**

While the mandatory units for this qualification provide the main skills and knowledge required to work in Agriculture; Livestock, Crop or Farm Mechanisation, the optional units provided give centres flexibility when devising programmes to meet local employment needs, where the purpose of the qualification demands this.

The assessments for the optional units will require that the candidate has experienced the full breadth of mandatory learning of the qualification in order to better demonstrate the rounded performance expected at higher grades.

Optional unit assessments are externally set, internally marked and externally verified.

### Assessment objectives

The assessments for this qualification are set against a set of assessment objectives (AOs) which are used across all City & Guilds Technicals to promote consistency among qualifications of a similar purpose. They are designed to allow judgement of the candidate to be made across a number of different categories of performance.

Each assessment for the qualification has been allocated a set number of marks against these AOs based on weightings recommended by stakeholders of the qualification. This mark allocation remains the same for all versions of the assessments, ensuring consistency across assessment versions and over time.

The following table explains all AOs in detail, including approximate weightings for the synoptic assignments. In some cases, due to the nature of a qualification's content, it is not appropriate to award marks for some AOs. Where this is the case these have been marked as N/A. Weightings for exams (AOs 1, 2 and 4 only) can be found with the exam specification.

#### City & Guilds Level 3 Advanced Technical Extended Diploma in Agriculture (1080) (Arable)

Assessment objective	Typical expected evidence of knowledge, understanding and skills	Approximate weighting
<b>AO1</b> Recalls knowledge from across the breadth of the qualification.	Use of terminology, health and safety considerations, welfare codes, environmental impact, recognising animal behaviour, signs of animal health, legislation and policies, routine tasks, waste management, spreaders and sprayers machinery use.	20%
<b>AO2</b> Demonstrates understanding of concepts, theories and processes from across the breadth of the qualification.	Planting specifications, weed, pest and disease control, rates and timings of fertilisers, interpreting data, application of legislation and codes of practices, storage conditions, harvest losses, physical and financial records, importance to the economy, quality management, market requirements, components used in all-terrain vehicles and rough terrain telescopic forklifts, development in technology, farm habitats, safe working practices, business opportunities and improvements	25%
<b>AO3</b> Demonstrates technical skills from across the breadth of the qualification.	Livestock husbandry tasks, estate skills and machinery operations, preparation, operation and maintenance of all-terrain vehicles and rough terrain telescopic forklift and spreaders and sprayers, waste disposal, business plans, surveying farm habitats, result reporting, maintaining land-based equipment.	30%
<b>AO4</b> Applies knowledge, understanding and skills from across the breadth of the qualification in an integrated and holistic way to achieve specified purposes.	Applying and linking knowledge, understanding and practical skills to a particular situation, justifying decisions/ approaches, taken contingencies, reflection and evaluation.	15%

<b>AO5</b> Demonstrates perseverance in achieving high standards and attention to detail while showing an understanding of wider impact of their actions.	Meeting specific requirements of the task; care of equipment; time management	10%
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### City & Guilds Level 3 Advanced Technical Extended Diploma in Agriculture (1080) (Livestock)

Assessment objective	Typical expected evidence of knowledge, understanding and skills	Approximate weighting
<b>AO1</b> Recalls knowledge from across the breadth of the qualification.	Use of terminology, health and safety considerations, welfare codes, environmental impact, recognising animal behaviour, signs of animal health, legislation and regulations, routine tasks, waste management, livestock industries, production cycle of livestock, livestock nutrition requirements	25%
<b>AO2</b> Demonstrates understanding of concepts, theories and processes from across the breadth of the qualification.	Planting specifications, weed, pest and disease control, rates and timings of fertilisers, interpreting data, application of legislation and codes of practices, storage conditions, harvest losses, physical and financial records, importance to the economy, quality management, market requirements, components used in all-terrain vehicles and rough terrain telescopic forklifts, diseases affecting livestock, business opportunities and improvements	30%
<b>AO3</b> Demonstrates technical skills from across the breadth of the qualification.	Livestock husbandry tasks, estate skills and machinery operations, preparation, operation and maintenance of all-terrain vehicles and rough terrain telescopic forklifts, recognising signs of livestock health, feed planning, waste disposal, business plans	20%
<b>AO4</b> Applies knowledge, understanding and skills from across the breadth of the qualification in an integrated and holistic way to achieve specified purposes.	Applying and linking knowledge, understanding and practical skills to a particular situation, justifying decisions/ approaches, taken contingencies, reflection and evaluation.	15%
<b>AO5</b> Demonstrates perseverance in achieving high standards and attention to detail while showing an understanding of wider impact of their actions.	Meeting specific requirements of the task; care of equipment; time management	10%

## City & Guilds Level 3 Advanced Technical Extended Diploma in Agriculture (1080) (Farm Mechanisation)

Assessment objective	Typical expected evidence of knowledge, understanding and skills	Approximate weighting
<b>AO1</b> Recalls knowledge from across the breadth of the qualification.	Use of terminology, health and safety considerations, welfare codes, environmental impact, recognising animal behaviour, signs of animal health, legislation, routine tasks, operating principles of land-based power units.	25%
<b>AO2</b> Demonstrates understanding of concepts, theories and processes from across the breadth of the qualification.	Planting specifications, weed, pest and disease control, rates and timings of fertilisers, interpreting data, application of legislation and codes of practices, storage conditions, harvest losses, physical and financial records, importance to the economy, quality management, market requirements, land-based power units, safe working practices, development in technology, business opportunities and improvements	25%
<b>AO3</b> Demonstrates technical skills from across the breadth of the qualification.	Livestock husbandry tasks, estate skills and machinery operations, preparation, operation and maintenance of all-terrain vehicles and rough terrain telescopic forklifts, maintaining land-based equipment, business plans	25%
<b>AO4</b> Applies knowledge, understanding and skills from across the breadth of the qualification in an integrated and holistic way to achieve specified purposes.	Applying and linking knowledge, understanding and practical skills to a particular situation, justifying decisions/ approaches, taken contingencies, reflection and evaluation.	15%
<b>AO5</b> Demonstrates perseverance in achieving high standards and attention to detail while showing an understanding of wider impact of their actions.	Meeting specific requirements of the task; care of equipment; time management	10%

## Exam specification

AO weightings per exam

Assessment Objective	Exam 002/502 weighting (approx. %)	Exam 010/510 weighting (approx. %)	Exam 012/512 weighting (approx. %)	Exam 014/514 weighting (approx. %)
AO1 Recalls knowledge from across the breadth of the qualification.	25	50	33	40
AO2 Demonstrates understanding of concepts, theories and processes from across the breadth of the qualification.	55	30	47	40
AO4 Applies knowledge, understanding and skills from across the breadth of the qualification in an integrated and holistic way to achieve specified purposes.	20	20	20	20

The way the exams cover the content of the qualification is laid out in the tables below:

**Assessment type:** Examiner marked, written exam

**Assessment conditions:** Invigilated examination conditions

**Grading:** X/P/M/D

002/502	Duration: 2 hours		
Unit	Unit title	Number of marks	%
303	Land based industry machinery operations	4	7
304	Agricultural crop production	8	13
305	Plant and soil science	21	35
307	Livestock husbandry	15	25
N/A	Integration across the units	12	20
<b>Total</b>		<b>60</b>	<b>100</b>

**Assessment type:** Examiner marked, written exam

**Assessment conditions:** Invigilated examination conditions

**Grading:** X/P/M/D

<b>Livestock (010/510)</b>	<b>Duration: 2 hours</b>		
<b>Unit</b>	<b>Unit Title</b>	<b>Number of marks</b>	<b>%</b>
313	Farm animal health and nutrition	12	20
316	Pollution and waste control management	10	17
334	Farm animal science	16	26
335	All-terrain vehicles and rough terrain telescopic forklifts	10	17
N/A	Integration across the units	12	20
	<b>Total</b>	<b>60</b>	<b>100</b>

**Assessment type:** Examiner marked, written exam

**Assessment conditions:** Invigilated examination conditions

**Grading:** X/P/M/D

<b>Arable (012/512)</b>	<b>Duration: 2 hours</b>		
<b>Unit</b>	<b>Unit title</b>	<b>Number of marks</b>	<b>%</b>
316	Pollution and waste control management	12	20
317	Farm habitat management	12	20
326	Spreaders and sprayers	12	20
335	All-terrain vehicles and rough terrain telescopic forklifts	12	20
N/A	Integration across the units	12	20
	<b>Total</b>	<b>60</b>	<b>100</b>

**Assessment type:** Examiner marked, written exam

**Assessment conditions:** Invigilated examination conditions

**Grading:** X/P/M/D

<b>Farm Mech (014/514)</b>	<b>Duration: 2 hours</b>		
<b>Unit</b>	<b>Unit title</b>	<b>Number of marks</b>	<b>%</b>
310	Land-based power units	38	63
318	Undertake land based workshop processes	10	17

N/A	Integration across the units	12	20
<b>Total</b>		<b>60</b>	<b>100</b>

**Assessment type:** Multiple-choice exam, delivered online \*

**Assessment conditions:** Invigilated examination conditions

**Grading:** X/P

Level 3 Principles of health and safety - Theory exam (300)	Duration: 1 hour		
Unit	Learning outcome	Number of marks	%
Level 3 Principles of health and safety (301)	1. Understand health and safety legislation	9	30
	2. Understand the risk assessment process	8	26
	3. Understand first aid requirements	7	23
	4. Understand safe manual handling principles	2	6
	5. Understand the use of fire extinguishers	4	15
<b>Total</b>		<b>30</b>	<b>100</b>

\*These exams are sat under invigilated examination conditions, as defined by the JCQ:  
<http://www.jcq.org.uk/exams-office/ice---instructions-for-conducting-examinations>.

Entry for exams can be made through the City & Guilds Walled Garden.

## 6 Moderation and standardisation of assessment

City & Guilds' externally set synoptic assignments for technical qualifications are designed to draw from across the qualifications' content, and to contribute a significant proportion towards the learner's final qualification grade. They are subject to a rigorous external quality assurance process known as external moderation.

Moderation is the process where external quality assurers are standardised to a national standard in order to review centre marking of internally marked assessments. These external quality assurers are referred to as 'moderators'. Moderators will review a representative sample of 'candidate work' across the mark range from every centre. Their marks act as a benchmark to inform City & Guilds whether centre marking is in line with City & Guilds' standard.

Where moderation shows that the centre is applying the marking criteria within a reasonable range of mark tolerance, centre marks for the whole cohort will be accepted. Where moderation shows that the centre is either consistently too lenient or consistently too harsh in comparison to the national standard, an appropriate adjustment (up or down) will be made to the marks of the whole cohort, retaining the centre's rank ordering. Due to the nature of the assessment and the marking grid across Assessment Objectives (AOs), it is not expected that the tutors mark and the moderators mark will match exactly.

Where centre application of the marking criteria is inconsistent, an appropriate adjustment for the whole cohort may not be possible on the basis of the sample of candidate work. In these instances a complete remark of the candidate work may be necessary.

Additional unit and optional unit assessments are also subject to external quality assurance through a verification process. This involves external quality assurers scrutinising IQA records; sampling candidates' work across a range of units and also sampling across the mark/grade range. Centres are then provided with feedback and actions to ensure that results are valid and reliable.

For more detailed information, on the quality assurance process for synoptic assignments and additional unit and optional unit assessments please refer to 'Quality Assurance Guide for Centres: Technical Qualifications and the EPQ available to download on the City & Guilds website.

It is vital that centres familiarise themselves with this process, and how it impacts on their delivery plan within the academic year.

### **Supervision and authentication of internally assessed work**

The Head of Centre is responsible for ensuring that internally assessed work is conducted in accordance with City & Guilds' requirements.

City & Guilds requires both tutors and candidates to sign declarations of authenticity. If the tutor is unable to sign the authentication statement for a particular candidate, then the candidate's work cannot be accepted for assessment.

### **Internal standardisation**

For internally marked work the centre is required to conduct internal standardisation to ensure that all work at the centre has been marked and / or graded to the same standard. It is the Internal Quality Assurer's (IQA's) responsibility to ensure that standardisation has taken place, and that the training includes the use of reference and archive materials such as work from previous years as appropriate.

### **Internal appeal**

Centres must have an internal process in place for candidates to appeal the marking of internally marked components, ie the synoptic assignment and any optional unit assignments. This must take place before the submission of marks or grades for external quality assurance. The internal process must include candidates being informed of the marks (or grades) the centre has given for internally assessed components, as they will need these to make the decision about whether or not to appeal.

### **Post-quality assurance procedures**

Once the external quality assurance processes have been completed, feedback is provided to the centre on the standard of the internal assessment, highlighting areas of good practice, and potential areas for improvement. This will inform future centre assessment, and standardisation activities, as well as external quality assurance and risk management activity.

City & Guilds will then carry out awarding, the process by which grade boundaries are set with reference to the candidate evidence available on the platform.

### **Centres retaining evidence**

Centres must retain assessment records for each candidate for a minimum of three years. To help prevent plagiarism or unfair advantage in future versions, candidate work may not be returned to candidates. Samples may however be retained by the centre as examples for future standardisation of marking.

## 7 Grading

### Awarding individual assessments

Individual assessments will be graded, by City & Guilds, as pass/merit/distinction where relevant. The grade boundaries for pass and distinction for each assessment will be set through a process of professional judgement by technical experts. Merit will usually be set at the midpoint between pass and distinction. The grade descriptors for pass and distinction, and other relevant information (eg archived samples of candidate work and statistical evidence) will be used to determine the mark at which candidate performance in the assessment best aligns with the grade descriptor in the context of the qualification's purpose. Boundaries will be set for each version of each assessment to take into account relative difficulty.

Please note that as the merit grade will usually be set at the arithmetical midpoint between pass and distinction, there are no descriptors for the merit grade for the qualification overall.

### Grade descriptors

#### To achieve a pass, a candidate will be able to

- Demonstrate the knowledge and understanding required to work in the occupational area, its principles, practices and legislation.
- Describe some of the main factors impacting on the occupation to show good understanding of how work tasks are shaped by the broader social, environmental and business environment it operates within.
- Use the technical industry specific terminology used in the industry accurately.
- Demonstrate the application of relevant theory and understanding to solve non-routine problems.
- Interpret a brief for complex work related tasks, identifying the key aspects, and showing a secure understanding of the application of concepts to specific work related tasks.
- Carry out planning which shows an ability to identify and analyse the relevant information in the brief and use knowledge and understanding from across the qualification (including complex technical information) to interpret what a fit for purpose outcome would be and develop a plausible plan to achieve it.
- Achieve an outcome which successfully meets the key requirements of the brief.
- Identify and reflect on the most obvious measures of success for the task and evaluate how successful they have been in meeting the intentions of the plan.
- Work safely throughout, independently carrying out tasks and procedures, and having some confidence in attempting the more complex tasks.

#### To achieve a distinction, a candidate will be able to

- Demonstrate the excellent knowledge and understanding required to work to a high level in the occupational area, its principles, practices and legislation.
- Analyse the impact of different factors on the occupation to show deep understanding of how work tasks are shaped by the broader social, environmental, and business environment it operates within.
- Demonstrate the application of relevant theory and understanding to provide efficient and effective solutions to complex and non-routine problems.
- Analyse the brief in detail, showing confident understanding of concepts and themes from across the qualification content, bringing these together to develop a clear and stretching plan that would credibly achieve an outcome that is highly fit for purpose.

- Achieve an outcome which shows an attention to detail in its planning, development and completion, so that it completely meets or exceeds the expectations of the brief to a high standard.
- Carry out an evaluation in a systematic way, focussing on relevant quality points, identifying areas of development/ improvement as well as assessing the fitness for purpose of the outcome.

### Awarding grades and reporting results

The overall qualification grade will be calculated based on aggregation of the candidate's achievement in each of the assessments for the mandatory units, taking into account the assessments' weighting. The qualification will be reported on a ten grade scale: Pass Pass Pass, Pass Pass Merit, Pass Merit Merit, Merit Merit Merit, Merit Merit Distinction, Merit Distinction Distinction, Distinction Distinction Distinction, Distinction Distinction Distinction\*, Distinction Distinction\* Distinction\*, Distinction\* Distinction\* Distinction\*.

All assessments **must** be achieved at a minimum of pass for the qualification to be awarded. Candidates who fail to reach the minimum standard for grade pass for an assessment(s) will not have a qualification grade awarded and will not receive a qualification certificate.

The approximate pass grade boundaries for the synoptic assignments in this qualification are:

Synoptic Assignment	Approximate Pass Mark (%)
001	40
009	40
011	40
013	40

Please note that each synoptic assignment is subject to an awarding process before final grade boundaries are confirmed.

The contribution of assessments towards the overall qualification grade is as follows:

Assessment method	Grade scale	% contribution
Synoptic Assignment (001)	X/P/M/D	30%
Synoptic Assignment (009), (011), (013)	X/P/M/D	30%
Exam (002/502)	X/P/M/D	20%
Exam (010/510), (012/512), (014/514)	X/P/M/D	20%

Both synoptic assignments and exams are awarded (see 'Awarding individual assessments', at the start of Section 7, above), and candidates' grades converted to points. The minimum points available for each assessment grade is listed in the table below. The range of points between the pass, merit and distinction boundaries will be accessible to candidates. For example a candidate that achieves a middle to high pass in an assessment will receive between 8 and 10 points, a candidate that achieves a low to middle merit in an assessment will receive between 12 and 14 points. The points above the minimum for the grade for each assessment are calculated based on the candidate's score in that assessment.

	Pass	Merit	Distinction
Synoptic Assignment (001): 30%	6	12	18
Synoptic Assignment (009), (011), (013): 30%	6	12	18
Exam (002/502): 20%	6	12	18
Exam (010/510), (012/512), (014/514) 20%	6	12	18

The weighted average of candidate's points for each assessment is calculated, and the overall grade of the qualification will then be determined using the following criteria.

Qualification Grade	Minimum points
Distinction*, Distinction*, Distinction*	20.5
Distinction, Distinction*, Distinction*	19.3
Distinction, Distinction, Distinction*	18.2
Distinction, Distinction, Distinction	17
Merit, Distinction, Distinction	15
Merit, Merit, Distinction	13
Merit, Merit, Merit	11
Pass, Merit, Merit	9.3
Pass, Pass, Merit	7.7
Pass, Pass, Pass	6

Candidates achieving Distinction\*, Distinction\*, Distinction\* will be the highest achieving of the Distinction candidates.

## 8 Administration

Approved centres must have effective quality assurance systems to ensure valid and reliable delivery and assessment of qualifications. Quality assurance includes initial centre registration by City & Guilds and the centre's own internal procedures for monitoring quality assurance procedures.

Consistent quality assurance requires City & Guilds and its associated centres to work together closely; our Quality Assurance Model encompasses both internal quality assurance (activities and processes undertaken within centres) and external quality assurance (activities and processes undertaken by City & Guilds).

For this qualification, standards and rigorous quality assurance are maintained by the use of:

- internal quality assurance
- City & Guilds external moderation (synoptic assessments)
- City & Guilds external verification (additional unit / optional assessments).

In order to carry out the quality assurance role, Internal Quality Assurers (IQAs) must have and maintain an appropriate level of technical competence and have recent relevant assessment experience. For more information on the requirements, refer to *Section 2: Centre requirements* in this handbook.

To meet the quality assurance criteria for this qualification, the centre must ensure that the following procedures are followed:

- suitable training of staff involved in the assessment of the qualification to ensure they understand the process of marking and standardisation
- completion by the person responsible for internal standardisation of the Centre Declaration Sheet to confirm that internal standardisation has taken place
- the completion by candidates and supervisors/tutors of the record form for each candidate's work.

### External quality assurance

City & Guilds will undertake external moderation and verification activities to ensure that the quality assurance criteria for this qualification are being met. Centres must ensure that they co-operate with City & Guilds staff and representatives when undertaking these activities.

City & Guilds requires the Head of Centre to

- facilitate any inspection of the centre which is undertaken on behalf of City & Guilds
- make arrangements to receive, check and keep assessment material secure at all times,
- maintain the security of City & Guilds confidential material from receipt to the time when it is no longer confidential and
- keep completed assignment work and examination scripts secure from the time they are collected from the candidates to their dispatch to City & Guilds.

### Enquiries about results

The services available for enquiries about results include a review of marking for exam results and review of moderation for synoptic assignments. Requests must be submitted within the specified period after the publication of results for individual assessments. Please see the **City & Guilds website** for more information.

### Re-sits and shelf-life of assessment results

Re-sits and shelf-life of assessment results Candidates who have failed an exam or wish to re-take it in an attempt to improve their grade, can do so **twice**. The best result will count towards the final qualification. See guidance on individual assessment types in Section 5.

### Factors affecting individual learners

If work is lost, City & Guilds should be notified immediately of the date of the loss, how it occurred, and who was responsible for the loss. Centres should use the JCQ form, JCQ/LCW, to inform City & Guilds Customer Services of the circumstances.

Learners who move from one centre to another during the course may require individual attention. Possible courses of action depend on the stage at which the move takes place. Centres should contact City & Guilds at the earliest possible stage for advice about appropriate arrangements in individual cases.

### Malpractice

Please refer to the City & Guilds guidance notes *Managing cases of suspected malpractice in examinations and assessments*. This document sets out the procedures to be followed in identifying and reporting malpractice by candidates and/or centre staff and the actions which City & Guilds may subsequently take. The document includes examples of candidate and centre malpractice and explains the responsibilities of centre staff to report actual or suspected malpractice. Centres can access this document on the City & Guilds website.

Examples of candidate malpractice are detailed below (please note that this is not an exhaustive list):

- falsification of assessment evidence or results documentation
- plagiarism of any nature
- collusion with others
- copying from another candidate (including the use of ICT to aid copying), or allowing work to be copied
- deliberate destruction of another's work
- false declaration of authenticity in relation to assessments
- impersonation.

These actions constitute malpractice, for which a penalty (eg disqualification from the assessment) will be applied.

Where suspected malpractice is identified by a centre after the candidate has signed the declaration of authentication, the Head of Centre must submit full details of the case to City & Guilds at the earliest opportunity. Please refer to the form in the document *Managing cases of suspected malpractice in examinations and assessments*. Please refer to the form in the document *Managing cases of suspected malpractice in examinations and assessments*.

### Access arrangements

Access arrangements are adjustments that allow candidates with disabilities, special educational needs and temporary injuries to access the assessment and demonstrate their skills and knowledge without changing the demands of the assessment. These arrangements must be made before assessment takes place.

It is the responsibility of the centre to ensure at the start of a programme of learning that candidates will be able to access the requirements of the qualification.

Please refer to the JCQ access arrangements and reasonable adjustments and Access arrangements - when and how applications need to be made to City & Guilds for more information. Both are available on the **City & Guilds website**.

### **Special consideration**

We can give special consideration to candidates who have had a temporary illness, injury or indisposition at the time of the examination. Where we do this, it is given after the examination.

Applications for either access arrangements or special consideration should be submitted to City & Guilds by the Examinations Officer at the centre. For more information please consult the current version of the JCQ document, A guide to the special consideration process. This document is available on the **City & Guilds website**

<b>UAN:</b>	A/507/4634
<b>Level:</b>	3
<b>GLH:</b>	30

**What is this unit about?**

This unit aims to provide learners with an understanding of the principles of health and safety and identify how these can be applied in practice within land-based or related industries. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or further education and training.

Learners will be able to recognise common health and safety practices and processes which they will encounter within the workplace. The land-based sector has one of the worst fatal accident records of any major industrial sector and a lack of basic training and/or competency is often a contributory factor. There is a need for new entrants to these industries to gain essential health and safety knowledge in order to minimise harm to themselves and to improve attitudes and behaviour in the workplace. In addition, the learners have the opportunity to consider factors which are specific to their workplace.

This unit must be taught alongside **all** technical units within the qualification ensuring learners gain an appreciation of its importance and so that they are equipped with knowledge and understanding to protect themselves and others when working in the industry.

**Learning outcomes**

In this unit, learners will be able to

1. Understand health and safety legislation
2. Understand the risk assessment process
3. Understand first aid requirements
4. Understand principles of safe manual handling
5. Understand the use of fire extinguishers

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

## Learning outcome:

### 1. Understand health and safety legislation

## Topics

- 1.1 Impact of good and bad practice upon individuals and businesses
- 1.2 Key legislation relating to health, safety and welfare
- 1.3 Statutory duties of employers, employees and the self-employed
- 1.4 Consequences of not complying with statutory duties
- 1.5 How individuals can contribute to establishing a good health and safety culture

### Topic 1.1

Learners will know direct and indirect consequences of poor standards of workplace health and safety practice on both businesses and individuals, to include

#### Financial eg:

- Prosecution fines and legal fees
- Compensation claims
- Repairs/replacement of equipment
- Recruit and train new staff
- Increased insurance premiums

#### Emotional eg:

- Guilt and grief
- Stress

#### Reputation eg:

- Loss of reputation
- Bad publicity

#### Employees eg:

- Reduced staff morale and productivity
- Increased staff turnover and sickness

#### Social eg:

- Loss of independence
- Reduced social activity

### Topic 1.2

Learners will know key legislation relating to health, safety and welfare within the workplace, for example, Health and Safety at Work etc. Act 1974 and the Management of Health and Safety at Work Regulations 1999. Learners will understand the importance of accident and incident reporting in accordance with the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) 2013. Learners will understand the legal status and practical implications of approved codes of practice and industry specific best practice guidance.

### Topic 1.3

Learners will know the statutory duties of employers, employees and the self-employed, to include

#### Employers

- Provide a safe working environment
- Provide safe equipment and systems of work.
- Provide information, instruction, training and supervision.
- Arrange for the safe storage, transport and use of articles and substances.
- Provide adequate welfare facilities.

#### Employees

- Take reasonable care of their own health and safety.
- Take reasonable care of other people who may be affected by what they do or don't do at work.
- Cooperate with their employer on health and safety.
- Not interfere with or misuse anything provided for their health, safety or welfare

#### Topic 1.4

Learners will know the powers of health and safety enforcement officers (eg inspection, investigation and guidance) and identify the range of enforcement actions and penalties that may be imposed (eg prohibition and improvement notices, intervention fee and prosecutions).

#### Topic 1.5

Learners will understand how individuals can contribute to establishing a good health and safety culture within their workplace, for example:

- Prompt reporting of defective safety equipment or other matters of concern
- Always use control measures and personal protective equipment (PPE) as instructed
- Help others to work safely by sharing knowledge and good practice
- Set a good example to others by always working safely
- Follow instructions and safe working procedures

### Learning outcome:

## 2. Understand the risk assessment process

### Topics

- 2.1 Principles of risk assessment
- 2.2 Workplace hazards
- 2.3 Risk assessment

Learning Outcome 2 provides learners with the knowledge on the requirements and importance of carrying out risk assessments. Learners will be expected to carry out risk assessments in practice when performing their industry specific activities as required.

#### Topic 2.1

Learners will understand the legal requirement to carry out suitable and sufficient risk assessments. They will understand the responsibilities of the employer, self-employed and employee within the risk assessment process and identify when expert advice and guidance may be required (eg lack of experience or knowledge).

### **Topic 2.2**

Learners will know common hazards associated with a workplace which could result in serious harm to themselves or others (eg visitors, colleagues, members of the public).

### **Topic 2.3**

Learners will understand how to undertake a detailed risk assessment within the context of their workplace, following the Health and Safety Executive 'Five Steps to Risk Assessment', to include

- Identification of the hazards
- Identification of who might be harmed and how they might be harmed
- Evaluation of the risks and decide how the level of risk may be controlled
- Recording and implementation of the results, as well as communication to others who may be affected
- Reviewing risk assessments and suggesting when risk assessments should be reviewed

Learners will also know the hierarchy of risk control:

- Elimination
- Substitution
- Safe working procedures
- Training, instruction and supervision
- Personal and respiratory protective equipment (PPE/RPE)

## **Learning outcome:**

### **3. Understand first aid requirements**

#### **Topics**

- 3.1 Planning for emergencies and first aid provision in the workplace
- 3.2 Procedures when encountering an accident or medical emergency
- 3.3 First aid for common emergencies

In this outcome learners will explore the importance of planning to and subsequently how to manage common first aid emergencies which may arise in the workplace, with emphasis upon their workplace. Learners should be aware of the aims of first aid (i.e., preserve life, prevent injuries worsening and promote recovery) Evidence towards this outcome could come from a current first aid training qualification (i.e., appointed persons or first aid at work).

#### **Topic 3.1**

Learners will understand the importance of emergency planning, especially for lone or isolated working, and the responsibilities of a first aider. Learners will also know the minimum requirements for first aid at work and identify supplementary arrangements which may be appropriate for their workplace.

#### **Topic 3.2**

Learners will know the procedures to follow when encountering an accident or medical emergency. Learners will know how to check the incident site to minimize risk to themselves, assess the situation, and how and when to contact the emergency services and identify prioritisation of activities (eg, 'DRABC').

### Topic 3.3

Learners will know how to manage the following common situations as well as other significant situations appropriate to their workplace:

- Wounds and burns
- Choking
- Severe bleeding
- Shock
- Concussion
- Unconscious casualties
- Falls from height
- Suspected broken limbs and dislocations
- Heart attacks

Learners will know how to recognise their own limitations and explain how to monitor the condition of the casualty and prevent an injury from worsening.

### Learning outcome:

#### 4. Understand principles of safe manual handling principles

### Topics

4.1 Principles of safe manual handling

4.2 Safe manual handling of common items

In this outcome learners will need to investigate the principles of risk assessment relevant to manual handling in order to plan for and safely move a range of common items associated with their workplace. Learners should have access to a range of common mechanical aids and these should be used as appropriate.

### Topic 4.1

Learners will understand how manual handling at work should be minimised and identify appropriate alternatives and mechanical aids. They will know the common causes of injuries associated with poor manual handling within the workplace.

### Topic 4.2

Learners will understand how to safely move a range of common items within their workplace. They will know appropriate mechanical aids for a range of common manual handling activities within their workplace.

### Learning outcome:

#### 5. Understand the use of fire extinguishers

### Topics

Topic 5.1 Use of fire extinguishers

### Topic 4.1

Learners will know the types, use and colours of portable fire extinguishers, to include

- Water
- Dry powder
- Foam
- CO<sub>2</sub>

Learners will know how to recognise their own limitations in managing fires in the workplace.

### **Guidance for delivery**

On completion of this unit, the learner will have developed an understanding of some of the key underlying principles and practices of health and safety to help prepare them to enter the workplace. It will be important that delivery relates to example situations that are vocationally relevant to the learners.

Visiting speakers eg paramedics, health and safety consultants or inspectors could enhance the relevance of the subject to learners.

### **Suggested learning resources**

#### **Books**

Anon. 2013. *Farmwise - Your Essential Guide to Health and Safety in Agriculture*. Health and Safety Executive ISBN 0717665097

Chadder P. and Duncan M. 2014. *Health & Safety at Work Essentials. 8<sup>th</sup> Edition*. Lawpack Publishing Ltd. ISBN 1910143006

Stranks, J. 2010. *Health and Safety at Work: An Essential Guide for Managers. 9<sup>th</sup> Edition*. Kogan Page. ISBN 0749461195

#### **Websites**

- Health and Safety Executive (HSE) [http:// www.hse.gov.uk](http://www.hse.gov.uk)
- The Royal Society for the Prevention of Accidents (ROSPA) <http://www.rospace.com/>

## Unit 302

## Undertake and review work related experience in the land based industries

<b>UAN:</b>	F/507/4635
<b>Level:</b>	3
<b>GLH:</b>	30

### What is this unit about?

The aim of this unit is to give learners the skills needed to identify, participate in and review work experience in the environmental and land based sector. The unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or further education and training.

### Learning outcomes

In this unit, learners will be able to

1. Determine employment opportunities in the environmental and land based industries
2. Prepare for a work-based experience in the environmental and land based industry
3. Understand the importance of effective interpersonal skills in the workplace
4. Review a work-based experience in the environmental and land based sector.

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

## Learning outcome:

### 1. Determine employment opportunities in the environmental and land based industries

## Topics

### 1.1 Career and progression opportunities within an environmental and land based industry

In this outcome, learners will explore the different job roles and responsibilities, and the job titles commonly associated with them in their specialist sector. This background understanding is likely to require some formal classroom teaching. Learners should be encouraged to explore the range of employment opportunities and career paths within their specialist sector. Learners will then consider the skills and qualifications that are required for appropriate jobs for themselves and should be encouraged to think about skills and qualifications that they may need to acquire to achieve their employment and careers ambitions. This should help them to identify suitable work experience.

#### Topic 1.1

Learners will know the job roles relevant to the land based sector, to include managerial, supervisory, team worker, trainee, volunteer, common job titles within the relevant sector, main duties and responsibilities

Learners will also know the skills, qualifications and experience needed to fulfil duties and responsibilities of appropriate jobs, to include job specific, vocational and personal

## Learning outcome:

### 2. Prepare for a work-based experience in the environmental and land based industry

## Topics

### 2.1 Appropriate work-based experience and the application process

### 2.2 Interview skills

This outcome involves learners going through the process of applying for work experience. They will need to locate suitable job adverts or work experience opportunities, but can be supported by centres suggesting suitable placements. When applying for work experience learners should produce, as a minimum, a detailed curriculum vitae and letter of application using a computer. It will be beneficial for learners to attend a real or simulated interview, and reflect on their performance outlining how they could improve their effectiveness.

#### Topic 2.1

Learners will find a suitable job opportunity based on existing skills, experience, qualifications, development of skills and experience to achieve future employment goals. They will use a range of sources of information about work opportunities eg trade magazines, websites. Learners will complete an application form (if applicable), curriculum vitae and letter of application.

#### Topic 2.2

Learners will know how to prepare for an interview, eg: Research the business and job role, suitable dress and personal presentation, information to find out and suitable questions to ask.

Learners will also know how to behave in an interview:  
eg attend punctually and dressed appropriately, answering questions, completion of other tests (eg practical, aptitude), and reflection on interview performance

### **Learning outcome:**

## **3. Understand the importance of effective interpersonal skills in the workplace**

### **Topics**

#### 3.1 The importance of effective interpersonal skills in the workplace

It would be appropriate for employers to be invited to outline to learners their expectations in the workplace.

#### **Topic 3.1**

Learners will understand the importance of effective interpersonal skills in the workplace when dealing with customers and colleagues, to include

- effective communication (eg addressing others face to face, appropriate telephone manner, effective written communication, use of social media)
- courtesy and helpfulness
- appropriate dress and body language
- product knowledge
- use of technical terms

### **Learning outcome:**

## **4. Review a work-based experience in the environmental and land based sector**

### **Topics**

- 4.1 Present evidence of activities and achievements during a work-based experience
- 4.2 Review a work-based experience, identifying strengths and areas for improvement
- 4.3 Evaluate future career aspirations

In this outcome, learners will use evidence from their work experience to present a report (eg written or visual), on their work experience business, job role, learning and achievements. They will then review the effectiveness of the workplace, making realistic and justified suggestions for improvement. Review of their own workplace performance and achievements should include all of the content identified, with reference to relevant evidence, eg reports, progress reviews, and the extent to which their aims, objectives/targets have been achieved. Learners should consider further training and experience that will help them to achieve their career ambitions.

#### **Topic 4.1**

Learners will present evidence of activities and achievements during a work-based experience to include, as appropriate: name of work experience provider, nature of the organisation (type of business, products or services, customers), organisation structure chart, main duties and

responsibilities, regular daily working routine, evidence of safe working practices (eg PPE, risk assessments)

#### **Topic 4.2**

Learners will review their work-based experience, identifying strengths and areas for improvement, to include work rate, work quality and effectiveness, punctuality, attendance, reliability, dress and personal presentation, working relationships with others work experience aims, objectives and targets

#### **Topic 4.3**

Learners will evaluate career aspirations, to include advantages and disadvantages of identified pathways, suitability to personal interests, skills and qualifications.

### **Guidance for delivery**

Learners on vocational courses should have experience of the type of work that they hope to do, and of the expectations of potential future employers.

Ideally this unit should be undertaken in a real business environment relevant to the subject interest of the learner, but actual work experience may be gained by a number of routes, eg as part of an industrial placement whilst within the programme, whilst working on a planned daily or weekly basis on the centre's commercial and/or educational facilities, whilst undertaking voluntary work within the industry, as previous relevant and current work experience in the industry or as a member of a group of learners invited to carry out practical work on a suitable business.

Throughout the unit, the emphasis should be on safe working. It is expected that learners will be aware of safe working practices and familiar with accepted practices and behaviours within the context in which they are working.

Learners should complete a minimum of 150 hours of work experience to achieve this unit. If work experience is in the industry, centres should be mindful of their responsibilities for ensuring that work placements have appropriate supervision, insurance and health and safety policies in place.

It is recommended that a summary report is completed by the employer at the end of the work placement.

## Unit 303

## Land based industry machinery operations

<b>UAN:</b>	J/507/4636
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

This unit aims to provide learners with an understanding of the principles of land based machinery operations and how these can be applied in practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or further education and training.

The learners will study the purpose and operation of land based machines including machine operating and working principles. They will explore routine maintenance and appropriate Personal Protective Equipment. They will also develop knowledge of the legal requirements and industry best practice guidance for land based machinery. They will learn how to safely operate and maintain machinery and consider the different conditions in which machinery might need to operate.

### Learning outcomes

In this unit, learners will be able to:

1. Understand the purpose and operation of land based industry machinery
2. Prepare land based industry machinery for work
3. Operate land based industry machinery

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

## Learning outcome:

### 1. Understand the purpose and operation of land based industry machinery

#### Topics:

- 1.1 Current legislation and industry guidance for land based industry machinery operation
- 1.2 Purpose and operation of land based machines

In Outcome 1 learners must understand the significance of current legislation and industry best practice guidance to the machinery they operate. Learners must also demonstrate understanding of the construction and working principles of a selection of machines commonly used in their specific land based industry, and knowledge of their work and performance parameters.

#### Topic 1.1

Learners will understand the significance of current legislation and industry best practice guidance to the machinery they operate. To include

- Legislation: eg Provision and Use of Work Equipment Regulations 1998 (PUWER), Health and Safety at Work Act 1974, Management of Health and Safety at Work Regulations 1999, Control of Substances Hazardous to Health Regulations 2002 (COSHH), Manual Handling Operations Regulations 1992, Personal Protective Equipment (PPE) at Work Regulations 1992, Environmental Protection Act 1990, Wildlife and Countryside Act 1981, Control of Noise at Work Regulations 2005, Control of Vibration at Work Regulations 2005, Lifting Operations and Lifting Equipment Regulations 1998
- Industry best practice guidance

#### Topic 1.2

Learners will understand the purpose, operating and working principles and limitations of land based industry machinery. For example:

- Purpose built, trailed, tractor mounted, self-propelled or pedestrian ,
- Power source (eg electric, battery, spark ignition, compression ignition, PTO and hydraulic)
- Drive and transmission systems
- Cutting mechanisms
- Cutting/loading capacity or range
- Input and output ranges and levels
- Terrain suitability
- Safety features

## Learning outcome:

### 2. Prepare land based industry machinery for work

#### Topics:

- 2.1 Machinery preparation
- 2.2 Carry out pre-use checks
- 2.3 Identify common faults and suggest appropriate remedial action

## 2.4 Check and report on safety requirements

In Outcome 2 learners will demonstrate the ability to prepare machines for work. Machines will be specific to learners' area of study. It is essential that manufacturers' recommendations, user's manuals and machinery handbooks are available to the learner. It is expected that learners do this for three different machines.

### Topic 2.1

Learners will prepare selected land based industry machinery for work in accordance with the manufacturers' recommendations, user's manual or machinery handbook.

### Topic 2.2

Learners will carry out pre-use checks for selected land based industry machinery in accordance with the manufacturers' recommendations, user's manual or machinery handbook.

### Topic 2.3

Learners will identify common faults and suggest appropriate remedial action to the machinery available to them. Common faults may include

- Incorrect, polluted or lack of fuel
- blocked filters (air, fuel, oils)
- poor oil pressure
- damaged sprockets and fouled drive systems
- damaged or blunt blades
- fouled or incorrectly set gap of spark plugs
- starter recoil tension
- blocked mechanisms

### Topic 2.4

Learner will be able to check and report on the safety requirements for selected land based industry machinery in accordance with the manufacturers' recommendations, user's manual or machinery handbook.

## Learning outcome:

### 3. Operate land based industry machinery

#### Topics:

- 3.1 Carry out risk assessments
- 3.2 Ways to minimise possible environmental impacts of using selected land based industry machinery
- 3.3 Operate land based industry machinery
- 3.4 Carry out post operating procedures

In outcome 3 learners will be required to operate land based industry machinery. It is anticipated that the delivery of this outcome will be through supervised practical training and the learners will be able to consolidate operational skills within realistic working environments. As a minimum, it is expected that the learner will be able to operate three powered machines appropriate to their area of study in a realistic industrial environment where possible. The learner should be given

appropriate time in order to develop operational skills before assessment. The learner is not required to transport machinery, but should be aware of transport requirements.

### **Topic 3.1**

Learners will carry out risk assessments for the machines they are to operate in accordance with The Management of Health and Safety at Work Regulations 1999

### **Topic 3.2**

Learners will know how to minimise possible environmental impacts of land based industry machinery, eg

- Oil and fuel spillage and storage
- Emissions
- Soil stability and erosion
- Protected species
- Waste disposal
- Watercourses

### **Topic 3.3**

Learners will demonstrate safe and efficient operation of specialist land based industry machinery, to include as appropriate:

- Risk assessment
- Adherence to industry safety guidance and operator's manual,
- Safe start and stop,
- Monitoring of machine performance and output
- Effective communications
- Clearance of blockages,
- Conversion between work and transport positions
- Economic operation
- Safe and efficient operation,

### **Topic 3.4**

Learners will carry out post operating procedures appropriate to machinery operated. To include

- Cleaning
- Inspecting for and reporting of damage or defects
- Lubrication
- Storage

## Guidance for delivery

This unit is designed to give learners knowledge, understanding and practical skills to enable them to recognise and understand the working principles of land based industry machinery typically used in their area of study.

Learners will be able to demonstrate pre use checks and fault finding of a range of selected machines. They will be able to prepare machines for work and operate them safely and efficiently. An emphasis will be put on the use of manufacturers' recommended procedures, health and safety issues and safe working practices.

Learners must show awareness and consideration of hazards and risks at all times, particularly during operational situations where levels of risk may vary at any given time.

Where possible, tasks should be undertaken in a real working environment. Following operations, learners will demonstrate simple inspection and maintenance and pre storage tasks to minimise degeneration of the machine, and to ensure it is in a useable condition for subsequent operations.

## Suggested learning resources

### Books

Arboricultural Association. 2005. *Arboricultural Association Health and Safety Package*. Cheltenham: Arboricultural Association. ISBN 0900978406.

Ireland, D. 2004. *Winching Operations in Forestry: Tree Takedown and Vehicle Debogging*. Norwich: Stationary Office Books. ISBN 085538638X.

Hathaway, L. 1994. *Tractors Fundamentals of Machine Operation*. Davenport: John Deere Publishing. ISBN 0866912126.

Kestel, B. 2009. *Chainsaw Operator's Manual: The Safe Use of Chainsaws*. Australia: Landlinks Press. ISBN 0643090282.

Southorn, N. 1999. *Tractor Operation and Maintenance*. Sydney: Inkata Press. ISBN 0750689145.

Williams, M. 2000. *Tractor Power*. Ipswich: Farming Press. ISBN 0852365144.

### Journals and magazines

Arboricultural Association newsletter

Forestry and British Timber

Arboriculture and Forestry Advisory Group (AFAG) Safety Guides

Forest Industry Safety Accord (FISA) Safety Guides

### Websites

- The Arboricultural Association <http://www.trees.org.uk>
- The Forest Industry Safety Accord <http://www.ukfisa.com>
- The Forestry Commission <http://www.gorestry.gov.uk>
- The Health and Safety Executive <http://www.hse.gov.uk>

## Unit 304

## Agricultural crop production

<b>UAN:</b>	H/507/6846
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

This unit aims to introduce learners to the skills and knowledge needed for agricultural crop production and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into employment in the agriculture sector or into further or higher education.

The aim of this unit is to develop learners' understanding of factors affecting the profitability of crop production as well as the practical skills required to establish and monitor crop growth.

### Learning outcomes:

In this unit, learners will be able to

1. know how to establish crops for given markets
2. plan the nutrition of crops
3. understand control measures for weeds, pests and diseases
4. understand harvest and storage losses and production costs

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

### Crops

Cereals, oilseeds, grass, peas, beans, alternative crops.

### Learning outcome:

#### 1. Know how to establish crops for given markets

### Topics

- 1.1 Crops and their life cycles
- 1.2 End uses and key market requirements
- 1.3 Planting specifications
- 1.4 Crop rotation

#### Topic 1.1

Learners will know different crops and their lifecycles in order to recognise seeds and their growth in field at all stages, including annual, biennial, perennial and ephemeral.

#### Topic 1.2

Learners will know end uses and market requirements, including

- named varieties for different uses (milling, malting, bio-fuel and seed)
- the various end uses for the crops (milling, malting, seed, bio-fuel, feed)
- quality standards (Hagberg falling number, protein, impurities, moisture content, appearance)
- crop assurance schemes.

#### Topic 1.3

Learners will know planting specifications, including

Timing of drilling, crop seedbed, expected yield, soil type, seed rate, depth, row width and spacing, plant population, and thousand grain weight (TGW).

#### Topic 1.4

Learners will know crop rotations and the reasons for them, including restorative and exhaustive crops, continuous cropping, break cropping, and catch cropping. They will also know crops for given soil types, eg clay, sand, loam, silt.

## Learning outcome:

### 2. Plan the nutrition of crops

#### Topics

- 2.1 Interpretation of soil analysis data
- 2.2 Fertiliser programmes
- 2.3 Function of nutrients, deficiency/excess symptoms
- 2.4 Legislative and environmental guidelines

#### Topic 2.1

Learners will interpret soil analysis data: SMN, SNS, Index system, field procedures, precision farming methods, variable rate application.

#### Topic 2.2

Learners will plan a fertiliser programme for a named crop, including Major and minor nutrients (nitrogen, phosphate, potassium, sulphur, manganese), timing of applications (drilling, spring split applications), lime, manure applications, RB209 or suitable software MANNER/PLANET, avoidance of waste/pollution.

#### Topic 2.3

Learners will understand the function of nutrients. Learners will recognise deficiency symptoms and will identify how to overcome them, including Function of key major and minor nutrients, excess and deficiency symptoms, disease association, pH.

#### Topic 2.4

The following is a comprehensive list of the legislation, regulation and good practice that applies to planning the nutrition of crops. For purposes of assessment, there is no requirement for detail, but learners must appreciate that it exists and where each applies

- Environmental Protection Act 1990
- Cross Compliance Nitrates Directive 1991
- Water Framework Directive 2003
- Local Environmental Risk Assessment Procedures (LERAPs)
- Nitrate Vulnerable Zones (NVZs) and timing
- Entry Level Scheme rules
- Protecting our Water, Soil and Air ( A DEFRA publication)

## Learning outcome:

### 3. Understand control measures for weeds, pests and diseases

#### Topics

- 3.1 Weeds, pests and diseases
- 3.2 Importance of weed, pest and disease control
- 3.3 Weed, pest and disease biology
- 3.4 Cultural and chemical control

### **Topic 3.1**

Learners will understand

- seed, soil, stem and leaf diseases
- major weeds and their importance
- pests and the damage they cause
- beneficial insects.

### **Topic 3.2**

Learners will understand the damage caused by weeds, pests and diseases in terms of:

- yield
- profit
- subsequent crops
- harvesting
- storage
- marketing
- environment

### **Topic 3.3**

Learners will understand

- fungal, viral and bacterial diseases
- spread of weeds pests and diseases
- life cycles
- resistance

in order to discuss aspects of the biology of weeds, pests and diseases that are relevant to their spread and control.

### **Topic 3.4**

Learners will understand methods of controlling weeds, pests and disease, in order to evaluate them. These include

- cultural control, including rotations, varieties, cultivations, seed, seed rates, rogueing, fertiliser use, biological, beneficial insects
- chemical control, including herbicides, insecticides, fungicides, molluscicides, Plant Growth Regulators (PGRs), seed dressings
- thresholds and timing.

## **Learning outcome:**

### **4. Understand harvest and storage losses and production costs**

#### **Topics**

- 4.1 Yield and quality losses during harvest
- 4.2 Storage conditions for crops
- 4.3 Production costs for crops

### Topic 4.1

Learners will understand

- timing and crop maturity
- field settings to minimise damage and losses
- effects of disease and weather
- typical yields

### Topic 4.2

Learners will understand

- store preparation
- crop moisture during storage
- temperature, pest and disease problems
- market requirements

### Topic 4.3

Learners will understand

- variable costs (seeds, fertilisers, sprays)
- fixed costs (machinery, depreciation, labour, fuel)
- contractors' costs
- gross margin data
- market prices.

## Guidance for delivery

This unit will involve practical delivery, theory sessions, and visits to suitable locations; it will also have links to industrial experience placements. The unit will imitate industry practice, with the learner being involved in all the operations of farm crop production. Tutors need to offer the learner as wide a selection of learning opportunities as possible. This will involve lectures, regular crop walks, farm practical work experience, talks, visits (eg local machinery dealers), and use of an agronomist if possible. In addition, the tutor needs to ensure that all relevant crops are included: cereals, grass, oil-seed rape, peas, beans, and alternatives (concentrating more on the crops typical to their locality). Other crops may be used at the tutor's discretion, according to locality. Learners will need access to farm recording data and relevant previous crop history.

Crop walks both in taught time and learners' own time are to be maximised. Health and safety must be regularly enforced especially with regard to machinery and chemicals.

Learning outcome 1 will need to be delivered at the start of the unit. In the autumn, learners may well have been working and involved in autumn cultivations and seedbed preparation. Crop walks at this time of year will primarily involve observing cultivations and seedbeds for specific crops in the range. Alternatively, spring-sown crops would equally lend themselves to observation for the purposes of this learning outcome.

Learning outcome 2 will need to be delivered to coincide with crop growth, which will likely be all year round, especially in the case of cereals. Crop walks and visits to local arable farms can be used to cover this outcome. Tutors could ensure that the learner has access to a farm's fertiliser programme for selected crops. An introduction to a farm agronomist would also be useful prior to the main fertilising season.

Learners will need to have access to soil analysis data, as well as fertiliser software such as MANNER or PLANET and/or the RB209 book. They may also be involved in soil sampling.

Learning outcome 3 will need to refer to at least two crops and be delivered throughout their growing season. Crop walks and visits to local arable farms can be used to cover this outcome. An introduction to a farm agronomist would also be useful prior to the main spraying season.

Learning outcome 4 will need to look at previous crop history, since learners will not be in college during the summer to monitor and gather current crop harvesting, storage and marketing information. The learner will need access to farm information and current market prices, such as those in the regular farming press or on the internet. Learners should be given the opportunity to view different storage and drying systems.

### **Suggested learning resources**

#### **Books**

Arable plants – a field guide Published by: Princeton University Press, 2004 ISBN 978-1903657027	Wilson, P. & King, M.
Resource management: soil Published by: Farming Press, 2001 ISBN 978-0852365595	Davies, D.; Finney, B; & Eagle D.
Lockhart & Wiseman’s Crop Husbandry including grassland 9th edition Published by: Woodhead publishing, 2014 ISBN 978-1782423713	Finch, H.; Samuel, A.; & Lane, G.
Organic cereals and pulses Published by: Chalcombe publications, 2002 ISBN 978-0948617478	Younie, D. & Taylor, B.
Farm Machinery Published by: Old Pond Publishing, 2005 ISBN 978-1903366684	Bell, B.
Culpin’s Farm Machinery Published by: Hesperides Press, 2008 ISBN 978-1443703017	Culpin, C. & Bloxham P.
Farm Management Pocketbook, 45th edition Published by: Agro Business Consultants Ltd, 2015 ISBN 978-0957693913	Nix, J.
Drying and storing combinable crops Published by: Farming Press, 1989	McLean, K.

ISBN 978-0852361931

Oilseed rape

Ward, J. & Basford, W.

Published by: Farming Press, 1985

ISBN 978-0852361559

The Agricultural Notebook, 20th edition

Soffe, R.

Published by: Wiley-Blackwell, 2003

ISBN 978-0632058297

Protecting our Water, Soil and Air

DEFRA

Published by: The Stationery Office Books, 2009

ISBN 978-0112432845

Fertiliser Manual RB209, 8th edition

DEFRA

Published by: The Stationery Office Books, 2010

ISBN 978-0112432869

UK Pesticide guide 2015, 28th edition

Lainsbury, M.

Published by: CABI Publishing, 2015

ISBN 978-1780645773

The Agricultural Budgeting and Costing Book, 79th Edition

ABC

Published by: Agro Business Consultants, 2014

ASIN: B00EGO3HQK

### **Publications**

- Crops
- Farm Contractor
- Farmers Guardian
- Farmers Weekly
- Farm Business

### **Websites**

- Farmers Weekly Interactive <http://www.fwi.co.uk>
- Home Grown Cereals Authority  
<http://www.cereals.ahdb.org.uk>
- UK website for Syngenta Crop Protection  
<http://www.newfarmcrops.co.uk>
- National Institute of Agricultural Botany <http://www.niab.com>
- Department for Environment, Food and Rural Affairs <http://www.defra.gov.uk>
  
- Welsh Assembly Government <http://www.wales.gov.uk>
- Scottish Executive Environment and Rural Affairs Department <http://www.scotland.gov.uk>
  
- Department of Agriculture and Rural Affairs (Northern Ireland) <http://www.dardni.gov.uk>

- Combine World

<http://www.combineworld.co.uk>

## Unit 305

## Plant and soil science

<b>UAN:</b>	L/507/4637
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

This unit aims to provide learners with an understanding of the principles of plant and soil science and how these can be applied in practice within land-based or related industries. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or further education and training.

Learners will be able to develop an understanding of soil characteristics and their relationship to crop growth and development. They will investigate how plants grow and develop, through a knowledge of their structure and physiology. In addition, the learners have the opportunity to consider factors which influence production of commercial crops and other plants, which provides a basis for plant and soil management techniques.

### Learning outcomes

In this unit, learners will be able to

1. Understand the function of plant structures
2. Understand the main processes of plant physiology, growth and development
3. Understand how soils affect plant growth and development

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

## Learning outcome:

### 1. Understand the function of plant structures

## Topics

1.1 Internal and external structures of plants

1.2 Function of plant structures

### Topic 1.1

Learners will understand the major internal and external structures of plants

- Major internal structures: cell structure (cytoplasm, organelles), parenchyma, collenchyma, sclerenchyma, xylem tissue, phloem tissue, cambium, epidermis, guard cells, and stomata
- Major external structures: roots, shoots, stem, leaves, buds, flowers, fruit and seeds
- Specialised cells, tissues and organs: eg pericycle, endodermis, lenticels, cotyledons, stolons, rhizomes, bulbs, corms, root and stem tubers

### Topic 1.2

Learners will understand the function of the major plant structures (eg photosynthesis, reproduction, support, transport, anchorage, absorption, storage, defence, attraction, gaseous exchange, respiration, division)

## Learning outcome:

### 2. Understand the main processes of plant physiology, growth and development

## Topics

2.1 Processes of plant physiology

2.2 Life cycle of selected plants

2.3 Growth and development of plants

In this outcome learners will explore the major processes of plant physiology and identify factors affecting growth and development of plants. Learners will also need an awareness of how knowledge of plant physiology can be applied within land-based management scenarios.

### Topic 2.1

Learners will understand the major processes of plant physiology

- Photosynthesis: process and equation for photosynthesis, chloroplasts, function of chlorophyll, functionality of guard cells and stomata, factors influencing the rate of photosynthesis (light, chlorophyll, temperature, carbon dioxide, water, leaf colour)
- Respiration: definition of aerobic and anaerobic respiration, equation for aerobic respiration, structure and function of mitochondria, diffusion, compensation point, factors influencing the rate of respiration (temperature, water availability, seasonal growth)
- Uptake, transport and loss of water and nutrients: osmosis, diffusion, plasmolysis, turgor, translocation, transpiration, factors influencing transpiration (eg temperature, humidity, air movement, water supply, light, stomata).

## Topic 2.2

Learners will understand the life cycle of plants

- life cycle types: ephemeral, annual, biennial, perennial
- germination: process and stages, types of germination (eg epigeal, hypogeal), types of reproduction (sexual reproduction eg flower structures, pollination and fertilisation, seed production, dispersal), (asexual reproduction eg vegetative propagation, parthenogenesis)

## Topic 2.3

Learners will understand the growth and development of plants, to include cell division, cell expansion, cell differentiation, apical meristems, lateral meristems, formation of roots, shoots, leaves and buds

## Learning outcome:

### 3. Understand how soils affect plant growth and development

#### Topics

- 3.1 Soil types and soil formation
- 3.2 Investigate characteristics of soil types
- 3.3 How soils affect plant growth and development
- 3.4 Cultural techniques that affect soil characteristics

In this outcome learners will need to investigate a range of soil types and carry out supervised basic soil experiments to investigate different soil characteristics. These could include investigating the proportion of sand, silt and clay through suspending in water, investigating the water holding capacity of different soil types, and determining soil pH. The learners' understanding of the effects of soil characteristics on plant growth and development could be supported by some controlled experiments, where learners grow plants in different soil types.

Delivery could be enhanced by visits to see different types of plants growing in different soil types. Visiting expert speakers' input would be useful, as they would describe practical aspects of managing soil structure and plant nutrition.

#### Topic 3.1

Learners will identify a range of soil types to include loams, clays, silts, sands, organic soils, and understand how soil is formed.

#### Topic 3.2

Learners will investigate the characteristics of a range of soil types and profiles to include

- soil profiles and different horizons
- properties of soil particles and texture (clay, silt and sand),
- soil structure (i.e. crumb structure, aggregate sizes)
- water holding capacity,
- aeration,

- stability,
- organic matter,
- pH
- soil life: decomposers, mycorrhizae.

### Topic 3.3

Learners will understand how soil properties and characteristics can affect plant growth and development, to include

- rooting depth and plant stability,
- pH and organic matter,
- availability or lack of macronutrients and micronutrients,
- effects of organic and inorganic fertiliser application,
- nutrient retention to include cation exchange capacity
- drainage/water logging,
- compaction/poor aeration
- effects of high or low soil water content
- effects on ability to prepare soil for planting

### Topic 3.4

Learners will understand how cultural techniques affect soil structure, to include

- Soil amelioration (eg green manure, addition of lime, organic matter, hydrogels, mycorrhizae, textural amendment)
- Soil cultivation (eg sub-soiling, ploughing, single and double digging, rotavating, minimal cultivation, zero cultivation)
- Soil protection and prevention of damage (eg capping, erosion, cultivation pans, surface and subsurface compaction)

## Guidance for delivery

On completion of this unit, the learner will have developed an understanding of how plants grow and develop, through knowledge of their structure and physiology. It will be important that delivery relates to plants that are vocationally relevant to the learners. Laboratory and field based practicals will be essential to help learners to explore soil characteristics, plant physiology and structure, and a series of visits to growing plants could help learners better understand plant growth and development. Learners are required to study a range of plants for this unit, although they should be able to focus upon plant types that are most relevant to their vocational area of study. Learners will also need to have access to a range of soils, as well as appropriate equipment and resources to undertake soil sampling and investigate soil profiles.

Visiting speakers could enhance relevance of the subject to learners. Development of areas within a college environment where learners are able to modify and manipulate plant environments may enhance understanding of the complexities of plants and their life cycles.

## Suggested learning resources

### Books

Adams C.R. and Early M. 2011. *Principles of Horticulture. 6<sup>th</sup> Edition*. Routledge. ISBN 0080969577

- Allaby, M. 2012. *A Dictionary of Plant Science. 3<sup>rd</sup> Edition*. OUP Oxford. ISBN 0199600570
- Ashman M. and Puri, G. 2008. *Essential Soil Science: A clear and concise introduction to soil science*. Wiley-Blackwell ISBN 0632048859.
- Beck C.B. 2010. *An Introduction to Plant Structure and Development: Plant Anatomy for the Twenty-First Century. 2<sup>nd</sup> Edition*. Cambridge University Press. ISBN 0521518059
- Brady N.C. and Weil R.R. 2014. *Nature and Properties of Soils. 14<sup>th</sup> Edition*. Pearson Education. ISBN 9332519102.
- Cutler D.F., Botha T. and Stevenson D.W. 2008. *Plant Anatomy: An Applied Approach*. John Wiley & Sons. ISBN 1405126795
- Buchanan B.B., Grussem W. and Jones, R. 2015. *Biochemistry and Molecular Biology of Plants. 2<sup>nd</sup> Edition*. Wiley-Blackwell. ISBN 0470714212
- Evert R.F and Eichhorn S.E. 2012. *Raven Biology of Plants. 8<sup>th</sup> Edition*. WH Freeman & Co Ltd. ISBN 1464113513.
- Lack, A. and Evans, D. 2005. *Instant Notes in Plant Biology. 2<sup>nd</sup> Edition*. Taylor and Francis. ISBN 0415356431
- Mauseth, J.D. 2014. *Botany: An Introduction to Plant Biology. 5<sup>th</sup> Edition*. Jones & Bartlett Publishers. ISBN 1284068854
- Reiss, M, Monger, G. 2000. *Advanced Biology*. Cheltenham: Nelson Thornes. ISBN 0174387326
- Roberts, M. and Ingram N. 2001. *Biology. 2<sup>nd</sup> Revised Edition* Nelson Thornes. ISBN 0748762388.
- Smith A., Coupland G., Dolan L., Harberd N., Jones J., Martin C., Sablowski R. and Amey A. 2009. *Plant Biology*. Garland Science. ISBN 0815340257
- Taiz, L., Zeiger, E. 2010. *Plant Physiology. 5<sup>th</sup> Edition*. Hampshire: Sinauer Associates. ISBN 0878935657
- Wayne R. 2009. *Plant Cell Biology*. Academic Press. ISBN 0123747783
- White R.E. 2005. *Principles and Practice of Soil Science: The Soil as a Natural Resource. 4<sup>th</sup> Edition*. Wiley-Blackwell. ISBN 0632064552.

### **Journals and magazines**

Arborist News  
 Essential Arb  
 Forestry Journal  
 Journal of Arboriculture  
 Quarterly Journal of Forestry  
 The Arb Magazine  
 Field mycology

### **Websites**

- Biotechnology and Biological Sciences Research Council <http://www.bbsrc.ac.uk>
- British Society of Soil Science <http://www.soils.org.uk/>
- DEFRA <http://www.defra.gov.uk>
- Environment Agency <http://www.environment-agency.gov.uk>
- Health and safety Executive <http://www.hse.gov.uk>
- Science and Plants for Schools <http://www.saps.org.uk/>
- The Arboricultural Association <http://www.trees.org.uk/>
- The Forestry Commission <http://www.forestry.gov.uk>

## Unit 306

## Undertake estate skills

<b>UAN:</b>	K/507/4645
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

The purpose of this unit is to introduce learners to common estate skills and knowledge and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into the sector or into further/higher education.

The learner will look at constructing, repairing and maintaining boundaries, structures and surfaces. They will build their experience and confidence in developing practical skills in a range of situations. The learner will be able to contextualise practical management work to a particular habitat that lies within their primary area of learning.

### Learning outcomes

In this unit, learners will be able to

1. Construct, repair or maintain boundaries
2. Construct, repair or maintain structures
3. Construct, repair or maintain surfaces
4. Carry out practical habitat management work

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

### Learning outcome:

#### 1. Construct, repair or maintain boundaries

### Topics

- 1.1 Prepare for work on boundaries
- 1.2 Select equipment and materials
- 1.3 Construct, repair or maintain boundaries

In this outcome learners will develop the practical skills needed to construct, repair or maintain at least **two** different boundaries.

#### Boundaries, eg

- hedge, bank, ditch,
- fence (post and rail, post and wire, electric, netting)
- wall (stone, brick)

#### Topic 1.1

Learners will plan the task, clear debris and prepare the site, ensure livestock and public safety, consider factors associated with the location (eg power supply, waste disposal, equipment and materials storage)

#### Topic 1.2:

Learners will select materials and equipment relevant to the task, taking into account health and safety, sustainable practice and cost implications

#### Topic 1.3:

Learners will undertake the task safely (eg implementation of risk assessment and appropriate Personal Protective Equipment (PPE)) and to the required standards

### Learning outcome:

#### 2. Construct, repair or maintain structures

### Topics

- 2.1 Prepare for work on structures
- 2.2 Select equipment and materials
- 2.3 Construct, repair or maintain structures

In this outcome, learners will construct, repair or maintain at least **two** different structures. These may typically be constructed from wood, metal, stone or brick. Learners are not expected to be able to fully construct substantial structures such as animal or machinery housing, however, it is anticipated that delivery could include repair and maintenance of such larger structures as would be found in an estate setting

### **Structures eg**

Gate, stile, horse jump, bird box, table, bench, door, raised bed, composting area or swim platform. Large structures requiring repair or maintenance may include animal house or pen, machinery or feed store, garden furniture, shed and pergola.

#### **Topic 2.1**

Learners will plan the activity, clear debris and prepare the site, ensure livestock and public safety, consider location factors (power supply, waste disposal, equipment and materials storage).

#### **Topic 2.2:**

Learners will select materials and equipment relevant to the task, taking into account health and safety, sustainable practice and cost implications.

#### **Topic 2.3:**

Learners will undertake the task safely (eg implementation of risk assessment and appropriate Personal Protective Equipment (PPE)) and to the required standards.

### **Learning outcome:**

#### **3. Construct, repair or maintain surfaces**

### **Topics**

- 3.1 Prepare for work on surfaces
- 3.2 Select equipment and materials
- 3.3 Construct, repair or maintain surfaces

In this outcome learners are required to construct, repair or maintain **one** surface (eg path, road and hard standing) which could be either solid (eg decking, concrete and paving), or loose (eg gravel, wood chippings and sand). Where appropriate, learners should be aware of timeliness considerations, for example preparing concrete at the right time for construction.

#### **Topic 3.1**

Learners will plan the task, clear debris and prepare the site, ensure livestock and public safety, consider factors associated with the location (eg power supply, waste disposal, equipment and materials storage)

#### **Topic 3.2:**

Learners will identify and select materials and equipment relevant to the task, taking into account health and safety, sustainable practice and cost implications

#### **Topic 3.3:**

Learners will undertake the task safely (eg implementation of risk assessment and appropriate Personal Protective Equipment (PPE)) and to the required standards

### **Learning outcome:**

#### **4. Carry out practical habitat management work**

### **Topics**

- 4.1 Prepare for habitat management work
- 4.2 Select equipment and materials
- 4.3 Carry out practical habitat management work

In this outcome learners are required to undertake practical habitat management work (eg mowing, renovation, tree and shrub planting, clearing unwanted vegetation, coppicing, pruning, thinning, pond, stream and ditch clearance, and control of invasive species). Where appropriate, learners should be aware of time considerations, for example preparing concrete at the right time for construction.

#### **Topic 4.1**

Learners will plan the task, clear debris and prepare the site, ensure livestock and public safety, consider factors associated with the location (eg power supply, waste disposal, equipment and materials storage)

#### **Topic 4.2**

Learners will identify and select materials and equipment relevant to the task, taking into account health and safety, sustainable practice and cost implications

#### **Topic 4.3**

Learners will undertake the task safely (eg implementation of risk assessment and appropriate Personal Protective Equipment (PPE)) and to the required standards.

### **Guidance for delivery**

This unit has a very practical focus, and aims to enable learners to develop estate skills which can be applied to a range of situations and circumstances. The unit has been written such that naturally occurring and locally relevant opportunities can be used in selecting sites, structures and surfaces to construct, repair or maintain.

As learners will be engaged in practical activity there should be an emphasis on safe working practices, including the use of appropriate personal protective equipment (PPE), and appropriate risk assessments should be undertaken. At Level 3 it is expected that learners will take an active part in completing risk assessments, so that this becomes an integral part of all practical activity. Learners should also be made aware of the impact on the environment, and sustainability concepts should also be demonstrated where possible.

Learners should have the opportunity to undertake estate skills activity in a land-based setting wherever possible to maximise the vocational relevance. It will be most beneficial if the structures, boundaries and surface selected are for a clear purpose above and beyond delivery of this unit. It is recognised that there will not be opportunities to carry out construction, repair *and* maintenance in each of the categories, but it would be appropriate for the skills of construction, repair and maintenance to each be developed in one aspect of the unit.

It is anticipated that most delivery of this unit will take place in a practical setting, with supervised practice of skills. Delivery will also include some classroom based activity in ensuring learners have a good understanding of planning, materials selection and preparation, and underpinning knowledge.

## Suggested learning resources

### Books

- Agate E (Ed), Brooks A and Adcock S (1999) *Dry Stone Walling: A Practical Handbook*. The Conservation Volunteers.
- Agate E (2001) *Fencing: A Practical Handbook*. The Conservation Volunteers.
- Agate E (2001) *Footpaths: A Practical Handbook*. The Conservation Volunteers.
- Agate E and Brooks A (1998) *Hedging: A Practical Handbook*. The Conservation Volunteers.
- Agate E (Ed) (2001) *Tree Planting and Aftercare: A Practical Handbook*. The Conservation Volunteers.
- Agate E (2000) *Tool Care: A Maintenance and Workshop Manual*. The Conservation Volunteers.
- Agate E (2001) *Waterways & Wetlands: A Practical Handbook*. The Conservation Volunteers.
- Agate E (Ed) (2002) *Woodlands: A Practical Handbook*. The Conservation Volunteers.
- Maclean M (2006) *Hedges and Hedgelaying – A Guide to Planting, Management and Conservation*. The Crowood Press.
- Roberts, M. (1997) *Poultry House Construction*. Gold Cockerel Books
- Roberts, M. (1999) *The Smallholder's DIY*. Gold Cockerel Books
- Roberts, M. (2005) *Farm and Smallholder Fencing: A Practical Guide to Permanent and Electric Livestock Fencing on the Farm and Smallholding*. Gold Cockerel Books
- Stokes A (1999) *Health and Safety Overview for Practical Conservation Project: A Guide to Good Practice for Conservation Groups and Land Managers*. The Conservation Volunteers.

### Websites

- The Conservation Volunteers [www.tcv.org.uk](http://www.tcv.org.uk)
- Department for Environment, Food and Rural Affairs [www.defra.gov.uk](http://www.defra.gov.uk)
- Health and Safety Executive [www.hse.gov.uk](http://www.hse.gov.uk)
- The Wildlife Trusts [www.wildlifetrusts.org](http://www.wildlifetrusts.org)
- Forestry Commission [www.forestry.gov.uk](http://www.forestry.gov.uk)

## Unit 307

## Livestock husbandry

<b>UAN:</b>	T/507/6849
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

This unit aims to introduce to the skills and knowledge needed for agricultural livestock production and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into employment in the agriculture sector or into further or higher education.

The learner will study the range of beef, dairy, pig and sheep husbandry systems, the principles of production animal health and breeding and practical skills and regulation involved in the planning and management of modern livestock production systems.

### Learning outcomes:

In this unit, learners will be able to

1. carry out beef husbandry activities
2. carry out dairy husbandry activities
3. carry out pig husbandry activities
4. carry out sheep husbandry activities

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

It is not anticipated that learners will develop practical skills to carry out the full range of husbandry activities across the full range of farm animals. Delivery should be planned to enable them to gain an overview of these, but then to take part in a range of six husbandry tasks or activities for at least two categories of farm livestock (where appropriate).

## Learning outcome:

### 1. Carry out beef husbandry activities

#### Topics

- 1.1 UK Beef Industry
- 1.2 beef production systems
- 1.3 husbandry tasks on beef cattle

#### Topic 1.1

Learners will understand the UK beef industry in terms of: trends, breeds, consumption vs production, marketing.

#### Topic 1.2

Learners will understand beef production systems:

- suitability of breed and sex for production system
- Grass fed, cereal fed, 18 month grass/cereal and 24 month grass/silage fed, suckled beef production.

#### Topic 1.3

Learners will understand and carry out husbandry tasks:

- restrain calf
- signs of health
- temperature
- ear tagging
- disbudding
- dosing
- weighing and handling
- selection for slaughter.

## Learning outcome:

### 2. Carry out dairy husbandry activities

#### Topics

- 2.1 UK Dairy Industry
- 2.2 The dairy cow's year
- 2.3 Husbandry tasks relating to dairy cattle

### **Topic 2.1**

Learners will understand the UK dairy industry in terms of: trends, breeds, consumption vs production, marketing

### **Topic 2.2**

Learners will understand the dairy cow's year:

- calving index
- replacements
- lactation
- feeding
- housing.

### **Topic 2.3**

Learners will understand and carry out husbandry tasks relating to dairy cattle:

- signs of heat
- milking
- parlour cleaning
- sterile milk sample
- condition score
- use of dairy cow records
- mastitis identification
- preparation for artificial insemination
- grazing techniques
- calving .

### **Learning outcome:**

#### **3. Carry out pig husbandry activities**

### **Topics**

- 3.1 UK pig Industry
- 3.2 Pig production systems
- 3.3 Husbandry tasks relating to pigs

### **Topic 3.1**

Learners will understand the UK pig industry in terms of: trends, breeds, consumption vs production, marketing.

### **Topic 3.2**

Learners will understand pig production systems

- farrowing to weaning
- weaning to service

- pregnant sow
- boar
- gilt
- weaned pig
- finishing pig.

### Topic 3.3

Learners will understand and carry out husbandry tasks relating to pigs:

- handle pigs of all ages
- move pigs of all ages
- teething, tailing
- iron injection
- earmark
- signs of health
- temperature taking
- heat detection
- prepare pig for farrowing
- select pig for slaughter.

### Learning outcome:

#### 4. Carry out sheep husbandry activities

### Topics

- 4.1 UK Sheep Industry
- 4.2 Sheep production systems
- 4.3 Husbandry tasks relating to sheep

### Topic 4.1

Learners will understand the UK sheep industry in terms of:

- Trends
- Breeds
- consumption vs production
- marketing.

### Topic 4.2

Learners will understand sheep production systems:

- preparation for tupping
- mating season
- mid-pregnancy
- preparation for lambing
- lambing
- grass lamb systems
- store lamb finishing

- shearing.

### **Topic 4.3**

Learners will understand and carry out husbandry tasks relating to sheep:

- move sheep
- use 5 point plan to deal with lameness
- recognise breeds
- age by dentition
- ear tagging
- signs of health
- catch
- restrain
- move turn
- oral drenching
- injection
- dagging
- select lambs for slaughter
- tail lambs
- castrate lambs
- harness a ram
- set up hand piece
- condition score ewes.

## Guidance for delivery

This unit will introduce learners to the major types of agricultural livestock production in the UK, and equip them with some practical husbandry skills. As learners will be engaged in practical activities, safe working practices should be emphasised, including the use of appropriate personal protective equipment (PPE). Appropriate risk assessments should be undertaken and at Level 3 it is expected that learners will take an active part in completing risk assessments, so that this becomes an integral part of all practical activity. Learners will also know the importance of animal welfare, and sustainability concepts should be demonstrated to them where possible.

Each learning outcome calls for a combination of practical and theoretical study. Theory and practical classes on the college farm can achieve this. Additional resources may need to be outsourced from local farms cooperating with the centre.

For each Learning outcome, learners need to gain an overview of all the major production systems for either beef cattle, dairy cattle, sheep or pigs. It would be helpful if delivery includes visits to a number of different production systems. Where this is not feasible due to production systems not being available in the local area, learning should be supported by high quality and up-to-date audiovisual resources.

Learners will understand the major husbandry requirements of production systems and develop the skills to undertake these husbandry tasks and requirements in practice. Learners will need supervised access to a range of production systems to enable them to practice their skills. This could be linked to appropriate work placements. It is important that the health and safety of learners and the welfare of animals are emphasised during both theoretical and practical learning

## Suggested learning resources

### Books

- Allen, D. 1990. Planned Beef Production and Marketing. (Blackwell Science, ISBN 0632026111)
- Croston, D and Pollott, G. 1993. Planned Sheep Production. (Blackwell Science, ISBN 0632035765)
- Gillespie, J. 2000. Modern Livestock and Poultry Production. Delmar, ISBN 0766816079
- Soffe, R and McConnell, P. 2003. The Agricultural Notebook. Blackwell Science, ISBN 0632058293
- Speedy, A. 1980. Sheep Production: Science into Practice. (Longman Higher Education, ISBN 0582455820)

### Websites

- <http://www.defra.gov.uk> Department for Environment, Food and Rural Affairs
- <http://www.wales.gov.uk> Welsh Assembly Government
- <http://www.scotland.gov.uk> Scottish Executive Environment and Rural Affairs Department
- <http://www.dardni.gov.uk> Department of Agriculture and Rural Affairs (Northern Ireland)
- <http://www.fawc.org.uk> Farm Animal Welfare Council
- <http://www.mdc.org.uk> Milk Development Council
- <http://www.mlc.org.uk> Meat and Livestock Commission
- <http://www.beefandlamb.ahdb.org.uk> Beef and lamb levy board
- [www.redtractor.org.uk](http://www.redtractor.org.uk)

## Unit 308

## Business management in the Land-Based sector

<b>UAN:</b>	A/507/4648
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

The purpose of this unit is for learners look at the businesses within the land based sector, the role and responsibilities of those employed in land-based businesses and resource requirements.

This unit links closely to **Unit 302: Undertake and review work related experience in the Land-based Industries**

### Learning outcomes

In this unit, learners will be able to

1. understand the breadth and importance of an industry in the land-based sector
2. understand business resources and structures
3. understand the business marketplace
4. understand how to use financial and physical record keeping systems

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

### Learning outcome:

#### 1. Understand the breadth and importance of an industry in the land-based sector

##### Topics

1.1 Importance to the economy

1.2 Associated businesses

In this outcome, learners will investigate the size, scope and importance of their specialist sector within the environment and land-based industries, and how this has developed over the last 50 years or so. They will also investigate the range of business types and other organisations that are represented in their sector, including important regulatory, professional or representative organisations. Wherever possible this should be related to specific businesses and organisations.

##### Topic 1.1

Learners will understand the importance of businesses within the industry to the economy

- Using measures available to the industry, including
  - value of output
  - contribution to Gross Domestic Product (GDP)
  - employment
  - land use
  - economic and social benefits
  - trends in importance
- Range of organisations:
  - typical types of businesses and other organisations (eg representative, regulatory, not-for-profit)
  - regional variations
  - changes and developments in the last 50 years

##### Topic 1.2

Learners will understand the range of associated businesses allied to the industry, to include

- relevant industries in primary, secondary and tertiary industrial sectors (eg suppliers of raw materials, processors, distributors, retailers, service providers)
- associated organisations:
  - specific interrelationships between one business and other associated organisations eg
    - suppliers of goods and services
    - representative organisations and professional bodies
    - regulatory bodies
    - competitors
    - customers
    - aims and roles of important organisations in the sector

## Learning outcome:

### 2. Understand business resources and structures

#### Topics

- 2.1 Legal structure and organisation
- 2.2 Physical resource requirements
- 2.3 Job roles and responsibilities

This outcome focuses on the legal and resource implications of constituting a business. Learners will learn about the range of business organisations in the private and public sectors, and the legal and practical implications of different business types. This should be related to the types of business important in their sector. Learners will investigate the physical resource requirements of businesses, and how they are managed.

#### Topic 2.1

Learners will understand the legal structure and organisation for the following business types:

- sole trader
- partnership
- limited company
- not-for-profit organization
- charity
- public sector organisations
- organisation staffing structure

#### Topic 2.2

Learners will understand the physical resource requirements of a selected land-based business, to include

- property ie forms of tenure, appraisal of business potential
- vehicles and machinery
- tools and equipment
- materials ie stocks control procedures
- insurance of physical resources

#### Topic 2.3

Learners will understand different job roles and responsibilities in a selected land-based business.

- Job roles relevant to the sector, including
  - director
  - manager
  - supervisor
  - team worker
  - trainee
  - administrator
  - volunteer
  - sub contractor
- For each of the above job roles, learners will explore:
  - job description (eg responsibilities for financial physical and human resources, staff motivation and performance management)
  - person specification (typical skills, qualifications and experience required to fulfil the role)

- legal rights and responsibilities in work (eg pay, working hours, holidays, equal opportunities, health and safety, employment protection)

Learners will know relevant employment legislation, including

- Employment Act 2002
- National minimum wage Act 1998
- Working times regulation Act 1998
- Equality Act 2010

### **Learning outcome:**

### **3. Understand the business marketplace**

#### **Topics**

- 3.1 Marketplace, customers and competitors
- 3.2 Supply chain
- 3.3 Quality management

In this outcome, learners will analyse the market for a specific land-based business. This could involve a case study project and should identify, for that business, information on the content listed. External influences should be relevant and current to that business. Specific competitors should be identified and analysed to identify strengths and weaknesses to the case study business. When investigating the supply chain learners will need to identify the flow of resources from production of raw materials, through relevant manufacture and processing, to end consumers. Quality management will include reference to any formal standards or approvals that are relevant. It should also consider the quality standards required by the industry, any systems and practices that are used to achieve quality, and implications of failing to meet prescribed or assumed levels of quality.

#### **Topic 3.1**

Learners will understand the marketplace, customers and competitors for a land-based business by investigating the following:

- size of market ie value of sales, number of customers
- external influences on the market ie political, economic, socio-cultural, technological
- customer base ie number, type, characteristics, market segments
- competitor analysis ie direct and indirect competitors

#### **Topic 3.2**

Learners will understand the importance of efficiency and interdependency in a supply chain in a land-based context, considering the following:

- suppliers
- distributors
- customers
- supply chain assurance
- ethics

#### **Topic 3.3**

Learners will understand quality management systems and practices within a land-based business

- Important aspects of quality in the sector
- Formal quality standards or approval eg BALI approved, Plant Passports, British Standards
- Informal systems and practices to achieve quality
- Problems arising if quality is not achieved

### **Learning outcome:**

#### **4. Understand how to use financial and physical record keeping systems**

### **Topics**

4.1 Financial records

4.2 Physical records

4.3 Monitor business performance and progress

This outcome focuses on the range of financial and physical records that are required to meet legal requirements as well as to ensure effective business operation. Learners will complete a range of financial records. They should be aware of paper-based and computerised systems for financial records but are not expected to become competent in the use of IT accounts software. The range of physical records investigated should be related to the needs of the learners' specialist sector, and should include important current examples of legally required records. In addition to completing a range of records, learners will investigate how specific examples can be used to aid decision making, monitor and control business performance.

#### **Topic 4.1**

Learners will understand the importance of keeping accurate financial records for a selected land-based business in relation to legal requirements and management efficiency. Learners will understand the following financial records:

- purchasing and ordering procedures
- order forms and orders
- deliveries and receipts
- invoices and sales records
- credit control
- payment methods
- bookkeeping ie cash analysis, petty cash, cash flow, budgets, computer accounts programmes
- basic accounts ie trading account, balance sheet, depreciation
- taxation ie VAT, income tax PAYE, national insurance contributions, corporation tax
- wage calculation.

#### **Topic 4.2**

Learners will understand the importance of recoding physical records for a selected land-based business, to include

- production
- inputs
- staffing
- customers
- resource use
- data protection

- legal requirements to keep records eg pesticide use, veterinary medicines, transport, animal movement, passports

#### **Topic 4.3:**

Learners will understand how financial and physical records are used in monitoring business performance and progress to include

- production levels
- costs of production
- financial efficiency
- monitoring against targets
- budgets
- previous periods
- relevant review periods ie weekly, monthly, annually
- appropriate remedial actions
- staff roles in recording and analysing information.

#### **Guidance for delivery**

This unit is designed to provide the learner with an understanding of the business aspects of their industry. It is applicable to all sectors of the environment and land-based sector and learners focus their study on the sector most relevant to their vocational interests.

Centres are encouraged to introduce employers and specific professionals from industry to provide interesting and relevant information to the learner. Teaching would also benefit from visits to a variety of establishments to add depth to the learner experience.

It is accepted that formal lectures will be necessary at level 3 but for this unit it is recommended that they are they are linked directly with interactive lessons in a real environment.

## Unit 309

## Undertake a specialist project in the Land-Based sector

<b>UAN:</b>	D/507/4643
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

The purpose of this unit is for learners to gain an understanding of the principles of undertaking a specialist project and how this can be put into practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or to further education and training.

Learners will develop project knowledge and skills by studying a chosen topic area through a project. They will explore topic areas that interest them and select one topic for their project. They will plan and carry out their specialist project working to meet deadlines and monitoring performance. Learners will prepare an evaluative report looking at how the project performed, if the schedule plan met the project aims and objectives and how improvements could be made in the future.

### Learning outcomes

In this unit, learners will be able to:

1. Develop proposals for specialist projects
2. Plan for specialist projects
3. Carry out specialist projects
4. Evaluate specialist projects

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

## Learning outcome:

### 1. Develop proposals for specialist projects

## Topics

1.1 Research topics for specialist sources using information sources

1.2 Project proposal

In this outcome, learners will need to identify a suitable topic for their investigative project. This should be relevant to their programme of study and have a particular interest for them, for example in relation to a special area of interest, experience or future employment of study ambitions. Ideal project topics could have a practical or theoretical focus, but all projects should include potential for research into existing literature and information sources as well as a practical investigation or application, so should be chosen in agreement with the tutor. Learners are likely to need guidance on suitable project topics and tutor support to ensure that selected topics are achievable in the timescale and with the resources available. The proposal should outline the aims and objectives, information sources, resource requirements, and the methodology by which the learner intends to complete the project, as well as their justification for topic selection. If appropriate to the investigation, a hypothesis should be included as part of the methodology.

### Topic 1.1

Learners will use a range of information sources to research topics for specialist project, including:

- textbooks
- journals
- magazines
- internet
- trade literature
- television and radio
- subject experts.

Learners will comment on the validity and reliability of each type of information source.

Learners will carry out research using methods appropriate to the topic, for example:

- literature review
- trials, experiments
- practical activities
- questionnaires
- interviews
- surveys.

### Topic 1.2

Learners will produce proposals for specialist projects to include:

- Title
- aims/objectives
- methodology
- information sources
- resources required for completion of the project ie advice and support, computers, materials
- justification of proposed project.

## Learning outcome:

### 2. Plan for specialist projects

#### Topics

2.1 Planning operations and resources

2.2 Selection of resources

In this outcome, learners will complete a detailed action plan for completion of the specialist project within the set timescale. This should include, as a minimum:

- a detailed breakdown of key milestones from starting the project up to submission of the completed project report
- resources required at each stage (and reasons for their selection)
- time expected for completion and interim target completion dates.

Learners should also consider possible setbacks to their planned schedule and contingency plans to ensure timely completion of the project.

#### Topic 2.1

Learners will plan operations required to carry out a selected specialist project, to include:

- Project planning techniques:
  - critical path analysis
  - Gantt charts
- sequencing of activities
- working to deadlines
- allowing for other commitments
- project action plan:
  - aims
  - objectives
  - specific operations / tasks
  - start and completion dates
  - time required
  - resources required
  - possible disruptions to plan eg illness, IT problems, resource problems, cost
  - Contingencies
  - remedial actions.

#### Topic 2.2

Learners will justify reasons for resources selected based on suitability, availability and cost, to include:

- people
- time
- buildings
- equipment
- animals
- materials
- literature and media eg internet, trade magazine
- IT applications and budget.

## Learning outcome:

### 3. Carry out specialist projects

#### Topics

##### 3.1 Monitor progress

##### 3.2 Health and safety implications

In this outcome, learners will conduct and complete their specialist project, collecting supporting evidence as appropriate, for example literature review, artefacts, witness statements, photographs or videos. Whilst doing this, they should maintain a log or diary of all actions, and regularly monitor their progress against their action plan. It would be appropriate for tutors to conduct progress reviews at key stages of the project. As part of conducting the project, learners should discuss any health and safety implications of their work, and identify any relevant legislation or codes of practice. Risk assessments may contribute to evidence of this.

#### Topic 3.1

When carrying out their project, learners will monitor progress against deadlines using a diary or action log.

Learners will monitor performance against:

- schedule plan ie daily, weekly, monthly progress
- budget
- other appropriate measures for each tasks.

Learners will capture reasons and remedial actions if falling behind schedule using a diary or action log.

Deadlines can be defined as interim, key milestones or final, and should be reviewed at regular intervals by tutor/supervisor.

#### Topic 3.2

Learners will discuss the health and safety implications, where applicable, of the specialist project, taking into consideration:

- health and safety
- risk assessment
- Personal Protective Equipment (PPE)
- relevant regulations and legislation
- codes of practice.

#### Learning outcome:

### 4. Evaluate specialist projects

#### Topics

##### 4.1 Report on project

##### 4.2 Evaluating achievements and areas for improvement

In this outcome, learners will produce a summary report of their project and the process of its completion. This should cover, as a minimum:

- title
- aims / objectives

- review of existing literature / information
- methodology
- results / findings
- conclusions
- references.

#### **Topic 4.1**

Learners will report on the project either in a written report format, or verbally through a presentation.

#### **Topic 4.2**

Learners will evaluate achievements and areas for improvement for their specialist projects, including:

- conduct and management of the project:
  - action plan
  - keeping to deadlines
  - problems and remedial actions
  - project results/findings
  - strengths and weaknesses
- Areas for improvement:
  - Planning
  - Implementation methodology
  - results/findings
  - report
  - topics for further investigation.

## Guidance for delivery

This unit is designed to encourage and develop learners' independent thinking and research skills. The concept of the project is applicable across all of the vocational areas in the environmental and land-based sector, and learners should be guided and encouraged to select a project topic that is particularly relevant to their interests. Suitable project topics could include:

- trial or experiment
- investigation of an issue important to the sector
- production of a structure or artefact
- training programme
- improving a process
- investigation of a new product or service.

All referencing should comply with academic conventions.

The project evaluation should consider the strengths and weaknesses of the finished project and the process of its completion. Consideration of the usefulness and importance of project planning, and ways in which the project could have been improved.

## Suggested learning resources

### **Books**

- |  |                     |
|--|---------------------|
| The Project Management Pocketbook<br>Published by: Management Pocketbooks, 1998  | Applegarth, M       |
| The Definitive Guide to Project Management: The Fast Track to Getting the Job Done on Time and on Budget<br>Published by: Financial Times Prentice Hall, 2 <sup>nd</sup> edition, 2007 | Nokes, S & Kelly, S |
| Project Management for Dummies<br>Published by: Wiley Publishing, 2001   | Portney, S.E        |

## Unit 310

## Land-based power units

<b>UAN:</b>	T/507/6852
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

This unit aims to provide learners with an understanding of the principles of land-based power units and how these can be applied in practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the agriculture sector or further education and training.

The aim of this unit is to provide learners with skills, knowledge and understanding to enable them to select, evaluate, maintain and repair a range of land-based power units typical to their area of study.

### Learning outcomes:

In this unit, learners will be able to

1. understand the functions of key components found in land-based power units
2. know the key features of land-based machines and power units
3. undertake routine maintenance of land-based machines and power units
4. understand the applications of land-based machines and power units

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

### Learning outcome:

#### 1. Understand the functions of key components found in land-based power units

### Topics

1.1 Purpose and function of key components

1.2 Operator adjustments

1.3 Control systems

#### Topic 1.1

Learners will understand the purpose of key components used in land-based power units, including

- mechanical power transmissions: gears; shafts; belts and pulleys; chains and sprockets; bearings; bushes; clutches; safety overload protection systems; power take off components and systems
- hydraulic systems: reservoirs; pumps; motors; filters; control valves and systems; oil cooling; pipes and fittings; pressure relief valves; pressure accumulators
- electrical systems: battery; fuses; generators; sensors; lighting; motors; cables and connections; auxiliary supply.

#### Topic 1.2

Learners will understand operator adjustments:

- power unit: speed, power, economy
- mechanical power transmission: power take off speeds and alignment; gear selection; belt and chain tensioning; clutch adjustment; overload protection adjustment
- hydraulic system: pressure and flow control, position and draft control, mixture control, auxiliary connections and services, single and double acting supply, mechanical and electrical control systems
- electrical systems: alternating and direct current, sensors..

#### Topic 1.3

Learners will understand control systems, including

- operator ergonomics - position of controls,
- wheels and tyres, including tracks, skids and flotation
- steering systems
- braking systems
- differential locking
- manual selection
- automatic integration headland management
- global positioning.

## Learning outcome:

### 2. Know the key features of land-based machines and power units

#### Topics

- 2.1 Power unit
- 2.2 Transmission system
- 2.3 Electrical and hydraulic systems

#### Topic 2.1

Learners will know the key features of power units:

- engine rpm, fuel types, weight, fuel consumption, power torque, exhaust emissions, two stroke cycle, four stroke cycle, fuel system, lubrication system (pressure lubrication, splash feed), turbo chargers
- liquid cooling systems: liquid and air-cooled systems, fans, pumps, thermostat, coolant, pressure caps, airflow, cowlings, guards
- air filtration systems: pre-cleaners, cyclones, oil bath, filters, restriction warning system, unloader valves.

#### Topic 2.2

Learners will know power transmission systems:

- vehicle transmissions
- lines of drive
- reduction gearbox
- interchangeable sprockets and pulleys
- variator drives
- slip clutch
- clatter clutch
- shear bolts.

#### Topic 2.3

Learners will know electrical and hydraulic systems:

- electrical systems: Alternating current, direct current, voltage and current flow, simple circuits, fuse ratings, applications to land-based vehicles and hand operated electrical powered equipment, charging and generating system, solenoids, actuators
- hydraulic systems: Hydraulic circuits, reservoirs, pumps, motors, open and closed systems, oil cooler, flow and return filtration.

## Learning outcome:

### 3. Undertake routine maintenance of land-based machines and power units

#### Topics

- 3.1 Risk assessment
- 3.2 Routine maintenance
- 3.3 Recording documents

#### Topic 3.1

Learners will carry out risk assessments in preparation for performing routine maintenance tasks to power units, and have knowledge of current legislation including

- Health and safety and environmental protection, hazards, risks, control measures, safe use of tools, jacks, lifting equipment, power isolation.
- Legislation
- Health and Safety at Work etc Act 1974 (HASWA),
- Control of Substances Hazardous to Health (2002) (COSHH),
- Provision and Use of Work Equipment Regulations 1998 (PUWER),
- Lifting Operations and Lifting Equipment Regulations 1998 (LOLER).

### **Topic 3.2**

Learners will carry out routine maintenance of power units, according to manufacturers' recommendations, including

- maintenance activities: pre-start checks, pre-operation inspections, routine maintenance, recommended service procedures, use of service charts, operator manuals, lubricant data sheets
- manufacturers' recommendations relating to: time intervals, work intervals, recommended lubricants, correct filters, service procedure, adjustments, critical settings, warranty restrictions.

### **Topic 3.3**

Learners will complete documentation to record maintenance tasks carried out on power units, including: check list, job card, date of service, type of service, replacement components used, vehicle recognition, serial and registration numbers, indication on machine of when future service is due.

## **Learning outcome:**

### **4. Understand the applications of land-based machines and power units**

#### **Topics**

- 4.1 Characteristics of power units, transmissions and hydraulic systems
- 4.2 Operating settings
- 4.3 Alternative designs

### **Topic 4.1**

Learners will understand the characteristics of power units, transmissions and hydraulic systems:

- power units: power, torque, fuel consumption, mobile and fixed applications, vehicles, generators
- transmissions: speed, ratios, torque requirements, traction
- hydraulic systems: linkage, brakes, steering, power transmission operation, external supply.

### **Topic 4.2**

Learners will understand operator settings available on power unit, transmission and hydraulic systems, in order to assess the effects on the performance of land-based machines when changing these operator settings

- power unit: speed (rpm) – power, torque, traction, fuel consumption, exhaust emissions

- transmission: gear selection and power take off speed  
traction, speed, torque, efficiency
- hydraulic system: position, draft, mixed and external services, flow rate, motor speeds, system pressure
- rate of work, quality of work, traction, safety

### Topic 4.3

Learners will understand designs of the following systems adopted by different manufacturers:

- power unit: cylinder number and configuration, turbocharged, capacity, diesel engines, spark ignition systems, type of fuel system/management
- transmission system: constant mesh, synchromesh, powershift, constantly variable transmissions, mechanical transmission clutch, fluid drive clutch, power drive clutch operation
- hydraulic system: open centred, closed centred, mechanical control, electro-hydraulic control, single/double acting external spool valves, fluid flow control.

### Guidance for delivery

This unit will develop learners' understanding of the working principles of a range of land-based power units and equipment to be found in their area of study. Learners will also be able to carry out routine maintenance tasks to manufacturers' recommendations and specifications.

The following considerations should be emphasised throughout delivery and particularly when practical tasks are carried out or assessed:

- safe, legal practices
- working to manufacturers' recommended procedures
- care of machines, tools and work areas
- attention to detail when recording information.

Depending on the land-based area the learner is studying, formal lecture delivery may be generic to all areas but practical experiences and learning should be appropriate to the area of study.

The range of machinery covered should include electric vehicles and machines if appropriate.

Learning outcome 1 will support learners' understanding of topical issues regarding available fuel types, environmental pollution and running costs.

In working towards Learning outcome 2, learners will develop forward thinking for the need for basic tools that may be required on the work site where unscheduled maintenance tasks may have to be performed, hence the need for basic tools to be available on the vehicle or machine. Due to the complexity of modern vehicles and machines, it is essential that learners understand that maintenance of machines and vehicles must be carried out to manufacturers' recommendations. Service documentation should be available and accurately followed when performing tasks.

For Learning outcome 3, learners will be required to assess all risks to themselves, others, the environment and equipment prior to commencing practical tasks. These risks will be recorded for future reference and appropriate control measures put in place and recorded against the risk.

Learners will know of current legislations and safe working practices and will need to adopt a clean, tidy and methodical approach to their work, aware of consequences should their actions be responsible for injury or damage to a third party. The importance of completing maintenance and

work records must be highlighted, as should the need to retrieve those records from file for future reference, particularly when assessing warranty claims, addressing recurring failures or for valuation on replacement.

Learning outcome 4 requires learners to compare a range of power units and machines from different manufacturers to evaluate alternative designs and systems that produce similar outcomes. It will, therefore, be necessary for learners to have access to a range of modern equipment for these comparisons and evaluations to be made.

### Suggested learning resources

#### Books

- |  |                         |
|--|-------------------------|
| Farm Machinery<br>Published by: Old Pond Publishing, 2005<br>ISBN: 978-1903366684                            | Bell, B                 |
| Farm Machinery<br>Published by: Culpin's. Hesperides Press, 2006<br>ISBN: 978-1443703017                     | Culpin, C; & Bloxham, P |
| Farm Management Pocketbook 2015<br>Published by: Agro Business Consultants Ltd. 2014<br>ISBN: 978-0957693913 | Nix J.                  |
| The Agricultural Notebook, 20th Edition<br>Published by: Wiley-Blackwell, 2003<br>ISBN: 978-0632058297       | Soffe, R.               |

Manufacturers' publications and manuals

#### Journals

- Horticulture Weekly
- Profi International
- Farmers Weekly
- Landwards

#### Websites

- |   |  |
|---|--|
| • <a href="http://www.bagma.com">http://www.bagma.com</a>             | British Agricultural and Garden Machinery Association          |
| • <a href="http://www.defra.gov.uk">http://www.defra.gov.uk</a>       | Dept for Environment, Food and Rural Affairs                   |
| • <a href="http://www.wales.gov.uk">http://www.wales.gov.uk</a>       | Welsh Assembly Government                                      |
| • <a href="http://www.scotland.gov.uk">http://www.scotland.gov.uk</a> | Scottish Executive Environment and Rural Affairs Department    |
| • <a href="http://www.dardni.gov.uk">http://www.dardni.gov.uk</a>     | Department of Agriculture and Rural Affairs (Northern Ireland) |
| • <a href="http://www.hse.gov.uk">http://www.hse.gov.uk</a>           | Health and Safety Executive                                    |
| • <a href="http://www.fwi.co.uk/">http://www.fwi.co.uk/</a>           | Farmers Weekly Interactive                                     |

## Unit 311

## Forage crop production

<b>UAN:</b>	A/507/6853
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

This unit aims to provide learners with an understanding of the principles of agricultural forage crop production and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into employment in the agriculture sector or into further or higher education.

The aim of this unit is to develop the learners' practical skills and understanding of the benefits of a range of non-grass forage crops.

### Learning outcomes:

In this unit, learners will be able to

1. know the role of a range of forage crops
2. plan the growth of forage crops
3. understand methods of harvesting and storing forage crops
4. understand the benefits and production costs of forage crops

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

### Forage crops

Maize, roots (eg stubble turnips, fodder beet), brassicas (eg kale, forage rape), whole crop, forage rye, legumes (eg peas, beans, Lucerne, clover), alternative crops.

### Learning outcome:

#### 1. Know the role of a range of forage crops

### Topics

- 1.1 Forage crops
- 1.2 Botanic and agronomic characteristics
- 1.3 The value of forage crops

#### Topic 1.1

Learners will know different forage crops in order to identify them at different growth stages, including field identification (from seedlings to mature crop)

#### Topic 1.2

Learners will know the botanic and agronomic characteristics of forage crops, including classification of species, growth patterns, and time of year when used.

#### Topic 1.3

Learners will know the value of forage crops for different classes of livestock, including Extending/replacing grazing, role as a catch/break crop/cover crop, contribution to a ration (eg animal growth rates and finishing), variety in ration, expected Dry Matter Intakes (DMI) and Metabolisable Energy (ME), palatability and suitability to stock, anaerobic digestion.

### Learning outcome:

#### 2. Plan the growth of forage crops

### Topics

- 2.1 Soil, and seedbed preparation
- 2.2 Planning a fertiliser programme
- 2.3 Weed, pest and disease control procedures
- 2.4 Legislative and environmental guidelines

#### Topic 2.1

Learners will prepare soils and seedbeds for forage crops, taking into consideration:  
The soil type suitable for crop; drainage and topography; selection of appropriate machinery; seedbed requirements; timing of cultivations; and sowing specification.

#### Topic 2.2

Learners will plan a fertiliser programme for forage crops, including requirements for major and minor elements, previous crop residual values, pH requirements, use of organic manures, and timing (eg in accordance with Nitrogen Vulnerable Zone guidelines).

### Topic 2.3

Learners will understand cultural and chemical weed, pest and disease control procedures appropriate to the production of forage crops, including

- weed control: cultural and chemical
- pest control: aphids and virus spread, pigeons, slugs and traps, use of treated seeds
- disease control: fungal diseases, eg mildew.

### Topic 2.4

The following is a comprehensive list of the legislation that applies to growing forage crops. Learners will appreciate how legislation will affect the planning of the growth of forage crops and where each applies:

- Environmental Protection Act 1990
- Cross Compliance Nitrates Directive 1991
- Water Framework Directive 2003
- Local Environment Risk Assessment Procedures (LERAPs)
- UK pesticide guide
- Nitrate Vulnerable Zones (NVZs)
- timing of applications
- Cross Compliance
- Protecting our Water, Soil and Air ( A DEFRA publication)

## Learning outcome:

### 3. Understand methods of harvesting and storing forage crops

#### Topics

##### 3.1 Harvesting arrangements

##### 3.2 Storage methods

### Topic 3.1

Learners will understand methods of harvesting and storing forage crops, including

- timing (eg weather, seasonality), crop maturity
- harvest by stock: strip grazing and electric fencing, amounts per day, use of run-back field to prevent crop and field poaching, length of harvesting period relative to following crop
- harvest by machine: types of machinery, trailers, health and safety.

### Topic 3.2

Learners will understand storage methods for forage crops, including

- preparation of store
- methods of storage, eg clamp
- monitoring of crop in store, eg silage analysis and interpretation, heating up in clamp and frost protection for fodder beet

- minimising storage losses.

## Learning outcome:

### 4. Understand the benefits and production costs of forage crops

#### Topics

- 4.1 Crop yields
- 4.2 Nutritional value
- 4.3 Production costs

#### Topic 4.1

Learners will understand

- target yields
- field estimates both pre-harvest and being harvested by stock
- predicted animal intakes to match moving electric fence
- prediction of likely end of harvest by stock to match following crop needs.

#### Topic 4.2

Learners will understand, in order to assess, the nutritional value of forage crops for different classes of livestock, including: crop value to match the animal ration (eg Dry Matter, ME and protein value), animal intakes and any associated disease problems (eg bloat in clovers), contribution to animal growth rates and live weight gain.

#### Topic 4.3

Learners will understand actual costs in comparison with published data, gross margin calculations, manurial values to soil and following crop, unit cost ME, labour costs, contractors' charges.

## Guidance for delivery

This unit deals with the role of forage crops within an arable cropping programme. Care will be needed by the tutor to ensure that the range of crops is covered whilst accounting for local growing conditions. For example, forage maize may not be suitable in all upland areas. Events and local farms can offer an alternative source.

Tutors will need to plan the programme carefully due to seasonality of forage crops and their use. Some crops will be grazed in situ by livestock (eg lambs on stubble turnips, cows on kale) and so fairly seasonal; others will be used in yards (eg fodder beet to beef cattle, maize silage to dairy and beef cattle ) and so tutors will need to link them with livestock feeding.

Learning outcome 1 needs to be delivered first in order that learners recognise the crops featured in this unit. It would lend itself to classroom, laboratory and field studies, such as crop walking. The use of a PowerPoint presentation to cover the range of crops might be useful.

Tutors need to be aware that some forage crop establishment programmes are likely to have taken place before learners start a course (eg stubble turnips). This may affect delivery of learning outcome 2. Autumn crop walks will be needed early on, although as some crops will be established in spring (eg maize, beet), there may be a degree of flexibility in timing delivery of content for this outcome. Many fields, however, are likely to receive manure applications during the autumn or winter (eg for maize), so learner involvement with machinery could be planned in collaboration with a farm.

Learning about harvesting for learning outcome 3 will vary according to locality and crop type. Fodder beet and maize are machinery based and could involve learners driving tractors and trailers from field to clamp. Stubble turnips and kale will be largely strip grazed. Tutors must ensure that learners experience both types of harvesting wherever possible. Where clamps are used (eg maize), learners need to be shown a silage analysis and its interpretation.

The content to be covered for learning outcome 4 lends itself to classroom-based learning. A case study approach may be useful as an individual or team exercise. This content will probably be taught last, most likely in the summer term.

### **Suggested learning resources**

#### **Books**

- |  |                                  |
|--|----------------------------------|
| Arable plants – a field guide<br>Published by: Princeton University Press, 2004<br>ISBN 978-1903657027                     | Wilson, P. & King, M.            |
| Resource management: soil<br>Published by: Farming Press, 2001<br>ISBN: 978-0852365595                                     | Davies, D;. Finney; &. Eagle, D. |
| Lockhart & Wiseman’s Crop Husbandry including grassland<br>Published by: Woodhead publishing, 2014<br>ISBN: 978-1782423713 | Finch, H; Samuel, A; & Lane, G   |
| Protecting our Water, Soil and Air<br>Published by: The Stationery Office Books, 2009<br>ISBN 978-0112432845               | DEFRA                            |
| Soil science simplified<br>Published by: Wiley-Blackwell publishing, 2008<br>ISBN: 978-0813818238                          | Eash, N: & Green, C              |
| Organic cereals and pulses<br>Published by: Chalcombe publications,<br>ISBN 0 948617 47 0                                  | Younie, D. Taylor, B. 2002..     |
| Farm Machinery<br>O Published by: Id Pond Publishing, 2005<br>ISBN: 978-1903366684   | Bell, B.                         |
| Culpin’s Farm Machinery<br>Published by: Hesperides Press, 2006<br>ISBN: 978-1443703017                                    | Culpin, C; & Bloxham, P          |
| Forage Conservation and feeding<br>Published by: Farming Press, 2002   | Waltham, R; & Raymond, F         |

ISBN: 978-0852363508

UK Pesticide guide. 2014.

Published by: CABI,

ISBN: 978-1780645773

Farm Management Pocketbook 2015

Nix, J.

Published by: Agro Business Consultants Ltd. 2014

ISBN: 978-0957693913

The Agricultural Notebook, 20th Edition

Soffe, R.

Published by: Wiley-Blackwell, 2003

ISBN: 978-0632058297

### **Journals**

- Crops Magazine
- Farm Contractor & Large Scale Farmer
- Farmers Guardian
- Farmers Weekly

### **Websites**

- <http://www.bayercropscience.co.uk> Bayer Crop Science
- <http://www.cereals.ahdb.org.uk> Home Grown Cereals Authority
- <http://www3.syngenta.com/country/uk/en/about/Pages/AboutUs.aspx> Syngenta
- <http://www.niab.com> National Institute of Agricultural Botany
- <http://www.defra.gov.uk> Department for Environment, Food and Rural Affairs
- <http://www.beefandlamb.ahdb.org.uk> EBLEX booklets on beef and sheep
- <http://www.wales.gov.uk> Welsh Assembly Government
- <http://www.scotland.gov.uk> Scottish Executive Environment and Rural Affairs Department
- <http://www.dardni.gov.uk> Department of Agriculture and Rural Affairs (Northern Ireland)

## Unit 312

## The principles of grassland management

<b>UAN:</b>	H/507/6877
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

The purpose of this unit is for learners to have an understanding of grassland management and how these can be applied in practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or further education and training.

This unit enable learners to develop the knowledge and skills needed to successfully manage grassland. It can be applied to all grazing livestock enterprises and grass kept for conservation purposes.

### Learning outcomes

In this unit, learners will be able to:

1. Understand grasses and grass growth.
2. Understand the factors to consider when establishing and maintaining grass
3. Manage grassland for grazing
4. Know how to conserve grass.

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

## Learning outcome:

### 1. Understand grasses and grass growth

## Topics

- 1.1 Terminology used in grass production and management
- 1.2 Relate growth patterns to the management of grass for grazing and conservation
- 1.3 Agronomic characteristics of key grass species/varieties
- 1.4 Agronomic characteristics of common weed grass species

This outcome serves as a general introduction to the unit as a whole, but will be common to all areas in the UK. The terminology could be given in the form of a 'dictionary A-Z' at the start of the course so that students have a continual reference point. The growth pattern would ideally be taught to match the season of grass growth, which is likely to be mostly from early spring onwards. The agronomic characteristics of grasses and weeds could be taught both in a laboratory and in the field. Weeds should be observed at their different growth stages, especially when relatively small.

### Topic 1.1

The learner will explain the terminology used in grass production and management.

Types of grassland:

- hill grazing
- permanent pasture
- leys (plants making up the sward)
- physiology of the grass plant (vegetative and inflorescence)
- digestibility of grass
- how it is measured and factors which influence this.

### Topic 1.2

The learner will relate growth patterns to the management of grass for grazing and conservation:

- Establishment of grass (grassland production curve, seeds mixtures)
- Managing grass for grazing (hay and silage)
- Effect of soil type
- Fertiliser
- Climate and topography on grassland production.

### Topic 1.3

The learner will discuss agronomic characteristics of key grass species/varieties.

Grass identification and assessment:

- recognise productive grassland species such as Italian rye grass
- perennial rye grass
- Timothy
- Cocksfoot
- meadow fescue
- white and red clover and some herbs.

- Identify attributes that make these species desirable.

#### Topic 1.4

The learner will discuss agronomic characteristics of common weed grass species:

- What makes a grass a weed
- grass weeds (annual meadow grass, chickweed, yorkshire fog, brome)
- use of grass keys to identify weed grass species
- environmental considerations.

### Learning outcome:

#### 2. Understand the factors to consider when establishing and maintaining grass

##### Topics

2.1 Methods used to prepare a site for and establish a grass crop

2.2 Nutrient requirements for grassland and prepare a nutrient programme to meet production and sward needs

2.3 Controlling common weeds, pests and diseases of grass

2.4 Factors that contribute to sward deterioration

This outcome will need to be taught according to the season of grass establishment, which will be either autumn or spring. It would be useful for students to observe the results of a recent grassland establishment programme in order to base their comments from direct observation. Students should be made familiar with Department for Environment, Food and Rural Affairs (England) (Defra), Welsh Assembly Government (Wales), Scottish Executive Environment and Rural Affairs Department (SEERAD), Department of Agriculture and Rural Affairs (DARD NI) RB209 Fertiliser Recommendations handbook and the updated NVZ guidelines for manure applications. Regular crop walking to monitor weeds, pests and diseases as well as signs of sward deterioration such as poaching will need to be continually borne in mind by the tutor. The unit should therefore contain an equal mix of classroom and field studies.

#### Topic 2.1

The learner will compare the alternative methods used to prepare a site for and establish a grass crop:

- Soil type
- drainage and topography
- reseeding techniques
- plough and reseed (Autumn and Spring)
- under-sowing
- direct drilling
- renovation
- partial and full.

#### Topic 2.2

The learner will assess nutrient requirements for grassland and prepare a nutrient programme to meet production and sward needs:

- Grass crop requirements
- Dry Matter production targets
- grassland pH targets

- the role of Nitrogen
- Phosphate
- Potash and Minor elements
- Nitrogen-Potash relationships
- Environmental considerations including Nitrate Vulnerable Zone (NVZ) calculations.

### Topic 2.3

The learner will describe how weeds, pests and diseases of grass can be controlled:

- Weed control:
  - mechanical (topping, rolling)
  - chemical (complete sward destruction, selective weed killers, weed wipers)
  - manual weeding
- Pest Control:
  - Moles
  - Rabbits
  - Deer
  - badgers and their effect on grassland
  - legislation and health and safety issues
- Diseases control:
  - common endoparasites with lifecycles for each
  - control measures and economic impact of neglect
  - rotational grazing
  - crop rotation
  - use of conservation crops to break disease cycles.

### Topic 2.4

The learner will discuss the factors that contribute to sward deterioration:

- Grazing Pressure (high and low)
- Drainage
- poor fencing
- soil type and poaching
- age of sward
- timeliness of machinery operations.

## Learning outcome:

### 3. Manage grassland for grazing

#### Topics

3.1 Soil sampling and analysis

3.2 Grass during the grazing season

3.3 Grassland improvement activities

### Topic 3.1

The learner will carry out soil sampling and analysis:

- Set effective nutrient levels for pH and the major grassland nutrients
- take statistically valid soil samples and make field scale determination of pH
- P and K levels.

### Topic 3.2

The learner will monitor grass during the grazing season:

- Daily
- Weekly
- monthly checks
- assess for sward length
- quality
- presence of weeds
- damage
- topping
- management of grazing pressure
- boundary maintenance
- drainage
- rotational grazing
- nutrition
- weed control and their effects on sward
- re-seeding.

### Topic 3.3

The learner will carry out grassland improvement activities:

- Plan and monitor activities
- boundary maintenance
- rotational grazing/conservation cuts
- drainage maintenance
- fertiliser application
- weed control
- partial sward replacement
- topping.

## Learning outcome:

### 4. Know how to conserve grass

#### Topics

4.1 Common systems for grass conservation

4.2 Mechanical methods/treatments for conserving grass

4.3 Harvesting and storing conserved grass process

This outcome would likely be taught at the appropriate season, which is likely to be from mid-February onwards, in preparation for the forthcoming grazing and conservation activities. Tutors will possibly need to account for flexibility in following grass growth with respect to the apparent changing seasons and milder winters. Where possible, learners should be involved in a farms' preparation for both grazing and conservation, especially where silage takes place. There would need to be strict adherence to Health and Safety at all times where machinery and grazing livestock are concerned.

#### Topic 4.1

The learner will describe common systems of grass conservation:

- Field dried hay
- wrapped hay/haylage/silage
- clamped silage
- dried grass
- Fertiliser requirements
- sward composition
- time of cutting
- target D value.

#### **Topic 4.2**

The learner will describe the alternative mechanical methods/treatments for conserving grass:

- Mowers and mower conditioners
- Tedding machines and their uses
- Wind row machines and their uses
- Baling machines (conventional, big round and big square)
- Wrapping machines, forage harvesters (self propelled and trailed).

#### **Topic 4.3**

The learner will describe the processes involved in harvesting and storing conserved grass.

Principles of preservation by:

- drying (hay)
- work plan/schedule of events
- weather forecasting
- mechanical handling
- example schedule of events
- target moisture content for baling.

Principles of preserving grass by wrapping:

- work plan/schedule of events
- weather forecasting
- mechanical handling
- wrapping
- transport and storage
- example schedule of events
- target moisture content for baling.

Principles of preserving grass by clamping:

- target pH of made silage
- desirable bacterial activity and how to promote it
- D Value - work plan/schedule of events
- weather forecasting
- mechanical handling,
- wrapping
- transport and storage
- example schedule of events
- target moisture content for baling.

## Guidance for delivery

This unit deals with the management of grass as a crop. Learners will look at methods of optimising grass productivity through its use both by the grazing animal and for conservation. Care will need to be taken to contextualise the study of grassland production to meet the requirements of the learners in their locality. Different emphasis will need to be placed on dairy cow grazing systems in lowland western areas than in hill farming areas or equine areas. The assignment should be tailored to meet the individual needs of the learner.

## Suggested learning resources

### Books

- |  |   |
|--|---|
| Farm Machinery<br>Published by: Old Pond Publishing, 2005<br>ISBN: 1903366682  | Bell, B                                       |
| Culpin's Farm Machinery<br>Published by: Blackwell Science, 2006<br>ISBN: 0632051825   | Culpin, C & Bloxham, P                        |
| Soil<br>Published by: The Crowood Press, 2002<br>ISBN: 0852365594  | Davies, B; Eagle, D & Finney, F               |
| Lockhart and Wiseman's Introduction to Crop Husbandry: Including Grasslands<br>Published by: Butterworth-Heinemann, 2002<br>ISBN: 0080420028         | Finch, H; Samuel, A; Lockhart, J & Wiseman, A |
| Fertiliser Recommendations: For Agricultural and Horticultural Crops, (RB209)<br>Published by: The Stationery Office Books, 2002<br>ISBN: 0112430589 | DEFRA   |
| Improved Grassland Management<br>Published by: The Crowood Press, 2002<br>ISBN: 0852365438   | Frame, J                                      |
| Grasses: A Guide to Their Structure, Identification, Uses and Distribution, 3rd Edition<br>Published by: Penguin Books, 1992<br>ISBN: 0140132279     | Hubbard, C                                    |
| Farm Management Pocketbook, 37th Edition<br>Published by: The Andersons Centre, 2009<br>ISBN: 0954120159   | Nix, J  |
| The Agricultural Notebook, 20th Edition<br>Published by: Blackwell Science, 2003<br>ISBN: 0632058293   | Soffe, R                                      |

The UK Pesticide Guide  
Published by: CABI Publishing, 2009  
ISBN: 1845930452

Whitehead, R

Silage  
Published by: Chalcombe Publications, 2005  
ISBN: 0948617500

Wilkinson, J

### ***Journals and magazines***

- Farm Contractor
- Farmers Guardian
- Farmers Weekly
- Grass and Forage Farmer
- Grass and Forage Science

### ***Websites***

- Bayer Crop Science [www.bayercropscience.co.uk](http://www.bayercropscience.co.uk)
- British Grassland Society [www.britishgrassland.com](http://www.britishgrassland.com)
- Environment, Food and Rural Affairs [www.defra.gov.uk](http://www.defra.gov.uk)
- Department for Welsh Assembly Government [www.wales.gov.uk](http://www.wales.gov.uk)
- Scottish Executive Environment and Rural Affairs Department [www.scotland.gov.uk](http://www.scotland.gov.uk)
- Department of Agriculture and Rural Affairs (Northern Ireland) [www.dardni.gov.uk](http://www.dardni.gov.uk)
- European Fertiliser Manufacturers Association [www.efma.org](http://www.efma.org)
- Health and Safety Executive [www.hse.gov.uk](http://www.hse.gov.uk)
- Institute of Grassland and Environmental Research Environment Agency: Best Farming Practices: Profiting From a Good Environment [www.iger.bbsrc.ac.uk](http://www.iger.bbsrc.ac.uk)

Natural England: Entry Level Stewardship Handbook  
[http://www.wensumalliance.org.uk/publications/EA\\_Best\\_farming\\_practices.pdf](http://www.wensumalliance.org.uk/publications/EA_Best_farming_practices.pdf)

- [\\_farming\\_practices.pdf](http://www.wensumalliance.org.uk/publications/EA_Best_farming_practices.pdf)

[org.uk/publications/EA\\_Best\\_farming\\_practices.pdf](http://www.wensumalliance.org.uk/publications/EA_Best_farming_practices.pdf)

## Unit 313

## Farm animal health and nutrition

<b>UAN:</b>	J/507/6855
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

The purpose of this unit is to provide learners with an understanding of the principles of livestock health and nutrition.

This unit introduces the learner to the signs of good and ill health in livestock and the legislation relating to livestock health. The role of pathogenic organisms will be examined and prevention and treatment of a range of diseases and disorders covered. Delivery should provide opportunity to carry out routine treatments for livestock. The learner will study the nutritional requirements of livestock and the importance of nutrition in maintaining animal health.

### Learning outcomes:

In this unit, learners will be able to

1. manage livestock health in accordance with legislation
2. understand common diseases that affect livestock
3. understand the nutrition requirements of livestock
4. understand ration planning.

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

**Species:** as appropriate to the local area of study: eg cattle, sheep, pigs, goats, poultry.

## Learning outcome:

### 1. Manage livestock health in accordance with legislation

#### Topics

- 1.1 Indicators of health in livestock
- 1.2 Legislation that relates to livestock health
- 1.3 Health plan

#### Topic 1.1

Learners will recognise and monitor indicators of health in livestock:

- temperature: use of thermometer and normal range
- respiration rate: method of measurement and normal range
- appetite and water intake
- behaviour: posture, movement, restlessness, actions and reactions
- faeces and urine output and abnormalities
- coughing and discharges from natural orifices
- condition of coat, skin, eyes, ears, nose, mouth/teeth, mucous membranes
- body condition

#### Topic 1.2

Learners will be aware of current legislation that relates to livestock health eg

- Animal Welfare Act 2006 or Animal Health and Welfare Act (Scotland) (2006)
- Welfare of Animals (Transport) Order 2006
- The Veterinary Surgeons Act 1966
- The Welfare of Farmed Animals Regulations 2007
- The Welfare of Animals Regulations 1999 (slaughter or killing)
- The Veterinary Medicines Regulations 2013.

#### Topic 1.3

Learners will produce a health plan for a chosen class of livestock

## Learning outcome:

### 2. Understand common diseases that affect livestock

#### Topics

- 2.1 Pathogenic organisms and the immune system
- 2.2 Notifiable and zoonotic diseases and disorders
- 2.3 Safe administration of medicines
- 2.4 Disposal methods

Learners will understand the signs and symptoms of selected diseases, their treatment, and methods of prevention and control including vaccination, prophylaxis, biosecurity and notification procedures.

### **Topic 2.1**

Learners will understand:

- pathogenic organisms: bacteria, viruses, fungi, protozoa, parasites including endoparasites and ectoparasites (worms, ticks, mites, lice)
- methods of disease transmission (eg direct, indirect, airborne, vectors, fomites, inhalation, ingestion, environment)
- types of immunity (passive, natural, active and artificial).

### **Topic 2.2**

Learners will understand:

- notifiable diseases, eg: avian flu, swine flu, Bovine Spongiform Encephalopathy (BSE), bovine tuberculosis, bluetongue, foot and mouth, Newcastle disease
- zoonotic diseases, eg: ringworm, salmonella, brucellosis, leptospirosis, enzootic abortion, orf.

### **Topic 2.3**

Learners will understand the safe administration of medicines, including

- recommended dose (overdosing, under dosing), withdrawal period, data sheet information, storage, risk assessments, COSHH, record keeping.
- methods of administration (feed/water, injection, mouth, topical, inhalation), including injection methods (intramuscular, intravenous, inframammary, subcutaneous).

### **Topic 2.4**

Learners will understand methods used to dispose of:

- veterinary medicines (medicines, needles, syringes)
- dead livestock
- livestock products after administration of medicines (eg animal parts, milk, eggs).

## **Learning outcome:**

### **3. Understand the nutrition requirements of livestock**

#### **Topics**

3.1 Essential nutrients and sources

3.2 Factors affecting the nutritional requirements of livestock

#### **Topic 3.1**

Learners will understand the essential nutrients for livestock, and sources of these:

- nutrients: water, protein, carbohydrate, lipids, minerals, vitamins
- feed sources and nutritional value (eg seeds, roots, grasses, legumes, fruits and vegetables).

#### **Topic 3.2**

Learners will understand factors affecting the nutritional requirements of livestock: digestive system (monogastric, ruminant) age, size, health status, life stage (juvenile, gestation, lactation), environment, productivity.

### **Learning outcome:**

#### **4. Understand ration planning**

### **Topics**

4.1 Dietary calculations and feed planning

4.2 Nutrient deficiency

#### **Topic 4.1**

Learners will carry out dietary calculations to include

- dry matter, energy content, metabolisable energy, protein analysis, feed quantities, timing of feed, method of feeding, water requirements, feed costs.

#### **Topic 4.2**

Learners will understand and recognise:

- nutrient deficiency diseases and disorders, supplementation, body condition scoring.

### **Guidance for delivery**

Learning outcome 1, learners will recognise signs of health in livestock. This outcome will require some formal delivery but it should also be delivered in practical situations in which learners can visually assess stock for health and undertake health checks. Delivery of this outcome will also include animal welfare legislation and its impact on livestock husbandry. When completing practical livestock tasks links will be made to legislation to reinforce learning and put legislation in context.

Learning outcome 2 will cover a wide range of diseases and disorders that affect livestock. It is important to include the pathogenic cause of disease and the body's defence against disease. It is envisaged that the outcome will be delivered in a classroom-based setting using images and video clips to ensure a wide coverage. Where appropriate learners should also have the opportunity to practice disease prevention measures in practical sessions.

Learning outcome 3: It is envisaged that the outcome will be delivered mainly in a classroom-based setting. Where appropriate learners should also have the opportunity to identify food sources and calculate nutritional requirements in practical sessions.

Learning outcome 4: It is envisaged that the outcome will be delivered mainly in a classroom-based setting using examples for dietary calculations. Where appropriate, learners should also have the opportunity to carry out condition scoring of animals in practical sessions. Images and video clips should be used to show nutrient deficiency diseases and disorders to ensure a wide coverage.

### **Suggested learning resources**

#### **Books**

A Veterinary Book for Dairy Farmers, 3rd Edition  
Published by: Old Pond Publishing, 1999  
ISBN 978-190523290

Blowey, R.

Modern Livestock and Poultry Production, 9th Revised Edition. Gillespie, J.  
Published by: Wadsworth Publishing Co Inc; 2015.  
ISBN 978-1133283508

Recent Developments in Pig Nutrition: No 3  
Publisher: Nottingham University Press (14 Feb. 2001)  
ISBN-10: 1897676441  
ISBN-13: 978-1897676448

Garnsworthy, P & Wiseman, J

Managing Pig Health  
Publisher: 5M Enterprises; 2nd Revised edition edition (8 Oct. 2013)  
ISBN-10: 0955501156  
ISBN-13: 978-0955501159

Muirhead, M & Alexander, T.

Pig Diseases, 8th Edition  
Publisher: CABI Publishing; 1 edition (28 Oct. 2014)  
ISBN-10: 1780642121  
ISBN-13: 978-1780642123

McOrist S.

The Veterinary Book for Sheep Farmers  
Published by: Old Pond Publishing, 1990  
ISBN-10: 1903366305  
ISBN-13: 978-1903366301

Henderson, D

The Agricultural Notebook, 20th Edition  
Published by: Wiley-Blackwell, 2003  
ISBN: 978-0632058297

Soffe, R.

### **Websites**

- <http://www.dairyuk.org> Dairy UK
- <http://www.dardni.gov.uk> Department of Agriculture and Rural Development (NI)
- <http://www.defra.gov.uk> Department for Environment, Food and Rural Affairs
- <http://www.wales.gov.uk> Welsh Assembly Government
- <http://www.scotland.gov.uk> Scottish Executive Environment and Rural Affairs Department
- <http://www.dardni.gov.uk> Department of Agriculture and Rural Affairs (Northern Ireland)
- <http://assurance.redtractor.org.uk/rtassurance/schemes.eb> Red Tractor Assurance scheme
- <http://www.fwi.co.uk/> Farmers Weekly Interactive
- Defra- Pig Welfare Codes <https://www.gov.uk/pig-welfare-g>
- [www.ahdb.org.uk](http://www.ahdb.org.uk)

## Unit 314

## Root crop production

<b>UAN:</b>	L/507/6856
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

This unit aims to introduce the learner to the skills and knowledge required for agricultural root crop production and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into employment in the agriculture sector or into further or higher education.

The learner will study a range of Root crops grown within a UK production system, the principles of production, practical skills and regulation involved in the planning and management of modern crop production systems.

### Learning outcomes:

In this unit, learners will be able to

1. know the husbandry for the establishment of a range of root crops
2. carry out a range of practical activities in the production of root crops
3. know the husbandry requirements for growing root crops
4. understand the storage and marketing of a range of root crops

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

### Root crops

eg potatoes, sugar beet, carrots, turnips, swedes, red beet.

### Learning outcome:

1. Know the husbandry for the establishment of a range of root crops

### Topics

- 1.1 Root crops and their growth stages
- 1.2 The botanic and agronomic characteristics of root crops
- 1.3 Soil and climate suitability for the establishment of root crops

#### Topic 1.1

Learners will know a range of root crops at different growth stages: field identification from seeds through seedlings to mature crops, varietal selection, use of recommended lists, rotational position.

#### Topic 1.2

Learners will know the botanic and agronomic characteristics of root crops, including: classification of species, growth patterns, time of year when used.

#### Topic 1.3

Learners will identify soil and climate suitability for the establishment of root crops, including: soil structure, types, pH, soil testing, indices for phosphate and potassium rainfall, water management, drainage and irrigation requirements, soil moisture deficits.

### Learning outcome:

2. Carry out a range of practical activities in the production of root crops

### Topics

- 2.1 Cultivation and planting
- 2.2 Nutrient application and plant protection
- 2.3 Harvesting

#### Topic 2.1

Learners will carry out the process of cultivation and planting, including stubble cultivations, inversion and non-inversion tillage techniques appropriate to crop and soil type, secondary and seedbed cultivations.

#### Topic 2.2

Learners will carry out the application of nutrients and protection of plants, including

- nutrient application: organic/inorganic nutrient applications, preparation and assisting with harvest and storage machinery and equipment (stores, clamps)

- pest management: insect, rabbits, pigeons, slugs, rats, mice and locally important pests.

### Topic 2.3

Harvesting arrangements

- Timing (eg weather, seasonality), crop maturity, dry matters, market requirements
- Harvest by machine: types of machinery, trailers, health and safety
- Frost protection of growing crops prior to harvest – eg strawing carrots

### Learning outcome:

#### 3. Know the husbandry requirements for growing root crops

### Topics

- 3.1 Fertiliser programme
- 3.2 Weed, pest and disease control
- 3.3 Legislative and environmental guidelines

### Range

Potatoes, Sugar Beet, Carrots, Turnips, Swedes

### Topic 3.1

Fertiliser programme

Requirements for major and minor elements, previous crop residual values, pH requirements, use of organic manures and timing (eg match Nitrogen Vulnerable Zone (NVZ) guidelines) Use of RB209 fertiliser manual

### Topic 3.2

Weed, pest and disease control, to include

- Weed control: mechanical (eg topping, harrowing, stale seedbed), chemical (eg pre-emergent, selective)
- Pest control: aphids and virus spread, pigeons, slugs and traps, use of treated seeds
- Disease control: identify fungal, Viral and Bacterial diseases

### Topic 3.3

The following is a comprehensive list of the legislation that applies to growing root crops. For purposes of assessment, there is no requirement for detail, but learners must appreciate that there is legislation and where each applies:

- Environmental Protection Act 1990
- Cross Compliance Nitrates Directive 1991
- Water Framework Directive 2003
- Local Environment Risk Assessment Procedures (LERAPs)
- UK pesticide guide
- Nitrate Vulnerable Zones (NVZs)
- timing of applications
- Entry/Higher Level scheme rules

- Protecting our Water, Soil and Air (A DEFRA publication)

### Learning outcome:

#### 4. Understand the storage and marketing of a range of root crops

### Topics

- 4.1 Storage methods for root crops
- 4.2 Production costs of different root crops
- 4.3 Market requirements and outlets for root crops

#### Range

Potatoes, Sugar Beet, Carrots, Turnips, Swedes

#### Topic 4.1

Storage methods

- Preparation of store, methods of storage (eg clamp, in store- bulk & boxes) monitoring of crop in store eg potatoes, heating up in clamp and frost protection for sugar beet, minimising storage losses, controlled environment storage, ambient storage temperature, relative humidity
- Frost protection of growing crops prior to harvest – eg strawing carrots

#### Topic 4.2

Physical and financial performance, Comparison of actual costs with published data, gross margin calculations, labour costs, contractor charges

#### Topic 4.3

Market/buyer requirements, contracts, quotas (Sugar Beet) preparation of crops for retail outlets

## Guidance for delivery

This unit is designed to introduce learners to the major types of agricultural root crop production in the UK, and to equip them with some practical husbandry skills. Care will be needed by the tutor not only to ensure that the range of crops is covered, but also to be flexible in accounting for local growing conditions. For example, some crops may not be available in all areas, so tutors need to be mindful of any events, local farms that can be used for visits. It would be useful if a small area of land is available within the centre to grow a range of crops from seeds to allow learners access to crops throughout the academic year to identify growth stages in addition to observing crops in a commercial situation. As learners will be engaged in practical activities, safe working practices should be emphasised, including the use of appropriate personal protective equipment (PPE). Appropriate risk assessments should be undertaken and at Level 3 it is expected that learners will take an active part in completing risk assessments, so that this becomes an integral part of all practical activity. Learners will also know the importance of animal welfare, and sustainability concepts should be demonstrated to them where possible. Tutors should be encouraged to use resources produced by levy organisations eg Potato Council and BBRO, and attend specialised shows and events.

Learning outcome 1 should be delivered at the commencement of the programme, uses should be made of a range of resources to facilitate understanding and recognition of crops at all significant growth stages. Use should be made of local specialist growers if suitable crops are not available on site for crop walks and specialist input (this should be a feature throughout the unit). Linkage should be made to the Plant and Soil science module for the botanical, agronomic, soils and climate knowledge. Where possible learners will be involved in the preparation, monitoring and operation of appropriate establishment and planting mechanisation, this will also provide evidence for mechanisation units. Given the specialism of these crops it is not expected learners will be undertaking actual planting/sowing operations however they must observe and evaluate said tasks. If certain crops are not available locally it is expected learners have access to high quality visual aids to facilitate learning and understanding

Learning outcome 2 should be an ongoing practical element of the unit delivery. Given the crop production cycles and academic year it will often be necessary to observe and participate in the harvest and storage of crops before they are planted. Tutors will need to plan for the visits to suitable storage areas for the crops studied over an extended period eg potatoes. Crop walks should be a regular feature of the programme to identify and collect crops at various growth stages, collect and preserve examples of weed, pests and diseases of crops. Soils should be sampled and tested for pH, P&K levels.

Learning outcome 3 will need to be delivered to coincide with crop growth, which will likely be all year round. Crop walks and visits to local arable farms can be used to cover this outcome. Tutors could ensure that the learner has access to a fertiliser and crop protection plan for selected crops; an introduction to a farm agronomist would also be useful, prior to the main spraying season. Legislative guidelines given the specialist nature of the cropping will need to be fully explored to allow learners to understand the implications of failure to follow guidelines, use of published articles regarding agricultural pollution could be a useful case study exercise,

For Learning outcome 4, visits to fields both prior to and for the harvesting operations is essential to allow learners to understand machine operation, loss minimisation, complexity and damage prevention, harvested crops will ideally be followed to store where applicable and learners again given the opportunity to evaluate all aspects of the crop entering storage and to observe long term storage techniques where appropriate, it is expected some crops will not be stored and sold fresh, learners must understand this concept and again be given the opportunity to evaluate this ideally at the processing outlet.

## Suggested learning resources

### Books

- Potatoes Post Harvest 1<sup>st</sup> edition  
Published by: CABI Publishing, 2009  
ISBN 978-0851995021  
Pringle, B.; Bishop, C.; Clayton, R.
- Protecting our Water, Soil and Air  
Published by: The Stationery Office Books, 2009  
ISBN 978-0112432845  
DEFRA
- Organic vegetable production: A complete guide  
Published by: The Crowood Press Ltd, 2006  
ISBN 978-1861267887  
Davies, G
- Arable plants – a field guide  
Published by: Princeton University Press, 2004  
ISBN 978-1903657027  
Wilson, P. & King, M.
- Growing Root Vegetables  
Published by: Lorenz Books  
ISBN 978-0754830948  
Bird, R.; Ingram, C.
- Resource management: soil  
Published by: Farming Press, 2001  
ISBN 978-0852365595  
Davies, D.; Finney, B; & Eagle D.
- Lockhart & Wiseman’s Crop Husbandry including grassland  
9th edition  
Published by: Woodhead publishing, 2014  
ISBN 978-1782423713  
Finch, H.; Samuel, A.; & Lane, G.
- Farm Machinery  
Published by: Old Pond Publishing, 2005  
ISBN 978-1903366684  
Bell, B.
- Culpin’s Farm Machinery  
Published by: Hesperides Press, 2008  
ISBN 978-1443703017  
Culpin, C. & Bloxham P.
- Farm Management Pocketbook, 45th edition  
Published by: Agro Business Consultants Ltd, 2015  
ISBN 978-0957693913  
Nix, J.
- The Agricultural Notebook, 20th edition  
Published by: Wiley-Blackwell, 2003  
Soffe, R.

ISBN 978-0632058297

Fertiliser Manual RB209, 8th edition.  
Published by: The Stationery Office Books, 2010  
ISBN 978-0112432869

DEFRA

UK Pesticide guide 2015, 28th edition.  
Published by: CABI Publishing, 2015  
ISBN 978-1780645773

Lainsbury, M.

### **Publications**

- Crops
- AHDB Grower
- Farm Contractor
- Farmers Guardian
- Farmers Weekly
- Farm Business

### **Websites**

- British Sugar <http://www.britishsugar.co.uk>
- Farmers Weekly Interactive <http://www.fwi.co.uk>
- Hutchinsons <http://www.hlhtd.co.uk>
- UK website for Syngenta Crop Protection <http://www.newfarmcrops.co.uk>
- Yara UK <http://yara.co.uk>
- National Institute of Agricultural Botany <http://www.niab.com>
- Welsh Assembly Government <http://www.wales.gov.uk>
- Scottish Executive Environment and Rural Affairs Department <http://www.scotland.gov.uk>
- Department of Agriculture and Rural Affairs (Northern Ireland) <http://www.dardni.gov.uk>
- UK Agriculture <http://www.ukagriculture.com>
- FERA <http://fera.co.uk>
- Agriculture and Horticulture Development Board <http://horticulture.ahdb.org.uk>
- Standon Engineering Ltd <http://www.standen.co.uk>

## Unit 315

## Field vegetable production

<b>UAN:</b>	R/507/6857
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

This unit aims to introduce the learner to the skills and knowledge required for agricultural field vegetable crop production and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into employment in the agriculture sector or into further or higher education.

The learner will study a range of field vegetable crops grown within a UK production system, the principles of production, practical skills and regulation involved in the planning and management of modern crop production systems.

### Learning outcomes:

In this unit, learners will be able to

1. know the husbandry for the establishment of a range of field vegetable crops
2. understand a range of activities in the production of field vegetable crops
3. know the husbandry requirements for growing field vegetable crops
4. determine the harvest, storage and marketing of a range of field vegetable crops

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

**Field vegetable crops:** Choose at least three from the following:

- brassicas (eg, cabbage, cauliflower, brussels sprouts, broccoli)
- pulses (eg peas, beans)
- roots (eg beetroot, parsnips, carrots)
- leeks
- onions.

## Learning outcome:

### 1. Know the husbandry for the establishment of a range of field vegetable crops

## Topics

- 1.1 Field vegetable crops and their growth stages
- 1.2 The botanic and agronomic characteristics of field vegetable crops
- 1.3 Soil and climate suitability for the establishment of field vegetable crops

### Topic 1.1

Learners will know a range of field vegetable crops at different growth stages:

- field identification from seeds through seedlings to mature crops
- varietal selection
- use of recommended lists
- rotational position.

### Topic 1.2

Learners will know the botanic and agronomic characteristics of field vegetable crops, including:

- classification of species
- growth patterns
- time of year when used.

### Topic 1.3

Learners will know soil and climate suitability for the establishment of field vegetable crops, including:

- soil structure
- types
- pH
- soil testing
- indices for phosphate and potassium rainfall
- water management

- drainage and irrigation requirements
- soil moisture deficits.

### **Learning outcome:**

## **2. Understand a range of activities in the production of field vegetable crops**

### **Topics**

- 2.1 Cultivation and planting
- 2.2 Nutrient application and plant protection
- 2.3 Harvesting

#### **Topic 2.1**

Learners will understand and observe the process of cultivation and planting, including stubble cultivations, inversion and non-inversion tillage techniques appropriate to crop and soil type, secondary and seedbed cultivations.

#### **Topic 2.2**

Learners will understand the application of nutrients and protection of plants, including

- nutrient application: organic/inorganic nutrient applications, soil sampling and analysis
- preparation of harvest and storage of machinery and equipment
- pest management: insect, rabbits, pigeons, slugs, rats, mice and locally important pests.

#### **Topic 2.3**

Learners will understand harvesting arrangements and observe where practical:

- timing (eg weather, seasonality), crop maturity, dry matters, market requirements
- harvest by machine: types of machinery, trailers, health and safety
- frost protection of growing crops prior to harvest, eg strawing carrots.

### **Learning outcome:**

## **3. Know the husbandry requirements for growing field vegetable crops**

### **Topics**

- 3.1 Fertiliser programme
- 3.2 Weed, pest and disease identification and control
- 3.3 Legislative and environmental guidelines

#### **Topic 3.1**

Learners will know the Fertiliser programme:

Requirements for major and minor elements, previous crop residual values, pH requirements, use of organic manures and timing (eg match Nitrogen Vulnerable Zone guidelines), use of RB209 fertiliser manual.

#### **Topic 3.2**

Learners will know methods of weed, pest and disease control

- weed control: identification, mechanical (eg topping, harrowing, stale seedbed), chemical (eg pre-emergent, selective)
- pest control: identification, aphids and virus spread, pigeons, slugs and traps, use of treated seeds
- disease control: identify fungal, viral and bacterial diseases and explain control methods: eg varietal choice, certified seed, rotations, crop husbandry, fungicides, thresholds.

### Topic 3.3

The following is a comprehensive list of the legislation that applies to growing field vegetable crops. For purposes of assessment, there is no requirement for detail, but learners must appreciate that there is legislation and where each applies:

- Environmental Protection Act 1990
- Cross Compliance Nitrates Directive 1991
- Water Framework Directive 2003
- Local Environment Risk Assessment Procedures (LERAPs)
- UK pesticide guide
- Nitrate Vulnerable Zones (NVZs)
- timing of applications
- Entry/Higher Level scheme rules
- Protecting our Water, Soil and Air ( A DEFRA publication)

### Learning outcome:

#### 4. Determine the harvest, storage and marketing of a range of field vegetable crops

### Topics

- 4.1 Storage methods for field vegetable crops
- 4.2 Production costs of different field vegetable crops
- 4.3 Market requirements and outlets for field vegetable crops

### Topic 4.1

Learners will understand storage methods:

preparation of store, methods of storage, monitoring of crop in store, minimising storage losses, controlled environment storage, ambient storage temperature, relative humidity, pest and disease problems.

### Topic 4.2

Learners will calculate and understand production costs:

physical and financial performance, comparison of actual costs with published data, gross margin calculations, labour costs, contractors' charges.

### Topic 4.3

Learners will know market/buyer requirements and outlets:

contracts, quality standards, crop assurance schemes, preparation of crops for retail outlets.

## Guidance for delivery

This unit will introduce learners to the major types of agricultural field vegetable crop production in the UK, and equip them with some practical husbandry skills. Care will be needed by the tutor to ensure that the range of crops is covered whilst accounting for local growing conditions. Where crops are unavailable learners could attend events and local farms or use high quality visual aids to facilitate learning. Specialist input should be a feature throughout the unit.

It would be useful if a small area of land is available within the centre to grow a range of crops from seeds. This access to crops throughout the academic year would enable learners to identify growth stages and observe crops in a commercial situation. As learners will be engaged in practical activities, safe working practices should be emphasised, including the use of appropriate personal protective equipment (PPE). Appropriate risk assessments should be undertaken and at Level 3 it is expected that learners will take an active part in completing risk assessments, so that this becomes an integral part of all practical activity. Learners will also know the importance of animal welfare, and sustainability concepts should be demonstrated to them where possible.

Learning outcome 1 should be delivered at the beginning. A range of resources should be used to facilitate learners' understanding and recognition of crops at all significant growth stages. Local specialist growers should be used if suitable crops are not available on site for crop walks. Links should be made with the 'Plant and soil science unit' to ensure learners have the botanical, agronomic, soils and climate knowledge underpinning this unit. Where possible learners will be involved in preparing, monitoring and operating appropriate establishment and planting machinery; this will also provide evidence for the Machinery Operations unit. Given the specialist nature of these crops, it is not expected learners will undertake actual planting/sowing operations; however they must observe and evaluate these tasks.

Learning outcome 2 calls for ongoing practical delivery. Given the crop production cycles and academic year, it will often be necessary to observe and participate in the harvest of crops before they are planted. Soils should be sampled and tested for pH, P and K levels.

Learning outcome 3 will need to be delivered with crop growth, which will likely be all year round. Crop walks and visits to local arable farms can be used to cover this outcome, identifying weeds, pests and diseases. Tutors could ensure that the learner has access to a grower's fertiliser and crop protection plan for selected crops. An introduction to a farm agronomist would also be useful prior to the main spraying season. Legislative guidelines will need to be fully explored to allow learners to understand the implications of failure to follow guidelines. Published articles regarding agricultural pollution could provide useful case studies.

For Learning outcome 4, visits to fields both prior to and during harvesting operations will be essential to allow learners to understand machine operation, loss minimisation, complexity, and damage prevention. Where applicable, harvested crops will ideally be followed to store and learners given the opportunity to evaluate all aspects of the crop entering storage and to observe long term storage techniques. Tutors will need to plan for the visits to suitable storage areas for the crops studied over an extended period. Learners will understand that some crops will be sold fresh rather than stored; again, they should be given the opportunity to evaluate this process, ideally at the processing outlet.

## Suggested learning resources

### Books

Organic vegetable production: A complete guide Published by: The Crowood Press Ltd, 2006 ISBN 978-1861267887	Davies, G
Arable plants – a field guide Published by: Princeton University Press, 2004 ISBN 978-1903657027	Wilson, P. & King, M.
Resource management: soil Published by: Farming Press, 2001 ISBN 978-0852365595	Davies, D.; Finney, B; & Eagle D.
Lockhart & Wiseman’s Crop Husbandry including grassland 9th edition Published by: Woodhead publishing, 2014 ISBN 978-1782423713	Finch, H.; Samuel, A.; & Lane, G.
Organic cereals and pulses Published by: Chalcombe publications, 2002 ISBN 978-0948617478	Younie, D. & Taylor, B.
Farm Machinery Published by: Old Pond Publishing, 2005 ISBN 978-1903366684	Bell, B.
Culpin’s Farm Machinery Published by: Hesperides Press, 2008 ISBN 978-1443703017	Culpin, C. & Bloxham P.
Farm Management Pocketbook, 45th edition Published by: Agro Business Consultants Ltd, 2015 ISBN 978-0957693913	Nix, J.
Drying and storing combinable crops Published by: Farming Press, 1989 ISBN 978-0852361931	McLean, K.
The Agricultural Notebook, 20th edition Published by: Wiley-Blackwell, 2003 ISBN 978-0632058297	Soffe, R.
Protecting our Water, Soil and Air Published by: The Stationery Office Books, 2009	DEFRA

ISBN 978-0112432845

Fertiliser Manual RB209, 8th edition.  
Published by: The Stationery Office Books, 2010  
ISBN 978-0112432869

DEFRA

UK Pesticide guide 2015, 28th edition.  
Published by: CABI Publishing, 2015  
ISBN 978-1780645773

Lainsbury, M.

### **Publications**

- Crops
- AHDB Grower
- Farm Contractor
- Farmers Guardian
- Farmers Weekly
- Farm Business

### **Websites**

- Farmers Weekly Interactive <http://www.fwi.co.uk>
- Hutchinsons  
[http://www.hlhltd.co.uk/vegetable\\_agronomy.html](http://www.hlhltd.co.uk/vegetable_agronomy.html)
- UK website for Syngenta Crop Protection  
<http://www.newfarmcrops.co.uk>
- National Institute of Agricultural Botany <http://www.niab.com>
- Department for Environment, Food and Rural Affairs <http://www.defra.gov.uk>
- Welsh Assembly Government <http://www.wales.gov.uk>
- Scottish Executive Environment and Rural Affairs Department <http://www.scotland.gov.uk>
- Department of Agriculture and Rural Affairs (Northern Ireland) <http://www.dardni.gov.uk>
- Combine World <http://www.combineworld.co.uk>
- UK Agriculture  
[http://www.ukagriculture.com/crops/crops\\_regions\\_vegetable.cfm](http://www.ukagriculture.com/crops/crops_regions_vegetable.cfm)
- FERA  
<http://fera.co.uk/plantClinic/priceLists/fieldVegPrice.cfm>
- Agriculture and Horticulture Development Board  
<http://horticulture.ahdb.org.uk/>

## Unit 316

## Pollution and waste control management

<b>UAN:</b>	Y/507/6858
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

This unit aims to provide learners with an understanding of the principles of land-based industries pollution and waste management control and how these can be applied in practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the agriculture sector or further education and training.

The learners will develop their knowledge of sources of farm waste, environmental legislation relevant to waste disposal, how to make optimum use the nutrient content of organic waste and methods of waste disposal to help equip enterprise managers for their future career.

### Learning outcomes:

In this unit, learners will be able to

1. know the sources and attributes of organic and inorganic waste
2. know the scope of waste management legislation and regulation
3. plan for managing waste in a farm environment
4. dispose of waste in a farm environment

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

## Learning outcome:

### 1. Know the sources and attributes of organic and inorganic waste

## Topics

- 1.1 Organic and inorganic wastes
- 1.2 Factors that influence the quantity of waste

### Organic wastes

Farmyard manure, hay, straw and silage, slurry, wood, soil, dead stock, milk, dirty water.

### Inorganic wastes

Plastics, batteries, fertiliser, packaging, metal, glass, inert waste, oils and fuel, hazardous wastes.

In this outcome learners will identify different types of waste and the origins of these. It is also expected that they will define organic (ie) and inorganic wastes (eg).

#### Topic 1.1

Learners will know the sources and attributes of organic and inorganic wastes (eg hazardous, smell) in given situations, eg:

- types of waste and their usefulness (organic, inorganic, hazardous, recyclable)
- wastes from animal and crop production processes (eg soiled bedding from livestock enterprises, waste plant material from crop processing)
- wastes from chemical use (eg medicines, needles, syringes, herbicides, pesticides and fungicides).

#### Topic 1.2

Learners will know factors that influence the quantity of waste eg:

waste treatment, compaction/consolidation, value as saleable material, recycling and recovery, packaging, amount of livestock, efficiency of systems and processes (eg spillage, leaks), over-production.

## Learning outcome:

### 2. Know the scope of waste management legislation and regulation

## Topics

- 2.1 Legislation and codes of practice that control the storage, handling and disposal of farm waste
- 2.2 Waste management and husbandry system

## **Farming activities involving waste management**

eg spraying, slurry application, fallen stock, waste water, sewage, and food and industrial waste disposal on farm.

Learners will know the importance of keeping accurate and up to date records on the amounts and types of waste.

### **Topic 2.1**

The following is a comprehensive list of the legislation that applies to the storage, handling and disposal of farm waste. For purposes of assessment, there is no requirement for detail, but learners must appreciate that there is legislation and where each applies:

- Legislation (eg The Groundwater Regulations (England and Wales) Regulations 2009; The Environmental Protection Act 1990; The Environment Act 1995; The Environmental Protection (Duty of Care) Regulations 1991; The Waste Management Licensing Regulations 1994 (and amendments 1995); The Control of Pollution (Amendment) Act 1989; The Framework Directive on Waste, Scrap Metal Dealers Act 1964; The Controlled Waste Regulations 1992; The Civic Government (Scotland) Act 1982)
- Codes of practice, directives, etc. (eg The Duty of care for waste, The Waste Electronic and Electrical Equipment (WEEE) Directive, Batteries Directive, Landfill Directive, Cross compliance, air quality, Nitrate Vulnerable Zones and implications of the Single Farm Payment Scheme in 2015).

### **Topic 2.2**

Learners will know constraints placed on waste management and husbandry systems by current regulations eg:

responsibility of waste producer, carrier and processor(s), registration and waste licensing, storage and handling procedures, cost implications of untreated wastes, disposal and pollution, penalties for improper disposal, Nitrate Vulnerable Zones and failure to cross comply with Single farm payment).

## **Learning outcome:**

### **3. Plan for managing waste in a farm environment**

## **Topics**

3.1 Management of organic and inorganic farm waste

3.2 Storage and disposal facilities for organic and inorganic farm waste

In this outcome learners will plan for managing waste appropriately. They will understand the importance of waste control and reduction as an alternative to direct disposal to landfill. The development of a waste management plan will describe how waste is dealt with including strategies for reduction and control.

### **Topic 3.1**

Learners will know appropriate methods for the management of organic and inorganic farm waste in accordance with relevant legislation and regulation, eg:

- waste reduction programme: waste segregation, separation, compaction, dilution, records/waste codes
- types of machinery used for waste application and their impact on the environment

- minimising ammonia volatilisation into the atmosphere by choosing suitable incorporation and application methods: trailing shoe, band spreader, splash plate and direct injection
- using Global Positioning System (GPS) and nutrient management maps for increased accuracy of waste application
- anaerobic digestion and benefits to the environment.

### Topic 3.2

Learners will outline storage and disposal facilities for organic and inorganic farm waste in a given situation eg:

bunded areas for liquid wastes; bins and waste skips; composters; anaerobic digesters; incinerators; compactors; cardboard; paper and plastics baling machinery; pelleters; shredders and chippers; rendering plant; decontamination equipment; slurry/muck store, landfill.

Learners will also identify waste storage requirement for different farm livestock systems and calculate storage requirements for each.

## Learning outcome:

### 4. Dispose of waste in a farm environment

#### Topics

- 4.1 Safe disposal of selected organic farm waste
- 4.2 Waste management plan for organic and inorganic waste

### Topic 4.1

Learners will demonstrate the safe disposal of selected organic farm waste in accordance with a given waste management plan eg:

direct application (eg farmyard manures and slurry), composting, bio-digesting, incineration, hazardous waste treatment prior to disposal, animal carcasses, transporting of waste off site.

Learners will know the importance of weather conditions in selecting work windows to minimise risks of pollution.

### Topic 4.2

Learners will prepare a waste management plan for organic and inorganic waste producing a farm map showing land available for spreading as high/ moderate/ low risk based on:

risk assessments, analysing of all farm wastes from production to disposal, waste quantities, demonstrating cross compliance in a given situations, analysing of systems and proposed application rates and zones, using slurry to offset buying of inorganic fertilisers, estimating and having a net worth of livestock slurries in production systems.

## Guidance for delivery

This unit will provide the learner with the knowledge and skills required to control, manage and dispose of waste in a farm environment.

Throughout delivery of the unit, the need to work safely and minimise environmental damage should be emphasised. It is expected that learners will know safe working practices and accepted practices and behaviours for the context in which they are working. Learners may be able to link the content of this unit to other learning, such as the application of pesticides, which generates waste.

This unit lends itself to a variety of teaching techniques. It is expected that as well as formal lectures, learners will benefit from a range of practical tasks, site visits (eg to landfill sites, farms and recycling facilities) and guest speakers (eg from organisations such as the Environment Agency).

Learners should also be given opportunities to observe and identify wastes in a practical setting. Care must be taken to ensure that safe working practices are adhered to, including the use of appropriate personal protective equipment (PPE), machine operation by qualified operatives, and secure storage of wastes.

In order to achieve Learning outcome 4, learners will dispose of waste safely in a practical/realistic context. Learners will need access to a range of quantities and types of waste produced from specific farming enterprises. Opportunities could include washing out and disposal of chemical containers; disposal of veterinary medicine products; disposal of packaging; slurry/manure spreading or disposal of dead stock. Safe working practices must be observed and risk assessments carried out prior to any practical activity that involves handling, treatment or disposal of waste.

## Suggested learning resources

### Books

Lainsbury M.A. 2014. *UK Pesticide Guide 2015. 28<sup>th</sup> Edition*. CABI Publishing. ISBN 1780645775  
Pillay T. 2004. *Aquaculture and the Environment. 2<sup>nd</sup> Edition*. Wiley-Blackwell. ISBN 1405101679  
Soffe R. 2003. *The Agricultural Notebook. 20<sup>th</sup> Edition*. ISBN 0632058293  
Sommer S.G., Christensen M.L., Schmidt T. and Jensen L.S. 2013 *Animal Manure Recycling: Treatment and Management*. Wiley-Blackwell. ISBN 1118488539  
Nix, J.2015, *Farm Management Pocketbook*. Agro Business Consultants Ltd ISBN: 978-0957693913

### Journals

- Farmers Weekly
- Landwards

### Websites

- The Chartered Institution of Wastes Management (CIWM) <http://www.ciwm.co.uk>
- DairyCo <http://www.dairy.ahdb.org.uk>
- Department of Environment, Food and Rural Affairs <http://www.defra.gov.uk>
- Environment Agency <http://www.environment-agency.gov.uk>
- The Waste and Resources Action Programme (WRAP) <http://www.wrap.org.uk>
- Farmers weekly

## Unit 317

## Farm habitat management

<b>UAN:</b>	D/507/6859
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

This unit aims to introduce learners to farm habitat management skills and knowledge and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into employment in the agriculture sector or into further or higher education.

Upon completion of this unit learners will have looked at changes in the farmed landscape since the advent of farming in the UK in the Neolithic (4000BC) to the present day and the various influences on and effects of these changes. They will consider ecological aspects and the wildlife value of farm habitat management. They will also develop skills in farm habitat surveying and practical habitat management.

### Learning outcomes:

In this unit, learners will be able to

1. understand the development of the agricultural landscape
2. understand the ecology of farm habitats and wildlife species
3. carry out farm habitat and species surveys
4. carry out practical farm habitat management.

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

### Farm habitats

Hedges, stone walls, ponds and lakes, rivers and streams, woodlands, trees (veteran, ancient, deadwood), field margins, conservation headlands, and grassland.

## Learning outcome:

### 1. Understand the development of the agricultural landscape

#### Topics

- 1.1 Development of the agricultural landscape
- 1.2 Effects of legislation or policy on the development of the agricultural landscape
- 1.3 Effects of organisations on the development of the agricultural landscape

Each topic would include learners identifying biotic and abiotic effects eg how the removal of hedges, ditches, ponds, woodland, farm buildings, dry stone walls, grading of the watercourse, the use of pesticides and inorganic fertilisers, silting of water courses via soil erosion have affected the landscape.

#### Topic 1.1

Learners will understand stages in the development of the agricultural landscape in the UK, including prehistoric, medieval, pre-enclosure, enclosure, industrial revolution, post 1940s, modern day agriculture.

#### Topic 1.2

For purposes of assessment, there is no requirement for detail, but learners must appreciate that legislation has had ecological effects including change to agricultural landscape over time, species diversity, range and distribution, change to habitat types and characteristics, impact of intensive agricultural management on flora and fauna:

The following is a comprehensive list of the legislation that applies to the development of the farmed landscape

- The General Enclosures Act 1845
- Corn Laws
- Agricultural Act 1947
- Common Agricultural Policy (CAP) (Reforms: to include Greening 2015)
- Wildlife and Countryside Act 1981 (as amended)
- Environmental Protection Act 1990
- Cross Compliance Nitrates Directive 1991(as amended)
- Hedgerows Regulations 1997
- Environmental Impact Assessment (Agriculture) (England) Regulations 2006

#### Topic 1.3

Learners will understand the effects of organisations on the development of the agricultural landscape including

- Defra
- Royal Society for the Protection of Birds (RSPB)
- Natural England
- Environment Agency
- Rural Payment Agency.



### Learning outcome:

## 2. Understand the ecology of farm habitats and wildlife species

### Topics

- 2.1 Ecological importance of habitat diversity
- 2.2 Biodiversity action plan

#### Topic 2.1

Learners will explain the ecological importance of habitat diversity in a selected farmed landscape. Provision of habitat for a diverse range of species (flora and fauna), rare and uncommon species, species with specific habitat requirements, availability and access to food preferences.

#### Topic 2.2

Learners will evaluate the effectiveness of a given biodiversity action plan, including Habitat Action Plans (HAPs), for example ancient and or species rich hedgerows action plan, cereal field margin action plans, grassland action plans, species action plans, ecological importance of habitat diversity in the farmed landscape, process of species and habitat action planning.

### Learning outcome:

## 3. Carry out farm habitat and species surveys

### Topics

- 3.1 Ecological surveying of a farm habitat
- 3.2 Results of farm habitat and species surveying

#### Topic 3.1

Learners will carry out ecological surveying of a given farm habitat, including Whole farm assessments, Linking Environment and Farming (LEAF) audit, Farm Environmental Record, Farm Environmental Plans (Environmental Stewardship Schemes), National Vegetation Classification (NVC), hedgerow survey, farmland bird surveys, arable plants survey, farmland species, ecological features, nature conservation value, habitat condition assessment, potential biodiversity improvements.

#### Topic 3.2

Learners will report the results of farm habitat and species surveys, including

- reporting results: including qualitative and quantitative data; using suitable presentation methods (eg tables, pie charts, annotated maps, histograms, scattergraphs); performing statistical analysis (eg mean, mode, distribution and correlation); establishing conclusion in relation to survey aims; identifying potential sources of error within survey data
- species: birds, mammals, invertebrates, grasses, shrubs, trees, wildflowers.

### Learning outcome:

## 4. Carry out practical farm habitat management

### Topics

- 4.1 Equipment and resources for practical management
- 4.2 Practical management techniques
- 4.3 Improving farm habitat management

#### **Topic 4.1**

Learners will prepare equipment and resources for practical management of farm habitats, including

- hand tools: spades, forks, shovels, secateurs, handsaws, clippers, hammers, pickaxes, billhooks, loppers, bowsaws, hand fencing equipment
- use, maintenance and storage
- sharpening of tools where appropriate
- suitable clothing and personal protective equipment (PPE).

#### **Topic 4.2**

Learners will apply practical management techniques, including

- clearance: path, fence line
- dry stone walling
- woodland management: coppicing, uprooting, planting, protection
- hedge maintenance: pruning, thinning, planting, laying, dead hedging
- grassland management: cutting, mowing, mulching, restoration and/or creation
- pond, stream and ditch clearance/creation
- installing artificial habitats: bird boxes, deadwood habitats, dormouse boxes
- good practice in avoiding waste: composting, reusing and recycling materials as appropriate; methods of recycling.

#### **Topic 4.3**

Learners will recommend improvements to the management of farm habitats, including Setting habitat management objectives, planning activities and resources, monitoring activities and resources, reviewing outcomes against objectives, recommendations and improvements.

### **Guidance for delivery**

The emphasis of the unit is for learners to explore the elements of the landscape occupied by semi natural habitats.

Delivery of this unit is likely to be a mixture of classroom learning and practical farm habitat surveying and management. Classroom activity will be enhanced by practical sessions and visits, wherever possible to local sites. Any sites to be used must comply with local legislation and have prior full permission from the landowner. Theoretical content can be delivered through formal lectures, directed study, and internet and library research.

Where practical activities are used, health and safety issues relating to working in an outdoor environment and handling animal material must be stressed and regularly reinforced. Risk assessments must be undertaken and recorded prior to practical activities. Adequate personal protective equipment (PPE) must be provided. It is important that all learners are familiar with the tools, equipment, protocols and methods to be used in order to collect accurate data safely.

Work experience would be beneficial for learners wishing to pursue a career in this field. Visiting speakers could add relevance to the subject by offering their perspectives on their work, the situations they face and the methods they use.

To achieve Learning outcome 3, learners will plan, carry out and report findings of farm habitat and species surveys. It is anticipated that there will be some group activities during surveying but learners will present their findings individually.

Learning outcome 4 requires the learner to plan and use equipment and resources to recommend and carry out practical farm habitat management. Learners will also devise a management scheme taking into account the needs of the sites they access. This links well with the previous outcomes, which develop the skills and knowledge needed to complete this task. Prior full permission must be obtained from the landowner of the site used prior to implementing change.

### Suggested learning resources

#### Books

- Future Nature: A Vision for Conservation Adams., W  
Published by: Routledge 2nd revised Edition, 2003  
ISBN 978-1853839986
- Farming and Wildlife: A Practical Management Handbook Andrews J., & Rebane M  
Published by: RSPB, 1994  
ISBN 978-0903138673
- Environmental Law Bell S., McGillivray D., & Pedersen O  
Published by: OUP Oxford, 2013  
ISBN 978 – 0199583805
- The Farm as Natural Habitat: Reconnecting Food Systems with Ecosystems Bradley N., Jackson D., Jackson L  
Published by: Island Press, 2002  
ISBN 978-1559638463
- Biotic Indicators for Biodiversity & Sustainable Agriculture Buchs W  
Published by: Elsevier Science, 2003.  
ISBN 978-0444515513
- Introduction to Wildlife Conservation in Farming Burchett S., & Burchett., S  
Published by: Wiley – Blackwell, 2010  
ISBN – 13: 978-0470699348
- Agriculture & International Trade: Law, C Cardwell M., Grossman M., & Rodgers  
Policy & WTO  
Published by: CABI publishing, 2003  
ISBN 978-0851996639
- Habitat Management for Conservation: A Handbook of Techniques Ausden, M  
Published by: OUP Oxford, 2007  
ISBN 978-0198568735
- Wildlife Habitat and Management McComb B  
Published by: CRC Press, 2007  
ISBN 978-0849374890
- The Illustrated History of the Countryside* Rackham O  
Published by: Wakefield & Nicholson, 2003  
ISBN 978-027843351

Monitoring Ecological Change  
Published by: Cambridge University Press, 2005  
ISBN 978-0521820288

Spellerburg I. F

*Woodland Management: A Practical Guide*  
Published by Crowood Press 2<sup>nd</sup> Revised Edition, 2013  
ISBN 978-1861267894

Starr C

The Conservation Handbook Techniques in Research,  
Management & Policy  
Published by: Wiley Blackwell, 2000  
ISBN 978- 0632053445

Sutherland W

Habitat Conservation: Managing the Physical Environment  
Published by: Wiley Blackwell, 2001  
ISBN 978-0471984993

Warren A., & French JR

### **Publications**

- British Wildlife
- Agriculture, Ecosystems and Environment

### **Websites**

- Campaign for farmed environment <http://www.cfeonline.org.uk>
- DEFRA <http://www.gov.uk>
- FWAG <http://www.fwagsw.org.uk>
- Game and Wildlife Trust <http://www.gwt.org.uk>
- Linking Environment and Farming <http://www.leafuk.org>
- Natural England <http://www.gov.uk>
- RSPB <http://www.rspb.org.uk>
- Soil Association <http://www.soilassociation.org>
- UK Agriculture <http://www.ukagriculture.com>
- Farmers weekly

## Unit 318

## Undertake land based workshop processes

<b>UAN:</b>	T/507/6995
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

The purpose of this unit is to provide learners with an understanding of the principles of land-based workshop practice and how these can be applied in practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the agriculture sector or further education and training.

Learners will develop the skills, knowledge and understanding to enable them to identify and carry out safe and efficient repair or replacements to worn or damaged land-based equipment components. The ability fabricate or re-fabricate components and to repair and service equipment to maintain optimum and efficient working effectiveness to minimise down time and costs is an important skill sought by employers.

### Learning outcomes:

In this unit, learners will be able to

1. understand the importance of health and safety and safe working practices within a workshop environment
2. use hand tools, joining and cutting equipment
3. use materials for given purposes
4. maintain, replace or repair worn or broken components-on land-based equipment

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

### Learning outcome:

1. Understand the importance of health and safety and safe working practices within a workshop environment

### Topics

- 1.1 Potential hazards
- 1.2 Legislations and/or codes of practice
- 1.3 Following legislations and safe working practices

In this outcome learners will demonstrate knowledge of health and safety issues that affect themselves and others in the workshop situation. Learners will also be required to identify potential hazards in a maintenance workshop and ways of minimising those hazards. An understanding of the legislation covering workshop activity and equipment maintenance is also necessary, as is the need for safe working practices and the identification of safe systems of work. The learner will know the required personal protective equipment (PPE) required for a task and this must be provided and worn; potential risks must be minimised.

#### Topic 1.1

Learners will know key potential hazards in a land-based maintenance workshop (eg fumes, sparks, combustible materials, faulty equipment, blocked access/egress, lifting heavy components, poisons, unsafe working area, slipping, tripping, electric cables, moving machinery). Learners will differentiate between 'hazard' and 'risk' and become familiar with the risk assessment process in order to manage risk.

#### Topic 1.2

Learners will know the key legislation and workplace practices that apply to given workshop operations, for example:

- Health and Safety at Work etc Act 1974, Provision and Use of Work Equipment Regulations (PUWER) 1998, Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) 1995, Control of Substances Hazardous to Health Regulations (COSHH) 1998, Grinding Wheels Regulations
- personal protective equipment (PPE), machine guarding, company health and safety policy, first aid policy, reporting procedures, personal hygiene facilities, housekeeping policies, waste storage/disposal policy, fire exits and procedures.

#### Topic 1.3

Learners will understand the reasons for the need to follow legislation and codes of practice (eg risk assessment, employer and employee responsibilities and rights, waste disposal, personal cleaning and hygiene, legal requirements, accident and incident reporting, injury to bystanders, work efficiency, location of tools and equipment, accountability for work done)

### Learning outcome:

2. Use hand tools, joining and cutting equipment

## Topics

- 2.1 Purpose of hand tools, joining and cutting equipment
- 2.2 Use of hand tools, joining and cutting equipment.
- 2.3 Maintenance procedures for hand tools, joining and cutting equipment

In this outcome learners will identify a range of common hand-tools, joining and cutting equipment. Learners will select, safely and efficiently use appropriate tools and equipment for given tasks. These tasks will include both the use of hand-tools and equipment for thermal and non-thermal joining. All tools used will be inspected, maintained and stored by the learners for subsequent use. It is essential that the learner wears the appropriate (PPE) and adheres to safe working practice.

**Hand tools** eg. powered (drills) and non-powered (hammers, spanners, wrenches, drivers, marking out tools, punches, pullers, measuring equipment)

**Joining equipment** eg Non-thermal (eg riveting, adhesives, threaded fasteners) and thermal (eg manual metal arc, metal inert gas, oxy/acetylene, soldering))

**Cutting equipment** eg hand and powered hacksaw, chisels, files, shears, bench and hand held grinders, drills, oxy/acetylene cutting, grinders

### Topic 2.1

Learners will know a range of hand tools and joining and cutting equipment used in land-based maintenance workshops and state their purpose.

### Topic 2.2

Learners will demonstrate the safe use of a given range of common hand tools, this will include safe transportation and storage of workshop tools and equipment as appropriate.

### Topic 2.3

Learners will demonstrate maintenance procedures for a given range of hand tools and joining and cutting equipment, for example:

- hand tool cleaning, storage and transportation,
- sharpening cutting tools, maintaining correct angles,
- replacement grinding/cutting discs,
- electrical equipment observation and testing requirements

## Learning outcome:

### 3. Use materials for given purposes

## Topics

- 3.1 Materials used to repair equipment
- 3.2 Repair objectives

In this outcome learners will know a range of materials and select the most appropriate material to complete a repair process. The learners will understand material properties to make the appropriate choice. Materials to be identified and their properties understood include both metallic and non-metallic material such as plastics and rubber. Selection factors will include ease of working,

recycled materials and cost as well as inherent properties such as ductility, strength and hardness. The learners will compare different materials and their possible uses.

### **Topic 3.1**

Learners will know a range of materials commonly used for the repair of land-based equipment, for example:

- metallic: iron, steel, copper, brass, aluminium, cast iron, lead, bronze
- non-metallic: wood, rubber, plastics, fibres, paper

### **Topic 3.2**

Learners will justify the selection of material(s) to meet given repair objectives (eg ease of use, cost, surface finish, self-lubrication, weight, resistance to wear, oxidation resistance, conductivity, heat resistance). They will also compare the use of selected materials for given repair situations (eg hardness, brittleness, ductility, workability, strength, cost, durability)

## **Learning outcome:**

### **4. Maintain, replace or repair worn or broken components on land based equipment**

#### **Topics**

- 4.1 Machine inspection
- 4.2 Tools and materials
- 4.3 Repair and component replacement procedures

In this outcome learners will maintain equipment and to replace or repair worn or broken components. The learner must demonstrate safe practices, and conform to legislation while undertaking selected repair/replacement tasks. Learners could work on a variety of common land-based equipment and machinery, such as ploughs, weighing equipment, brushwood chippers, cultivation machinery, grass cutting machinery, planting/sowing/spreading machinery. On completion of the tasks learners will verify their own work and comment on alternative replacement/repair strategies, should the problem reoccur. Learners are expected to report unresolved repairs and dispose of waste appropriately.

#### **Topic 4.1**

Learners will inspect a selected land based machine to identify the need for safe repair or replacement of identified worn or damaged components, for example:

- replacements: Worn components, damaged components, bearings, bushes, seals
- repairs: Broken welds, framework fractures, re-alignments, re-fabrications

#### **Topic 4.2**

Learners will prepare tools and materials and safely repair or replace worn or damaged land-based equipment components.

#### **Topic 4.3**

Learners will make recommendations for possible changes to repair and component replacement procedures carried out on a selected land-based machine, for example:

- recommendations to repair: strengthening of weak areas, heavier duty materials, gussets, braces, manufacturer updates/modifications to wearing components, improvement to lubrication, reduction of vibration, spreading load

- recommendations for changes to procedures: to reduce time, save costs, improve working conditions, improve longevity, improve effectiveness

### **Guidance for delivery**

This unit is designed to give the learners the necessary knowledge and skills to detect and rectify faults on a range of land-based equipment typical to their area of study; a suggested range is listed in the range/scope details in outcome four. Learners will need access to a range of consumable items needed to undertake fabrication projects, as well as to an appropriately equipped workshop environment, which has appropriate facilities for storage and disposal of waste in line with current legislation.

Throughout the unit the emphasis will be on safe, legal practices, working to employers' recommended procedures and attention to detail when verifying completed work. It is important that learners are closely supervised when working in a workshop environment and follow safe working practices at all times and that risk and hazards are assessed prior to any activity commencing; simulation could be used to introduce the learners to a range of workshop hazards. The use of manufacturers' handbooks should be emphasised throughout both for the equipment to be repaired and maintained and also for the tools and equipment used.

It is accepted that some formal lectures will be necessary, however it is recommended that these are linked to considerable interactive practical lessons in a real working environment. Learners will maintain appropriate workshop records and documentation, such as maintenance records or job cards.

Centres are encouraged to introduce employers and specific professionals to provide interesting and relevant information to the learner. Teaching would also benefit from visits to a variety of workshops and dealers to add depth to the learners' experience.

## Suggested learning resources

### Books

- Anon. 2013. *Welding and Fabrication Workbook*. Cengage Learning
- Bell, B. 1992. *Farm Workshop*. 2nd Edition. Farming Press. ISBN 0852362374
- Bolton W. and Higgins R.A. 2014. *Materials for Engineers and Technicians. 6th Edition*. Routledge. ISBN 1138778753
- Finch R. 2005. *The Farm Welding Handbook*. Motorbooks International ISBN 0760322511
- Kiubick R. 2007. *How to Set up Your Farm Workshop*. Motorbooks International. ISBN 0760325499
- Pearce A. 2012. *Farm and Workshop Welding*. Fox Chapel Publishing. ISBN 1565237414
- Pritchard D. 2001. *Soldering, Brazing and Welding: A Manual of Techniques*. The Crowood Press Ltd. ISBN 1861263910
- Weiss A. 1999, *Workshop Materials*, Special Interest Model Books. ISBN 978-1854861924

### Journals

- Profi International
- Farmers Weekly
- Forestry Journal
- Practical Farm Ideas

### Websites

- Health and Safety Executive <http://www.hse.gov.uk>
- Environment agency [www.environment-agency.gov.uk](http://www.environment-agency.gov.uk)
- Manufacturers website <https://www.deere.co.uk>  
[www.masseyferguson.co.uk](http://www.masseyferguson.co.uk)  
[www.claas.co.uk](http://www.claas.co.uk)
- Farmers weekly [www.fwi.co.uk](http://www.fwi.co.uk)
- The Agriculture and Food Development Authority [www.teagasc.ie](http://www.teagasc.ie) (safety in the farm workshop)
- Practical Farm Ideas [www.farmideas.co.uk](http://www.farmideas.co.uk)
- The welding Institute <http://www.twi.co.uk>
- Profi International <http://www.profi.com>
- Health and Safety Executive <http://www.hse.gov.uk>

## Unit 319

## Dairy production

<b>UAN:</b>	Y/507/6861
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

This unit aims to introduce learners to the skills and knowledge in dairy production and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into employment in the agriculture sector or into further or higher education.

The aim of this unit is to allow learners to develop and understanding of the principles of dairy herd management. The practical application of this knowledge is covered, with an emphasis on animal health and welfare in relation to clean milk production.

### Learning outcomes:

In this unit, learners will be able to

1. know the dairy industry
2. understand the principles of rearing dairy herd replacements
3. know how to manage cows through the production cycle
4. apply hygiene regulations and legislation to clean milk production

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

## Learning outcome:

### 1. Know the dairy industry

#### Topics

- 1.1 Trends in the UK, EU and world milk industry
- 1.2 Dairy cow breeds used in the UK
- 1.3 Milk contracts
- 1.4 Dairy gross margins

#### Topic 1.1

Learners will know trends in the UK, EU and world dairy industry:

- UK and EU numbers of cows, numbers of producers, yield per cow, milk price, size of herds, profitability.
- World Commodities markets, prices and trends for liquid, milk powder, cheese.

#### Topic 1.2

Learners will know dairy cow breeds used in the UK and their qualities, including pedigree, crossbreds for dairy, and crossing for beef. They will know the effect of quality factors on price received by the farmer.

#### Topic 1.3

Learners will know the requirements of milk contracts, the differences between contracts, pricing formula, volume requirements and testing regimes

#### Topic 1.4

Learners will know about dairy gross margins:

- fixed costs, variable costs, sensitivities
- margin over purchased feed and forage.

## Learning outcome:

### 2. Understand the principles of rearing dairy herd replacements

#### Topics

- 2.1 Husbandry and health care requirements of the new-born calf
- 2.2 Rearing and management requirements of a herd of heifers
- 2.3 Replacement breeding stock

#### Topic 2.1

Learners will understand the husbandry and health care requirements of the new-born calf:

- Housing
- husbandry requirements
- milk and feed requirements
- rearing and feeding systems
- importance and timing of colostrum intake

- husbandry tasks (for example reasons for and methods of supernumerary teat reduction, disbudding, castrating)
- weaning
- function and closure of oesophageal groove
- introduction of hay and concentrates to encourage rumen development
- disease prevention.

### Topic 2.2

Learners will understand the rearing and management requirements of a herd of heifers:

- rearing and feeding systems
- management at grass
- herd replacement policy
- planned timing of conception
- choice of bull (for example for ease of calving)
- use of natural service or artificial insemination
- condition scoring
- target weights
- target growth rates.

### Topic 2.3

Learners will understand selection of replacement breeding stock:

- choice based on conformation
- maternal milking performance
- breed characteristics
- condition
- health
- age and size,
- herd objectives
- time of year born
- herd calving pattern.

## Learning outcome:

### 3. Know how to manage cows through the production cycle

#### Topics

- 3.1 Management of cows during each phase of the production cycle
- 3.2 Breeding cycle in cows
- 3.3 Feeding requirements of cows through the production cycle
- 3.4 Management of disease in cows through the production cycle

Learners will understand the different requirements for nutrition at different stages of lactation, and how the different feeding strategies link to both economics and enhancing productivity. Learners will also understand the different types of disease, and particularly the importance of metabolic disease in the high performing dairy cow.

### Topic 3.1

Learners will understand the management of cows during each phase of the production cycle:

- management at each phase of the production cycle: lactation curve, housing, husbandry, routine stock tasks, use of condition scoring, preparation for drying off, calving and weaning management, reasons for culling, disposal of deadstock
- housing requirements: accommodation, loafing areas, stocking density, ventilation and draught prevention, cubicle housing, bedding systems, cow comfort, safety implications of group housing.

### **Topic 3.2**

Learners will understand the breeding cycle in cows:

- events through the year
- calving
- early lactation
- choice of bull
- service timing and management
- oestrus detection methods
- service management
- use of natural service or artificial insemination
- mid and late lactation
- drying off
- calving interval definition and optimal length.

Activities to manage reproduction:

- Detection of oestrus
- use of synchronisation and oestrus detection aids, service management, presentation for artificial insemination
- embryo transfer
- sexed semen
- natural breeding management
- presentation and methods for pregnancy diagnosis
- condition scoring.

### **Topic 3.3**

Learners will understand the feeding requirements of cows through the production cycle:

- requirements for maintenance and production (milk production, growth)
- development of the unborn calf)
- feeding objectives at each stage of the cycle
- selection of feeding regime grass/forage, concentrates
- feed to yield
- flat rate feeding
- complete diet feeding (TMR, New Zealand system, in parlour feeding, out of parlour feeders)
- appetite
- use of condition scoring
- relationship between diet and milk quality.

Ration constituents and the importance of milk from forage.

### Topic 3.4

Learners will understand the prevention and treatment of disease in cows through the production cycle:

- Metabolic diseases (for example hypocalcaemia, hypomagnesaemia, fatty liver, ketosis, acidosis)
- bacterial, viral and fungal diseases
- notifiable diseases (for example brucellosis, BSE, tuberculosis),
- displaced abomasums, foot problems
- use of preventative measures (for example vaccination, control of internal and external parasites, foot trimming, diet management)
- requirement for veterinary assistance.

### Learning outcome:

#### 4. Apply hygiene regulations and legislation to clean milk production

### Topics

- 4.1 Milking parlour types and milk quality
- 4.2 Activities to milk dairy cows and record necessary information
- 4.3 Hygiene procedures to meet in relation to current food hygiene regulations and legislation
- 4.4 Symptoms, causes, prevention and treatment of mastitis in dairy cows

### Topic 4.1

Learners will know the benefits and drawbacks of milking parlour types and understand milk quality requirements:

- Herringbone, abreast, rotary, robotic
- Quality requirements of purchase contracts: eg protein, butterfat, lactose.
- Hygiene requirements eg total bacterial counts (Bactoscan), mastitis cell counts (SCC), contaminants such as water, colostrum, blood.

### Topic 4.2

Learners will carry out the activities to milk dairy cows and record necessary information:

- parlour preparation and set up,
- reasons for in and out of parlour feeding,
- udder washing and preparation
- application of teat cups
- removal of teat cups (for example by hand, by automatic cluster removal),
- teat disinfection before and after milking
- cow entrance and exit from the parlour
- parlour cleaning and shut down.

Help keep computerised records of yield and state the benefits of monitoring.

### Topic 4.3

#### Hygiene procedures:

- udder washing and drying
- use of teat disinfectant
- use of fore milking
- avoidance of over milking
- use of clean clothing
- cleaning arms and forearms
- reasons for use of gloves
- parlour cleaning
- discarding of milk from ill or antibiotic treated cows.

Current UK and EU regulations and legislation, for example Regulation (EC) 852/2004, 853/2004, 854/2004, Food Hygiene Regulations 2006.

#### **Topic 4.4**

Symptoms, causes, prevention and treatment of mastitis:

- types of mastitis (acute, sub acute, chronic)
- symptoms for each type (for example udder pain, swelling, fever, udder hardening, milk reduction, cow behaviour)
- causes: bacterial (for example *Streptococcus uberis*, *Staphylococcus aureus*, *Corynebacterium*)
- prevention and treatment: design of accommodation, bedding and cleanliness, milk machine testing, cell count monitoring, use of parlour hygiene procedures, early diagnosis and treatment of affected cows, use of antibiotic treatment

### **Guidance for delivery**

This unit will equip learners with an understanding of dairy cow management and some practical husbandry skills. As learners will be engaged in practical activities, safe working practices should be emphasised, including the use of appropriate personal protective equipment (PPE). Appropriate risk assessments should be undertaken and at Level 3 it is expected that learners will take an active part in completing risk assessments, so that this becomes an integral part of all practical activity. Learners will also know the importance of animal welfare, and sustainability concepts should be demonstrated to them where possible.

Centres are encouraged to introduce employers and specific professionals from industry to provide interesting and relevant information to the learner. Teaching would also benefit from visits to a variety of establishments to add depth to the learner experience.

Learners should know of new technology and legislation.

Delivery of Learning outcome 1 is likely to be mainly classroom based. Wherever possible real financial and production data, and contracts from real units that the learners can visit, should be used.

For Learning outcome 2 delivery is likely to include a mix of theory and practical activities. Classroom based activity will enable learners to gain an understanding of calf husbandry and health care requirements and heifer management. It is anticipated this will be supplemented by visits and the opportunity to take part in supervised practical activities.

Delivery of Learning outcome 3 learners will be most effective if learners are able to witness a range of feeding, breeding and management practices at the different stages of the production cycle.

Learners will need the opportunity to develop practical skills in dairy cow reproduction management through supervised farm practicals. This could be linked to an appropriate work placement. Learners will also need the opportunity to select replacements or breeding stock, and will need access to appropriate records as well as to the heifers or cows.

To achieve Learning outcome 4, learners will need sufficient opportunity to develop their skills in practical milking procedures, including parlour set up and cleaning, the use of good hygiene procedures and recognising mastitis. It is anticipated there will also be some classroom based delivery on mastitis. Visits to different types of parlours would be a useful addition.

## Suggested learning resources

### Books

- Reproduction in Cattle, 3rd Edition  
Published by: Blackwell Publishing, 2004  
ISBN 978-1405115452  
Ball, P; & Peters, A.
- A Veterinary Book for Dairy Farmers, 3rd Edition  
Published by: Old Pond Publishing, 1999  
ISBN 978-1905523290  
Blowey, R.
- Modern Livestock and Poultry Production, 9th Revised Edition. Gillespie, J.  
Published by: Wadsworth Publishing Co Inc; 2015.  
ISBN 978-1133283508
- Calf Rearing Guide - Practical & Easy to Use  
Published by: Context Products Ltd (12 Feb. 2013)  
ISBN-10: 1899043136  
ISBN-13: 978-1899043132  
Charlton, S
- Farm Management Pocketbook 2015  
Published by: Agro Business Consultants Ltd. 2014  
ISBN: 978-0957693913  
Nix, J.
- The Agricultural Notebook, 20th Edition  
Published by: Wiley-Blackwell, 2003  
ISBN: 978-0632058297  
Soffe, R.

### Websites

- <http://www.dairyuk.org> Dairy UK
- <http://www.dardni.gov.uk> Department of Agriculture and Rural Development (NI)
- <http://www.defra.gov.uk> Department for Environment, Food and Rural Affairs
- <http://www.wales.gov.uk> Welsh Assembly Government
- <http://www.scotland.gov.uk> Scottish Executive Environment and Rural Affairs Department
- <http://www.dardni.gov.uk> Department of Agriculture and Rural Affairs (Northern Ireland)
- <http://www.dairyco.org.uk/> DairyCo
- <http://www.milk.co.uk> Dairy Council
- <http://assurance.redtractor.org.uk/rtassurance/schemes.eb> Red Tractor Assurance scheme
- <http://www.fwi.co.uk/> Farmers Weekly Interactive

## Unit 320

## Beef production

<b>UAN:</b>	D/507/6862
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

This unit aims to provide learners with an understanding of the principles of beef production and how these can be put into practice.

This unit aims to develop learners' skills in beef stock production and an understanding of how these can be applied in practice. Learners will develop their knowledge of different beef production systems as well as good husbandry and management of beef stock. They will research the health and nutritional needs of beef stock.

### Learning outcomes:

In this unit, learners will be able to

1. know beef production systems used in the UK
2. understand principles of suckler herd health and breeding
3. perform routine beef stock
4. complete and use beef management records

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

### Learning outcome:

#### 1. Know beef production systems used in the UK

### Topics

- 1.1 Characteristics
- 1.2 Beef production systems
- 1.3 Nutritional and health requirements

#### Topic 1.1

Learners will know:

- examples of different beef breeds (British, continental), early maturing (eg Aberdeen Angus, Hereford), late maturing (eg Charolais, Simmental), cross breeds from dairy production systems
- characteristics including size at maturity; growth rates; feed conversion ratio; handling and management considerations; carcass quality; growth differences between heifers, steers and bulls.

#### Topic 1.2

Learners will know beef production systems, including

- type of system: cereal beef, maize silage beef, 18 month grass/cereal beef and 24 month grass/silage beef, grass finishing of store cattle
- features of system: growth rates, age at reaching finished weight, suitability of breed and sex for production system, cost, market requirements, housing and grassland requirements, stock handling requirements.

#### Topic 1.3

Learners will know the nutritional and health requirements for given beef production systems, including

Nutritional requirements for different systems, grassland management (18 and 24 month systems), stocking density, use of cereals, target liveweight gains, common health problems for each system and their prevention and treatment.

### Learning outcome:

#### 2. Understand principles of suckler herd health and breeding

### Topics

- 2.1 Production of a suckled calf
- 2.2 Factors affecting suckler herd performance

#### Topic 2.1

Learners will understand

- suckled calf systems: single, double and multiple suckling, and reasons for system choice (for example location, breed, grassland availability)
- factors affecting timing of calving and weaning

- nutritional requirements through cycle
- feeding and herd health
- market requirements
- target body condition score
- service planning and management
- advantages and disadvantages of autumn and spring born calves.

### Topic 2.2

Learners will understand suckler herd performance and factors affecting this, including

- performance: gross margin (sales of calves and culls less variable costs, for example feed), daily liveweight gain, calf mortality rates, age and value at sale, herd replacement rates, calving spread, calving interval, stocking rates
- factors: type of system, breed, use of purebreds or crossbreds, season of calving, compact calving, grassland quality and management, health problems and their management (for example mastitis, diarrhoea, dehydration, cystic ovaries, internal and external parasites, lameness), feeding and condition, use of housing during winter, breeding management (for example choice of bull in terms of breed/performance record, oestrus detection, calving intervals, planned calving), sale of store or finished cattle.

### Learning outcome:

#### 3. Perform routine beef stock

### Topics

3.1 Risk assessment

3.2 Routine beef stock procedures

### Topic 3.1

Learners will complete risk assessment relevant to routine beef stock procedures, including:

- risks
- assess for likelihood and impact
- determine actions to minimise risk (for example use of personal protective equipment)
- briefing of others involved
- use of equipment and procedures
- checking equipment before task
- restraint for livestock.

### Topic 3.2

Learners will carry out routine beef stock procedures to meet given objectives. This will include:

- restraint and handling methods (for example use of race, halter, cattle crush)
- weighing
- treatment of internal and external parasites
- vaccinating
- foot trimming
- branding
- ear tagging
- clipping out

- castration
- disbudding
- feeding and grazing management,
- movement
- selection of animals (for example stores for purchase, beef animal for slaughter)
- condition scoring.

### Learning outcome:

#### 4. complete and use beef management records

#### Topics

4.1 Beef management data

4.2 Beef management records

##### Topic 4.1

Learners will collect and use beef management data, including daily live weight gain, food consumed, food conversion ratio, days to finishing, finishing weight, age and sale price per kg, purchase price (if applicable) variable costs (for example feed costs, vet and medicine costs), gross margin calculation and comparison with targets and standards.

##### Topic 4.2

Learners will complete beef management records in compliance with relevant health and safety requirements, including:

- herd register (ear tag number, date of birth, sex, breed, dam details),
- movement records (date of movement on or off premises and movement details)
- date of cattle deaths
- timescales for completion
- application for cattle passports
- veterinary medicines book completion, use of computerised and online records.

Requirements of legislation and codes of practice include, for example:

- The Cattle Identification Regulations 2007
- Welfare of Farmed Animals Regulations 2000
- Welfare of Animals (Transport) Order 2006
- Defra Welfare of Cattle code of recommendations 2003
- Veterinary Medicines Directive Code of Practice on the responsible use of animal medicines on the farm.

## Guidance for delivery

This unit will provide learners with an understanding of the main types of beef production system in the UK, and equip them with some practical husbandry skills. As learners will be engaged in practical activities, safe working practices should be emphasised, including the use of appropriate personal protective equipment (PPE). Appropriate risk assessments should be undertaken and at Level 3 it is expected that learners will take an active part in completing risk assessments, so that this becomes an integral part of all practical activity. Learners will also know the importance of animal welfare, and sustainability concepts should be demonstrated to them where possible.

Centres are encouraged to introduce employers and specific professionals from industry to provide interesting and relevant information to the learner. Teaching would also benefit from visits to a variety of establishments to add depth to the learner experience.

For Learning outcome 1, delivery is likely to include a mix of theory and practical activities. Classroom based activity will enable learners to gain an overview of beef breeds, their different characteristics and the systems which are most suited to different breed types. It would be helpful for learners to visit a range of beef production systems, and to witness different breed types.

For Learning outcome 2, learners will understand suckler cow enterprises and how these may differ in different UK locations, for example a hill single suckled system selling stores compared with a lowland double suckled system taking stock through to slaughter. Delivery is likely to include a mix of classroom activity and visits, but may also include audiovisual material to highlight systems in other UK regions.

For Learning outcome 3, learners will need the opportunity to develop practical husbandry skills in a supervised beef enterprise setting. This could be linked to an appropriate work placement. It is important that the health and safety of the learner, and welfare of the animal, are emphasised in both theory and practice. It is expected that learners will gain an overview of the husbandry tasks and requirements, and will acquire practical skills in at least three tasks.

For Learning outcome 4, learners will need access to a range of beef management data. Delivery will need to encompass use and analysis of data, and comparison with local and national performance standards. Where data is sensitive in nature, for example financial data, collected data may be supplemented with realistic case study material. It will be acceptable for learners to complete simulated records where it is not appropriate or feasible to complete them first hand. Learners will have an overview of key current legislation and the requirements for beef farmers to comply with this, which may be supplemented by a guest speaker discussing how legislation affects their husbandry practices.

## Suggested learning resources

### Books

- Planned Beef Production and Marketing, 3rd Edition. Allen, D.  
Published by: Blackwell Science 1990.  
ISBN 0632026111
- Reproduction in Cattle, 3rd Edition. Ball, P. and Peters, A.  
Published by: Blackwell Publishing, 2004.  
ISBN 1405115459
- Modern Livestock and Poultry Production, 9th Revised Edition. Gillespie, J.  
Published by: Wadsworth Publishing Co Inc; 2015.  
ISBN 978-1133283508
- The Agricultural Notebook, 20th Edition. Soffe, R.  
Published by: Wiley-Blackwell, 2003  
ISBN 978-0632058297
- Calf Rearing. Thickett, B. Mitchell, D. and Hallows, B.  
Published by: Farming Press, 2003  
ISBN 186126643X
- Storey's Guide to Raising Beef Cattle. 3<sup>rd</sup> Edition. Thomas, H.  
Published by: Storey Publishing, 2009.  
ISBN 978-1603424547

### Websites

- <http://www.dardni.gov.uk> Department of Agriculture and Rural Development (NI)
- <http://www.wales.gov.uk> Welsh Assembly Government
- <http://www.scotland.gov.uk> Scottish Executive Environment and Rural Affairs Department
- <http://www.defra.gov.uk> Department for Environment, Food and Rural Affairs
- <http://www.fawc.org.uk> Farm Animal Welfare Council
- <http://www.mlc.org.uk> Meat and Livestock Commission
- <http://www.rpa.gov.uk> Rural Payments Agency
- <http://www.vmd.gov.uk> Veterinary Medicines Directorate

## Unit 321

## Pig production

<b>UAN:</b>	H/507/6863
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

This unit aims to provide learners with an understanding of the principles of pig production and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into employment in the agriculture sector or into further or higher education.

The aim of this unit is to develop learners understanding of pig production systems coupled with the husbandry and managerial skills needed to work in the pig sector.

### Learning outcomes:

In this unit, learners will be able to

1. understand major pig production systems
2. understand the management of the breeding pig
3. understand the management of the growing pig
4. perform relevant pig husbandry activities.

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

## Learning outcome:

### 1. Understand major pig production systems

## Topics

### 1.1 Pig production systems

### 1.2 Factors determining the choice of system

#### Topic 1.1

Learners will understand

- indoor pig production systems: straw based and slatted, types of housing, space requirements
- outdoor pig production systems, layouts, arcs, suitable soil types, space requirements, topography
- purpose of systems (eg breeding unit, weaner production, fatterer units)
- methods of waste disposal
- productivity

in order to compare the major pig production systems including intensive and extensive.

#### Topic 1.2

Learners will understand the factors that determine the choice of each system including

- accommodation: land availability and soil type, pig housing availability, suitability of pig housing, construction materials, ventilation, heating, lighting, dimensions, stocking density
- location: weather, exposure, accessibility, topography, proximity to markets, transport routes
- markets: opportunity for niche market, availability of buyers, supply requirements
- environmental: waste management systems, proximity to population dwellings, proximity to water courses,
- impact of environmental legislation:  
Environmental Protection Act 1990,  
Waste Management (England and Wales) Regulations 2006,  
Environmental Impact Assessment (Agriculture) (England) Regulations 2006
- resources: investment capital, labour, feedstuffs, machinery.

## Learning outcome:

### 2. Understand the management of the breeding pig

## Topics

### 2.1 Husbandry of breeding pigs

### 2.2 Problems associated with breeding pigs

### 2.3 Factors influencing sow productivity

#### Topic 2.1

Learners will understand the husbandry of breeding pigs, including:

- nutrition and feeding
- feed types
- frequency of feeding
- ration formulation
- health checks
- preventative care
- maintaining health
- cleaning accommodation
- accommodation maintenance
- service management, pregnancy diagnosis,
- gilt management
- care based on 'five animal needs'.

### Topic 2.2

Learners will understand

- sow condition after weaning
- infertility
- boar performance
- farrowing problems
- age
- other general health problems

in order to discuss the common problems associated with breeding pigs.

### Topic 2.3

Learners will understand factors that determine sow productivity:

- factors: breed, age, condition, service management (including heat detection, timings of service, frequency, use of boar or artificial insemination)
- productivity: number of litters born per year, number of live piglets born per litter, number of piglets born per litter, weaning age.

## Learning outcome:

### 3. Understand the management of the growing pig

#### Topics

- 3.1 Husbandry of the growing pig
- 3.2 Problems associated with growing pigs
- 3.3 Factors influencing the growth of pigs

Pigs being kept for meat production (pork, bacon, cutters), from birth to sale as weaners, and from birth to finishing.

### Topic 3.1

Learners will understand the husbandry of growing pigs, including:

- nutrition and feeding

- feed types
- frequency of feeding
- ration formulation
- health checks
- preventative care
- maintaining health (for example iron injections, observing for signs of disease and treating accordingly)
- housing
- care at different life stages
- movement
- routine stock care tasks (for example teeth clipping, weighing)
- care based on 'five animal needs'.

### Topic 3.2

Learners will understand:

- piglet mortality
- disease
- behaviour problems (eg tail biting, aggression)
- growth rate problems

in order to discuss the common problems associated with growing pigs.

### Topic 3.3

Learners will understand factors that influence the growth of pigs including:

- accommodation
- location
- markets
- environmental
- available resources
- breed
- feeding regime
- housing
- health
- welfare
- management.

## Learning outcome:

### 4. Perform relevant pig husbandry activities

#### Topics

- 4.1 Care and associated stock tasks
- 4.2 Plan a layout for a pig unit from given information
- 4.3 Analyse selected physical and financial records to assess performance of a pig herd

### Topic 4.1

Learners will carry out routine care and associated stock tasks according to codes of practice and legislation, including

- routine care: feeding, watering, waste disposal, movement, record keeping (eg of medication, feed, date of movement, service dates, farrowing data)
- Stock tasks: teeth clipping, tail docking, injecting, weighing, moving, handling

- codes of practice and legislation: relevant legislation and codes of practice eg Health and Safety at Work Act 1974; Farm Animal Welfare Council Five Needs; Welfare of Farmed Animals Regulations 2007; Veterinary Medicines Regulations; Defra Code of Recommendations for the Welfare of Animals: Pigs 2005.

#### **Topic 4.2**

Learners will plan a layout for a pig unit from given information, including indoor/outdoor pig housing for different age groupings, boar pens, service area, location of feed bins, waste disposal systems, isolation pens, access for transport.

#### **Topic 4.3**

Learners will analyse selected physical and financial records to assess performance of a pig herd, including: growth rates, sow productivity, food conversion ratio, financial records including gross margin analysis.

### **Guidance for delivery**

This unit will provide learners with an understanding of pig production, including a study of the different pig production systems in operation. It also enables learners to develop some practical skills in routine care and stock tasks for pigs.

As learners will be engaged in practical activities, safe working practices should be emphasised, including the use of appropriate personal protective equipment (PPE). Appropriate risk assessments should be undertaken and at Level 3 it is expected that learners will take an active part in completing risk assessments, so that this becomes an integral part of all practical activity.

Delivery of this unit will include practical tasks and visits to pig units housing growing and breeding pigs in extensive and intensive systems. Learners would also benefit from time spent at an appropriate work placement.

Visits to different pig units will help learners to achieve Learning outcome 1, as will discussion with those currently managing units. It will be particularly useful for learners to gain a clear understanding of the soil, climate and topography requirements of an outdoor unit, which may be through first hand experience or appropriate class based activity and research.

It is anticipated that a range of delivery techniques will be used to address Learning outcome 2, which covers the husbandry and management of the breeding pig. These may include practical demonstrations, lectures, supervised pig handling practical sessions and appropriate farm visits.

Delivery of Learning outcome 3, which focuses on the husbandry and management of the growing pig, should include the opportunity for learners to practise a range of husbandry tasks as well as more formal input.

Learning about the practicalities of pig unit management to achieve outcome 4 will include practical stock tasks. Sufficient delivery time is required to ensure learners develop appropriate confidence and ability. A range of stock tasks and routine care duties should be practised, including those required for adult and younger pigs.

Learners are also asked to plan a basic layout for a pig unit based on information supplied by the tutor, and to analyse physical and financial records. Where live records are not available, realistic case study

material should be used. Analysis will be carried out relative to appropriate industry standards. A particular emphasis on health and safety is required for Learning outcome 4, which could also be developed in conjunction with learners' work experience at an appropriate placement.

### Suggested learning resources

#### Books

- Farm Management Pocketbook 2015  
Agro Business Consultants Ltd. 2014  
ISBN: 978-0957693913  
Nix J.
- The Agricultural Notebook, 20th Edition  
Wiley-Blackwell, 2003  
ISBN: 978-0632058297  
Soffe, R.
- The Growing and Finishing Pig: Improving Efficiency  
Published by: Farming Press, 1988  
ISBN-10: 0852361386  
ISBN-13: 978-0852361382  
English, P
- Recent Developments in Pig Nutrition: No 3  
Publisher: Nottingham University Press (14 Feb. 2001)  
ISBN-10: 1897676441  
ISBN-13: 978-1897676448  
Garnsworthy, P & Wiseman, J
- Practical Pig Keeping.  
Publisher: The Crowood Press Ltd (26 Feb. 2001)  
ISBN-10: 1861263880  
ISBN-13: 978-1861263889  
Smith, P.
- Managing Pig Health  
Publisher: 5M Enterprises; 2nd Revised edition edition (8 Oct. 2013)  
ISBN-10: 0955501156  
ISBN-13: 978-0955501159  
Muirhead, M & Alexander, T.
- Pig Diseases, 8th Edition  
Publisher: CABI Publishing; 1 edition (28 Oct. 2014)  
ISBN-10: 1780642121  
ISBN-13: 978-1780642123  
McOrist S.

#### Websites

- <http://www.dardni.gov.uk> Department of Agriculture and Rural Development (NI)
- <http://www.wales.gov.uk> Welsh Assembly Government
- <http://www.scotland.gov.uk> Scottish Executive Environment and Rural Affairs Department
- <http://www.defra.gov.uk> Department for Environment, Food and Rural Affairs

- <http://www.pork.ahdb.org.uk> AHDB
- <http://www.rpa.gov.uk> Rural Payments Agency
- <http://www.fwi.co.uk/> Farmers Weekly Interactive
- [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/388494/Soil\\_protection\\_standards\\_2015.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/388494/Soil_protection_standards_2015.pdf)
- Cross Compliance in England, soil protection standards
- Defra- Pig Welfare Codes <https://www.gov.uk/pig-welfare-regulations>
- <http://assurance.redtractor.org.uk/rtassurance/schemes.eb> Red Tractor Assurance scheme
- Pig site <http://www.thepigsite.com/>

## Unit 322

## Poultry production

<b>UAN:</b>	K/507/6864
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

This unit aims to provide learners with an understanding of the principles of poultry production and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into employment in the agriculture sector or into further or higher education.

Upon completion of this unit learners will have developed skills and knowledge of monitoring and caring for poultry in different systems of production.

### Learning outcomes:

In this unit, learners will be able to

1. know the requirements of the main commercial poultry systems
2. understand husbandry requirements for different systems of poultry production
3. carry out routine poultry husbandry procedures
4. evaluate poultry production performance

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

### Poultry

Chickens, turkeys, ducks, geese.

### Commercial poultry systems

Intensive/cages, barns, deep litter, semi intensive, extensive/free range, mobile arks.

## Learning outcome:

### 1. Know the requirements of the main commercial poultry systems

#### Topics

- 1.1 Commercial poultry systems
- 1.2 Factors that determine the choice of poultry system
- 1.3 Accommodation requirements

#### Topic 1.1

Learners will know the major commercial poultry systems: intensive, semi-intensive, extensive.

#### Topic 1.2

Learners will know the factors that determine the choice of each system, including housing, feeding, disease control, predators, costs, labour, welfare, resource and capital availability, market influence.

#### Topic 1.3

Learners will know different accommodation requirements for the major commercial poultry, including:

- stocking density
- protection/shelter
- ventilation
- feed and water
- temperature
- lighting
- litter
- cleaning requirements
- egg handling systems
- current relevant legislation and restrictions relating to poultry accommodation.

## Learning outcome:

### 2. Understand husbandry requirements for different systems of poultry production

#### Topics

- 2.1 Husbandry requirements
- 2.2 Common problems associated with poultry in production systems

### **Topic 2.1**

Learners will understand husbandry requirements including

- codes of practice
- “five animal needs”
- inspection
- lighting
- basic litter management
- feeding and watering methods
- health care and checking
- manual/automatic systems.

### **Topic 2.2**

Learners will understand common problems associated with poultry in production systems, including:

- disease/illness
- competition between birds
- cannibalism
- feather pecking
- injury
- poor production
- access to feed and water,
- stress
- poor design
- vermin.

## **Learning outcome:**

### **3. Carry out routine poultry husbandry procedures**

#### **Topics**

- 3.1 Stock tasks
- 3.2 Accommodation
- 3.3 Routine care
- 3.4 Environmental conditions

### **Poultry**

eg broilers, breeders, commercial layers, turkey breeders, turkey growers, duck breeders, growing ducklings, geese.

#### **Topic 3.1**

Learners will carry out stock tasks associated with poultry production, including:

- inspection
- health checks
- basic litter management
- providing food and water.

#### **Topic 3.2**

Learners will prepare accommodation for poultry, including

- assessing, setting or adjusting ventilation, temperature and lighting
- cleaning and replenishing bedding
- preparing feeders and drinkers
- establishing biosecurity
- keeping records.

### Topic 3.3

Learners will carry out routine care of stock, including:

- feeding
- watering
- basic litter management
- health checking
- controlling the environment
- waste disposal
- culling,
- inspection, recording.

### Topic 3.4

Learners will maintain environmental conditions for given systems, including

- ventilation
- temperature
- lighting.

## Learning outcome:

### 4. Evaluate poultry production performance

#### Topics

4.1 Performance measures and records

4.2 Physical and financial record analysis

### Topic 4.1

Learners will measure and record poultry production performance including count and calculate egg production, record feed consumption, calculate live weight gain and food conversion ratio, record sales prices (eggs, table birds).

### Topic 4.2

Learners will analyse selected physical and financial records to assess performance of a poultry system, including

- aspects of performance including bodyweight, variation, egg numbers, egg weight, egg mass, egg quality, mortality, food conversion rate (FCR), fertility, hatchability, bird housed, bird day, mortality.
- financial records, including gross margin, housing costs, labour costs, compared with national averages
- physical records including sales, stock numbers, health events.
- legally required records including regulatory compliance records, contracts

These records could be computerised, manual, graphs or charts

### **Guidance for delivery**

This unit will develop learners' knowledge of and skills in monitoring and caring for poultry in different systems of production.

The delivery of this unit should use as wide a range of techniques as possible. These could include lectures, discussions, seminar presentations, supervised poultry practicals, site visits, work placements, and internet and/or library-based research. Delivery of this unit could be enhanced by the use of case studies and talks from commercial poultry farmers.

It is important that any practical sessions are planned and delivered in line with commercial requirements, pressures and constraints; Health and Safety requirements; and current legislation and welfare guidelines. The welfare of the animals is paramount. This must be regularly reinforced and the learners' confidence and use of correct techniques in relation to animal welfare should be ensured prior to assessment (wherever possible) in an environment reflective of the commercial poultry sector. Tutors and learners should comply with biosecurity requirements of any farms being visited. The tutor should be mindful, particularly in intensive poultry production, that management of the controlled environment is critical.

For the purposes of Learning outcome 1, learners will be required to cover all types of systems.

Delivery of Learning outcome 2 will be mainly through formal lectures and guided study although visits to different commercial poultry production establishments would enhance learners' experience.

Learning outcome 3, which requires the learner to carry out practical routine poultry husbandry procedures, is very practical. Learners should be given opportunities to carry out tasks in a supervised in a commercial environment.

Learning outcome 4 requires the learner to understand production performance. The practical experience learners will have gained in commercial environments will enable them to understand the importance of accuracy when measuring, recording and analysing such records. Delivery of the outcome will need to support learners' understanding of how to interpret data and the impact that this has on the commercial poultry production environment and profitability.

## Suggested learning resources

### Books

- Nahm, KH & BA. 2004. *Poultry Production and Waste Management*. Yu Han Publishing ISBN 978-897726234
- Leeson, S. & Summers, J .D. 2009. *Broiler Breeder Production*. Nottingham University Press, ISBN 978-1904761792
- Taylor-Pickard, J.A. and Spring, P. 2007. *Gaining the edge in Pork and Poultry Production: Enhancing Efficiency, Quality and safety*.(Wageningen Academic, ISBN 978-9086860180
- Theer , K. 1977. *Incubation- A Guide to hatching & rearing*. Broad Leys Pub 3rd edition, ISBN 978-0906137253
- Ekarius, C. 2007. *Storey's Illustrated Guide to Poultry Breeds*. Storey Books, ISBN 978-1580176675
2009. *Breeding Poultry for Egg Production (1911)*. Kessinger Publishing, ISBN 978-1104626358
2009. *The Joy of keeping Chickens: The Ultimate Guide to Raising Poultry for Fun or Profit*. Skyhorse Publishing, ISBN 978-1602393134
- Scrivener, D. 2008. *Poultry Breeds & Management: An Introductory Guide*. Crowood Press, ISBN 978-1861269942
- Fowls for Profit. 2006. *A Practical Treatise of Poultry Farming for Smallholders, Including a Selection of the Best Breeds of Fowl for Egg Production... Their Management, Feeding and Ailments*. Read Country Books, ISBN 978-1905124497
- Bussom, F. 2009. *Mini Encyclopaedia of chicken Breeds and Care*. Interpet publishing, ISBN 978-1842862124
1993. *Poultry: A Guide to Management*. The Crowood Press 2nd revised edition, ISBN 978-1852237554
- Gillespie, J. 2009. *Modern Livestock and Poultry production*. Delmar Publishing 8th edition, ISBN 978-1428318083
- Feltwell, R. 1992. *Small-scale Poultry Keeping: A Guide to Free Range Poultry Production*. Faber & Faber 2nd revised edition, ISBN 978-0571166992
- Cole, L. 2001. *Teamwork in Poultry Production: Improving Grower Employee Interpersonal Skills* WileyBlackwell Publishing, ISBN 978-0813804125
- Fisher, C. Gous, R.M. & Morris, T.R. 2006. *Mechanistic Modelling in Pig & Poultry Production*. CAB publishing, ISBN 978-1845930707
- Taylor- Pickard, J.A. & Spring, P. 2008 *Gut Efficiency- the Key Ingredient in Pig and Poultry Production: Elevating Animal Performance & Health*. Wageningen Academic
- Swan, S.E.J. & Sonaiya, E. 2007. *Small Scale Poultry Production: Technical Guide*. Daya Publishing, ISBN 978-8170355021

### Websites

- <http://www.defra.gov.uk> Department for Environment, Food and Rural Affairs
- <http://www.wales.gov.uk> Welsh Assembly Government
- <http://www.scotland.gov.uk> Scottish Executive Environment and Rural Affairs Department
- <http://www.dardni.gov.uk> Department of Agriculture and Rural Affairs (Northern Ireland)
- <http://www.bvpa.org> BVPA
- <http://www.eggsinfo.co.uk>

## Unit 323

## Sheep production

<b>UAN:</b>	M/507/6865
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

This unit aims to provide learners with an understanding of the principles of sheep production and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into employment in the agriculture sector or into further or higher education.

This unit enables learners to relate sheep husbandry and management skills to flock management. It also applies information on nutrition, welfare and marketing in a practical situation.

### Learning outcomes:

In this unit, learners will be able to

1. understand common sheep production and marketing systems
2. manage the ewe from weaning to lambing
3. manage the ewe and lambs from lambing to weaning
4. understand the management and profitability of finishing store lambs

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

## Learning outcome:

### 1. Understand common sheep production and marketing systems

## Topics

- 1.1 Stratification system of the UK sheep industry
- 1.2 Sheep breeds and their suitability for different production systems
- 1.3 Market requirements for common sheep production systems
- 1.4 Marketing opportunities for common sheep production systems

### Topic 1.1

Learners will explain the stratification system of the UK sheep industry in terms of local breeds and production systems:

- Definition of stratification system
- interdependence of cross-breeding programme
- sale of draft ewes from hills to uplands
- sale of crossbred lambs to lowlands for finishing
- cross breeding and hybrid vigour

### Topic 1.2

The learners will compare the main sheep breeds and their suitability for different production systems:

Main sheep breeds:

- Hill breeds (for example Scottish Blackface, Swaledale, Welsh Mountain)
- Upland breeds (for example Clun, North Country)
- Longwools (for example Blue-faced Leicester, Border Leicester)
- Lowland breeds (for example Suffolk, Texel, Hampshire Down Lleyn)
- Crossbreeds (for example Mule, Masham, Scottish Halfbred)

Suitability for different production systems:

- Hardiness
- milking and mothering ability
- fertility
- growth rate
- carcass quality

### Topic 1.3

Learners will describe market requirements for common sheep production systems:

Market criteria:

- for weight
- conformation and breed type
- age

- outline the shepherds year for an early
- spring
- late lambing flock

#### **Topic 1.4**

Learners will describe the marketing opportunities for common sheep production systems:

- Marketing options for finished lambs
- store lambs
- breeding stock
- draft ewes
- ewes for crossing with terminal sire breeds
- pedigree breeding stock
- timing of sales and impact on price and marketability
- gross margin
- carcass classification

### **Learning outcome:**

#### **2. Manage the ewe from weaning to lambing**

#### **Topics**

- 2.1 Preparation of the flock for tugging and lambing
- 2.2 Carry out lambing
- 2.3 Control/prevention of common sheep diseases and disorders

#### **Topic 2.1**

Learners will prepare the flock for tugging and lambing.

##### **Preparation of the flock for tugging**

Culling, condition scoring. routine tasks ,feeding the ewe, ewe to tup ratios ,teaser rams, raddling, methods of oestrus synchronisation

##### **Prepare a flock for lambing**

Scanning, preparation for accommodation, feeding of ewe for each month of pregnancy, acceptable change of weight and condition score during pregnancy, organisation of flock at lambing

#### **Topic 2.2**

Learners will carry out lambing:

- signs of lambing
- normal and abnormal presentations
- equipment required and initial care of ewes and lambs
- care of new born lamb
- colostrum
- navel treatment castration
- stomach tube
- hypothermia
- record keeping

### Topic 2.3

Learners will explain the control and prevention of sheep diseases and disorders:

- management factors
- treatment programmes
- administration of treatments
- completing medicine records
- construction of a health plan for the flock
- disposal of waste
- safe storage of medicine
- Twin lamb disease
- Lameness
- internal and external parasites including taking worm counts
- respiratory infections
- clostridial diseases
- abortion
- lamb diseases

### Learning outcome:

#### 3. Manage the ewe and lambs from lambing to weaning

### Topics

- 3.1 Feeding of the ewe and lamb
- 3.2 Health and husbandry of ewes and lambs
- 3.3 Grassland management for a flock of ewes and lambs planning

### Topic 3.1

Learners will know how to feed the ewe and lambs flock:

- evaluate types and utilisation of feeds
- feeding programme
- lactation curve and significance feeding after lambing until grass growth is adequate
- management during grazing season
- potential stocking rates and nitrogen use
- different grazing systems merits and problems

### Topic 3.2

Learners will undertake health and husbandry of ewes and lambs eg:

- common internal and external parasites
- treatment and prevention
- worming programmes
- dagging
- dippings
- shearing
- weaning of lambs
- when to wean in different situations

### Topic 3.3

Learners will plan grassland management for a flock of ewes and lambs:

- Requirements for conservation and grazing
- matching grass growth curve to flock demands
- requirements for conserved winter forage and method of providing it
- managing grazing areas throughout the grazing season.

### Learning outcome:

#### 4. Understand the management and profitability of finishing store lambs

### Topics

4.1 Describe store lamb production methods

4.2 Outline economics of store lamb finishing

4.3 Select lambs for market

### Topic 4.1

Learners will know store lamb production methods:

- Breeds
- length of production system
- Foods and feeding
- Housing
- grass catch crops
- arable by products
- root crops and other forage crops
- ad lib cereals.

### Topic 4.2

Learners will understand economics of store lamb finishing:

- importance of buying price and mortality
- gross margin and feeders margin for each system
- factors affecting lamb selling price

### Topic 4.3

Learners will select lambs for slaughter/market:

- select finished and store,
- on weight, lambs fat cover,
- conformation and target market.

Have an understanding of current relevant livestock legislation including tagging and transport of livestock, completion of movement records and market data analysis

## Guidance for delivery

This unit is designed to provide the learner with sound knowledge and skills required to manage a sheep enterprise. This unit gives tutors scope to focus on sheep management systems found in the locality.

Throughout the unit, the emphasis should be on health and safety. It is expected that learners will know safe working practices, environmental issues and accepted practices and behaviours within the context in which they are working. Potential risks are minimised by considering relevant health and safety issues and welfare codes of practice when undertaking practical and managerial tasks.

In Learning outcome 1 learners will be required to consider the types of sheep flock found on farms in the British Isles, and see how different breeding systems have been used. They will be involved in comparing breeds and breed crosses, their role in the local industry, and the role each breed/breed cross has in meeting market requirements. It will be important for learners to understand the climate and other environmental factors that have contributed to the evolution of the interdependent system of sales and cross breeding between hills, upland and lowland sheep flocks. As most learners will only have the opportunity to visit one type of production system in their locality, it would be helpful if delivery could be supplemented by DVD and video footage of alternative UK systems.

Learning outcome 2 covers the selection of breeding stock and how a flock is prepared for breeding. This entails considering the managerial activities that are involved in preparing a flock for tupping and practicing the skills associated with these activities. Learners will also be involved in caring for ewes and lambs at lambing time.

In Learning outcome 3 learners will look at the nutrition of the flock throughout the year, the role of grass in flock nutrition and the role of supplements at times of peak demand. This will entail investigating the nutritional content of common feedstuffs and how these can be used to meet the needs of ewes and lambs.

This unit aims to develop the learner's knowledge and skills in flock husbandry and management. Learners will follow the production cycle from pre tupping, through lambing to weaning and sale of lambs. Emphasis needs to be placed not only on 'doing' but also in the importance of being involved in managerial decisions. It is also important that the learner understands current legislation and Codes of Practice in relation to animal health and welfare, health and safety and transport of livestock.

Centres are encouraged to introduce employers and specific professionals from industry to provide interesting and relevant information to the learner. It is accepted that formal lectures will be necessary at Level 3, but for this unit it is recommended that they are linked directly with interactive lessons in the working environment. Learners must be given the opportunity to see and work with a range of types of sheep flock that reflects current industry practice in the locality.

## Suggested learning resources

### Books

The Modern Shepherd  
Published by: Farming Press, 2002  
ISBN 0852361882

Brown, D; & Meadowcroft, S

Practical Sheep Keeping

Cardell, K

Published by: The Crowood Press Ltd; 1998  
ISBN: 978-1847973399

Planned Sheep Production  
Published by: Wiley-Blackwell, 1993  
ISBN 978-0632035762

Croston, D; & Pollock G

The Veterinary Book for Sheep Farmers  
Published by: Old Pond Publishing, 1990  
ISBN-10: 1903366305  
ISBN-13: 978-1903366301

Henderson, D

Manual of lambing techniques  
Published by: Crowood Press, 2003  
ISBN 9781861265746

Winter, A; & Hill, C.

Farm Management Pocketbook 2015  
Published by: Agro Business Consultants Ltd. 2014  
ISBN: 978-0957693913

Nix, J

The Agricultural Notebook, 20th Edition  
Published by: Wiley-Blackwell, 2003  
ISBN: 978-0632058297

Soffe, R.

### **Journals**

- Sheep farmer
- Farmers Guardian
- Farmers weekly
- The Scottish farmer

### **Websites**

- National Sheep Association <http://www.nationalsheep.org.uk>
- The ELBEX Better returns programme <http://www.eblex.org.uk/returns/>
- The Moredun group <http://www.moredun.org.uk>
- Teagasc <http://www.teagasc.ie/>
- Defra Welfare code sheep  
<http://archive.defra.gov.uk/foodfarm/farmanimal/welfare/onfarm/documents/sheep.pdf>
- Defra Sheep health and disease <https://www.gov.uk/monitoring-prevention-and-control-of-disease-in-sheep-and-goats>
- Farmers Weekly interactive <http://www.fwi.co.uk/>

## Unit 324

## Mechanised agricultural crop handling and storage

<b>UAN:</b>	T/507/6866
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

This unit aims to provide learners with an understanding of the principles of mechanised agricultural crop handling and storage and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into employment in the agriculture sector or into further or higher education.

The correct handling and storage of crops is key requirement to maintain product quality and has become increasingly important, particularly with food safety requirements and traceability within the food chain. Learners will develop their knowledge and understanding of the efficient handling, conditioning, storage, weighing and grading of a range of agricultural crops, including combinable crops, forage crops, field vegetables, potatoes and sugar beet.

### Learning outcomes:

In this unit, learners will be able to

1. understand processes and systems used to maintain combinable crop seeds in store
2. understand processes and systems used to maintain harvested root crops in store
3. understand processes and systems used to maintain soft fruit, field vegetable or forage crops in store
4. use machinery and equipment for handling, cleaning, grading and weighing crops

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

### Learning outcome:

1. Understand processes and systems used to maintain combinable crop seeds in store

### Topics

- 1.1 Combinable crop drying and storage systems
- 1.2 Factors that define appropriate storage conditions for combinable crops
- 1.3 How storage systems/dryer designs are influenced by the quality requirements of combinable crops in storage

#### Combinable crops

eg wheat, barley, oats, beans, peas, oilseed rape.

#### Topic 1.1

Learners will understand combinable crop drying and storage systems:

eg permanent, portable direct heating systems, continuous flow, batch, ventilated bin and on-floor dryers, on-floor and ventilated bins, cooperative stores.

#### Topic 1.2

Learners will understand the parameters that define appropriate storage conditions for combinable crops, eg:

- the effect that current relevant legislation and assurance schemes have on storage systems
- crop properties and the influence of local climatic conditions
- cleanliness in terms of dust, mildew, contaminants (oil, grease, spillage)
- moisture content into store and market requirements
- pest control: rodents, insects, birds.

#### Topic 1.3

Learners will understand how storage systems/dryer designs are influenced by the quality requirements of combinable crops in storage, eg:

- storage systems/dryer designs: dryer capacity; continuous air flow capacity; volume to be stored; end use of crop (eg seed, feed, malt, industrial); fuels and heat sources; cost; monitoring and control instrumentation
- quality requirements: moisture content; cleanliness; lack of contamination; nutrient content, processor and/or market requirements.

### Learning outcome:

2. Understand processes and systems used to maintain harvested root crops in store

### Topics

- 2.1 Root crop storage systems
- 2.2 Factors that define appropriate storage conditions for root crops
- 2.3 Criteria used to select appropriate storage methods for root crops

## **Root crops**

eg potatoes, carrots, parsnips, onions, sugar beet, swedes and turnips.

### **Topic 2.1**

Learners will understand root crop storage systems:

In-field clamps, indoor storage (eg bulk, boxed, ventilated, chilled).

### **Topic 2.2**

Learners will understand factors that define appropriate storage conditions for root crops:

eg cleanliness, moisture content, temperature, air movement, use of chemicals.

### **Topic 2.3**

Learners will understand criteria used to select appropriate storage methods for root crops:

eg length of storage time, future use of stored crop, local climate, pest and disease control, quantity of crop to be stored, costs, site management limitations.

Learners will also understand the importance of meeting processors' requirements.

## **Learning outcome:**

### **3. Understand the processes and systems used to maintain soft fruit, field vegetable or forage crops in store**

#### **Topics**

- 3.1 Processes involved in the storage of selected field scale vegetables, soft fruit or forage crops
- 3.2 Minimising the deterioration and maintaining the quality of field scale vegetables, soft fruit or forage crops in store

**Soft fruit:** Strawberries and raspberries.

**Vegetables:** Lettuce, cabbage, peas, cauliflower, broccoli, potatoes, carrots, parsnips, onions, beet.

**Forage crops:** Hay, silage, haylage and treated whole crop cereals.

### **Topic 3.1**

Learners will understand

- chilling
- refrigeration
- controlled atmosphere
- acidification

in order to explain the processes involved in the storage of selected field scale vegetables, soft fruit or forage crops.

### **Topic 3.2**

Learners will understand:

- time management of perishable crops
- storage area preparation and design: decontamination and cleaning, minimising risk of contamination, bulk and container storage, cooling systems
- crop health: removal of diseased, damaged, oversize and undersize crop, removal of green waste, soil, stones and debris, pest and disease control, removal of field heat (crop temperature reduction)

- crop treatment into and in store: chemical, air, temperature and environmental control
- the importance of meeting processor/market requirements

in order to discuss minimising the risk of deterioration and maintaining the quality of field scale vegetables, soft fruit or forage crops in store.

### Learning outcome:

#### 4. Use machinery and equipment for handling, cleaning, grading and weighing crops

#### Topics

4.1 Selection of equipment for handling, cleaning, grading and weighing selected crops

4.2 Use equipment for handling, cleaning, grading and weighing selected crops safely

#### Selected crops

A minimum of one of the following categories of crop: soft fruit, vegetables, forage crops or cereals.

#### Equipment

Both moveable equipment such as forklifts and tractors and fixed equipment such as grading, cleaning and sorting lines.

#### Topic 4.1

Learners will describe the selection and use of equipment for handling, cleaning, grading and weighing selected crops:

eg cost, crop volume and size, relation to rate of harvesting, final use of crop, length of time in store, system design, equipment compatibility, local climatic conditions

#### Topic 4.2

Learners will operate appropriate equipment for handling, cleaning, grading and weighing selected crops, eg-in accordance with current codes of practice and legislation

- pre-operation: controls, pre-start checks, health and safety requirements, safe start and stop procedures, power take off (PTO) guards, fitness for purpose
- in operation: appropriate attachment for machine, controls, adjustments, safe working with machine and attachments, fitness for working environment, use of codes of practice and manufacturers' instructions
- handling: material handlers, tractors, trailers, boxes, augers, conveyors, elevators, chopper blowers, box fillers
- cleaning, grading and weighing: riddles, washers, brushes, sizers, weighing machines, bagging and packaging systems.

### **Guidance for delivery**

This unit will give learners a broad knowledge of handling and storage requirements for a range of crops and experience of using related equipment.

It is unlikely that either centres or single enterprises will have the range of facilities covered by this unit. It is essential therefore that delivery of this unit is supported by visits, videos and online resources to ensure that the range is covered. Some of the learning may best be acquired via research assignments. It is important that as much of this unit as possible is delivered in a real practical environment.

Centres are encouraged to introduce employers and specific professionals from industry to learners, in order that they can provide specialist and relevant information.

In the delivery of Learning outcome 2, emphasis should be placed on potatoes, as this is the most significant crop stored; however, other crops should be mentioned. The need to maintain the clean, healthy condition of crops into store to ensure good store life should also be emphasised.

A wide range of crops are covered by Learning outcome 3. Either crops for human consumption or forage crops could be selected. The storage of soft fruit in particular, but also of vegetable crops, can be specialist and expensive, and not all centres will have a sufficient range of equipment to support the delivery of this outcome. Visits to suitable farms or pack-houses will greatly enhance delivery.

The delivery of Learning outcome 4 must emphasise safe operation of equipment; selection of suitable clothing and, where appropriate, personal protective equipment (PPE); and safe working practices.

## Suggested learning resources

### Books

- Anon. 2011. The Grain Store Guide. 3rd Edition. Home Grown Cereals Authority
- Balls R., 1985. Horticultural Engineering Technology: Field Machinery (Science in Horticulture Series). Palgrave MacMillan. ISBN 0333364341
- Bell B. 2005. Farm Machinery. 5th Edition. Old Pond Publishing. ISBN 1903366682
- Booder D., Bakker-Arkema F. & Hall C., 1992. Drying and Storage of Grains and Oilseed. Springer. ISBN 0442205155
- Chaney K., 2007. Integrated Farm Management and Sustainable Systems. Wiley Blackwell. ISBN 0632064234
- Finch H.J.S., Samuel A. and Lane G.P. 2014. Lockhart and Wiseman's Crop Husbandry Including Grassland 9th Edition. Woodhead Publishing. ISBN 1782423710
- National Institute for Research in Dairying, 1982. Silage for Milk Production. National Institute for research in Dairying. ISBN 070840166X
- Redman G. 2014. The John Nix Farm Management Pocketbook. 44th Edition. Agro Business Consultants. ISBN 0957693907
- Soffe R. 2003. The Agricultural Notebook. 20th Edition. ISBN 0632058293
- Srivastava A.K. , Goering C.E, Rohrbach R.P. and Buckmaster D.R. 2005. Engineering Principles of Agricultural Machines. 2nd Edition. American Society of Agricultural Engineers. ISBN 1892769506
- Witney B., 1995. Choosing and Using Farm Machines. Land Technology. ISBN 0952559609

### Journals

- Arable Farming
- British Sugar Review
- Crop Production Magazine
- Crops Magazine
- Farmers Weekly
- Landwards
- Organic Farming
- Power farming
- The Furrow

### Websites

- British Potato Council <http://www.potato.org.uk>
- British Sugar <http://www.bsonline.co.uk>
- Environment Agency <http://www.environment-agency.gov.uk>
- Health and Safety Executive <http://www.hse.gov.uk>
- Home Grown Cereals Authority <http://www.cereals.ahdb.org.uk>

## Unit 325

# Exploring improvements, opportunities for diversification and new business initiatives within the Land Based sector

<b>UAN:</b>	K/507/6878
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

This unit aims to provide learners with an understanding of the principles of business planning and improvement in the land-based industries and how these can be put into practice.

The learner will explore business improvement, including opportunities for diversification, how it can give a competitive advantage and reduce environmental impact. They will learn the skills necessary for developing a business idea, and preparing a business plan.

### Learning outcomes

In this unit, learners will be able to

1. understand business improvement in land-based industries
2. plan opportunities for practical business improvement
3. produce business plans.

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

## Learning outcome:

### 1. Understand business improvement in land-based industries

## Topics

- 1.1 Strategies a land-based business can adopt to improve performance
- 1.2 How land-based business can achieve competitive advantage
- 1.3 How a land-based business can improve its environmental impact

In this outcome, learners will investigate how business improvement should be sought in all of the key functional areas. They will discover that a sound business strategy derives from an understanding of current strengths, weaknesses, opportunities and threats and provides a focus for future improvements and development. They will also learn about the importance of sustainability and the need for businesses to reduce their environmental impact.

### Topic 1.1

Learners will understand how the following strategies can improve business performance:

- consolidation
- expand market share
- product development
- market development
- diversification
- SWOT analysis

Learners will understand key indicators of improved business performance, to include

- Improved effectiveness and efficiency in key business functional areas eg products, services, marketing, customer relations, staffing, staff management, working practices, production efficiency, financing, financial control
- internal factors eg resources and management
- external factors eg political, economic, socio-cultural and technological

### Topic 1.2

Learners will understand how businesses can achieve a competitive advantage through

- cost of service
- differentiation eg quality, location, customer service and perceived added value
- use of marketing mix eg product, price, place, promotion.

### Topic 1.3

Learners how businesses can improve its environmental impact taking the following into consideration:

- resource use
- waste
- recycling

- pollution ie chemical, biological, visual, audible, light
- road traffic
- carbon footprint
- enhancement of the environment (e.g. preservation or creation of habitats, conservation of structures)
- principles of sustainability
- relevant environmental legislation
  - Wildlife and Countryside Act 1981 (as amended 1991)
  - Environmental Protection Act 1990 (as amended 1995)
  - Control of Substances Hazardous to Health (COSHH) 2002
  - The Control of Pollution Regulations (Oil Storage) (England) Regulations 2001
  - Water Framework Directive (WFD)
  - Cross Compliance, Nitrates Directive, Waste Management (England and Wales) Regulations 2006

### Learning outcome:

## 2. Plan opportunities for practical business improvement

### Topics

2.1 Potential improvements in a business within a land-based context

2.2 Plan for achieving business improvements or diversification within a land-based context

In this outcome, learners will identify specific improvements that could be made in a selected business from some of the key functional areas listed. These improvements could involve opportunities for business diversification, but learners should be cautioned that diversification is often a high risk strategy and opportunities need to be carefully evaluated. Learners will need to prepare a detailed plan for implementation of proposed improvements.

#### Topic 2.1

Learners will explore a selected business and identify improvements, as specified in Topic 1.1.

#### Topic 2.2

Learners will plan for achieving business improvements or diversification taking into account

- specific actions
- rationale
- timescales
- resource implications
- financial implications ie costs, likely returns
- key factors for success and risks
- forward, backward, horizontal diversification
- opportunities in relation to resources, skills and finance needed

## **Learning outcome:**

### **3. Produce business plans**

#### **Topics**

- 3.1 Research the market for a land-based business idea
- 3.2 Develop a land-based business idea
- 3.3 Produce business plans

In this outcome, learners will propose a land-based business plan. This could be based on business improvements or developments identified in outcome 2, a diversification proposal or for a new business start-up.

#### **Topic 3.1**

Learners will carry out market analysis using primary and secondary data, to include

- size
- trends
- competition
- segmentation
- target market

#### **Topic 3.2**

Learners will propose a business development including

- establishment of a new business
- diversification or development of new enterprise
- recommendations for implementation of improvements to an existing business.

#### **Topic 3.3**

Learners will prepare a business plan for business idea developed. The completed business plan should be addressed to a specific audience and include

- business products or services
- aims and objectives
- market analysis ie size, trends, competition, segmentation, target market
- physical resources ie property, machinery, vehicles, equipment and stock
- human resources ie staffing structure, management and key personnel, job descriptions and person specifications
- promotion ie media and cost
- financial forecasts ie setting up costs, pricing, income, costs, profit and monthly cash flow forecast
- finance needs
- sources of finance ie equity, borrowing and grants
- legal issues ie business type, trading terms and conditions, trading standards, licences, relevant current legislation, planning permission, health and safety, fire regulations, regulatory bodies, sources of advice.

### **Guidance for delivery**

This unit allows learners to explore the importance of improvement and planning for future business development. It should be related to the types of business relevant to the learners' vocational area and can include all forms of business. This may be not-for-profit organisation and not restricted to commercial private sector businesses.

Centres are encouraged to introduce employers and specific professionals from industry to provide interesting and relevant information to the learner. Teaching would also benefit from visits to a variety of establishments to add depth to the learner experience.

## Unit 326

## Spreaders and sprayers

<b>UAN:</b>	F/507/6868
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

This unit aims to introduce learners to the skills and knowledge needed for agricultural spreaders and sprayers, and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into employment in the agriculture sector or into further or higher education.

The learner will know the equipment and techniques used to apply agri-chemicals and fertilisers, the routine maintenance and use of sprayers and spreaders, and the legislation that applies to their operation. They will develop practical skills needed to safely operate and maintain sprayers and spreaders. They will also investigate the impact of developments in agricultural application machinery on operator safety, the wider environment and the perception of modern agricultural practices.

### Learning outcomes:

In this unit, learners will be able to

1. know machinery used for the application of pesticides and fertilisers to agricultural crops
2. prepare, operate and maintain spraying and spreading machinery
3. know factors affecting efficiency and accuracy of pesticide and fertiliser placement
4. understand the impact of developments in application technology on operator safety and environmental protection standards

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

## Learning outcome:

### 1. Know machinery used for the application of pesticides and fertilisers to agricultural crops

## Topics

- 1.1 The operation of spraying machinery
- 1.2 The operation of spreading machinery

**Operation:** Power source, mechanical drive, lines, hydraulic circuits, pneumatic systems, electronic control, filtration, application rates.

### Topic 1.1

Learners will know the operation of spraying machinery: Trailed or mounted or self-propelled hydraulic sprayer, weed wiper, knapsack sprayer, controlled droplet application, boom sleeved sprayers, variable geometry booms.

### Topic 1.2

Learners will know the operation of spreading machinery: Fertiliser application: trailed and mounted machines, single/twin spinning disc, oscillating spout, pneumatic discharge.

## Learning outcome:

### 2. Prepare, operate and maintain spraying and spreading machinery

## Topics

- 2.1 Machinery preparation
- 2.2 Machinery operation
- 2.3 Machinery maintenance

### Pesticides application machine

Trailed or mounted or self-propelled hydraulic sprayer, weed wiper, knapsack sprayer, controlled droplet application, boom sleeved sprayers, variable geometry booms.

### Fertiliser application

Trailed and mounted machines, single/twin spinning disc, oscillating spout, pneumatic discharge.

### Materials

Liquids, granules, compounds, powders, FYM, slurry.

### Topic 2.1

Learners will prepare machinery safely, including:

Linked to power sources, linkage/drawbar adjustment, decontamination of previous materials/residue, lubrication, clear filtration, initial calibrations/output settings, mixing/loading, safe operation of controls, wheel and tyre adjustment, personal protective equipment (PPE),

traction/stability aids, ground compaction, leakage/spillage, component security, replacement of worn/damaged components, pre-operation tests.

### **Topic 2.2**

Learner will operate machinery safely, including:

Transport to site, site assessment, method of work, headland margins, working in lands, tramlining, use of marker systems, watercourses, ground conditions, wind/weather conditions, obstacles, public/animal access, load shifting on slopes, safe transport of fertiliser and pesticides, field/site loading of materials, headland work, assessment on machine performance, PPE, operator legislation and certification, warnings to the public, animal exclusion periods, harvest intervals, cleanings/washings, pollution control.

### **Topic 2.3**

Learner will maintain machinery safely, including:

Lubrication, pre-season maintenance, pre-storage maintenance, manufacturers' recommendations, in-season maintenance, scheduling maintenance within work requirements, cleaning, decontamination, recognition of worn parts, replacement parts, PPE, safe waste disposal (containers/bags/boxes/contaminated PPE/replaced components).

## **Learning outcome:**

### **3. Know factors affecting efficiency and accuracy of pesticide and fertiliser placement**

#### **Topics**

3.1 Variables affecting the efficiency and accuracy of pesticide and fertiliser placement

3.2 Impacts of changing variables on efficiency and accuracy of pesticide and fertiliser placement

#### **Topic 3.1**

Learners will know variables affecting the efficiency and accuracy of pesticide and fertiliser placement, including:

- Efficiency and accuracy: suitable product, correct output, over/under lapping, double dosing headlands, loss due to wind drift, evaporation, use of wetters/spreaders/adhesion agents, load cells/re-calibration devices, Global Positioning System (GPS), computerised output monitoring/automatic rate control
- Spreader application: accurate calibrations, material types/quality, material flow characteristics, moisture, disc/spout, boom and deflector condition, balance of spread, wind conditions, ground conditions, forward speed, power input speed, materials flow rate, power unit wheel slip, spreading height
- Sprayer application: accurate calibrations, nozzle types, pressures, pump performance, boom alignment, wind speed, ground conditions, forward speed, power unit wheel slip, boom height, spray quality.

#### **Topic 3.2**

Learners will know how variables affects costs, work rates over/under lapping, decrease in output, increase in output, residual build up in soil, high pesticide/nitrate count in crop product in order to describe the impact of changing these variables

## **Learning outcome:**

### **4. Understand the impact of developments in application technology on operator safety and environmental protection standards**

## Topics

- 4.1 Impacts of developments in application technology on operator safety
- 4.2 Impacts of developments in application technology on environmental protection standards
- 4.3 Legislation relevant to the application of pesticides and fertilisers

**Pesticides application machine:** trailed or mounted or self-propelled hydraulic sprayer, weed wiper, knapsack sprayer, controlled droplet application, boom sleeved sprayers, variable geometry booms.

**Fertiliser application:** trailed and mounted machines, single/twin spinning disc, oscillating spout, pneumatic discharge.

**Materials:** liquids, granules, compounds, powders, FYM, slurry.

### Topics 4.1/4.2

Learners will understand impacts of developments in application technology on operator safety and environmental protection standards:

- Spreaders: PPE recommendations, materials packaging, product labelling/data sheets, machine hitching systems, centre of gravity, calibration systems, variable rate application, GPS, auto steer, headland auto cut off.
- Sprayers/pesticides application: PPE recommendations, materials packaging, product labels, data sheets, waste disposal methods, engineering controls, nozzle designs, self-cleaning filters, tank rinse systems, pesticides measuring and induction systems, auto-fold booms, decontamination systems, rate controllers, automatic boom height adjustment, GPS, auto steer, headland auto cut off, boom cut off technology for short work.
- Operator safety: safe hitching procedures, contamination through ingestion, inhalation, absorption, materials storage systems, safe lifting and operator fatigue.

### Topic 4.3

The following is a comprehensive list of the legislation that applies to environmental protection. For purposes of assessment, there is no requirement for detail, but learners must appreciate that there is legislation and where each applies:

- Local Environment Risk Assessment for Pesticides (LERAP)
- Nitrate Vulnerable Zones (NVZ)
- headland margins/buffer zones,
- Sites of Special Scientific Interest (SSSI)
- chemical storage
- transport of chemicals
- waste management regulations
- Food and Environmental Protection Act 1985 (FEPA)
- Control of Pesticides Regulations 1986 (COPR)
- Health and Safety at Work etc Act 1974
- Control of Substances Hazardous to Health 2002 (COSHH)
- Groundwater Regulations 1998
- Provision and Use of Work Equipment Regulations 1998 (PUWER)
- Plant Protection Product Regulations 2005
- relevant Codes of Practice.



## Guidance for delivery

This unit is designed for the learner who will be applying fertilisers and pesticides to grassland and/crops. It will provide an insight into machine availability and capability; safe working practices and procedures; accuracy of application; and legislations affecting operators, the general public and environment.

Technological advances in chemical application machinery have improved ease of use, operator safety and environmental safety. The learning in this unit, when consolidated, should allow for safe, efficient use of equipment and application of fertiliser and pesticides.

Safe practices will be emphasised throughout the unit. All learners should be competent in the operation of power units prior to carrying out any field, work practice. Equipment used must be in safe, useable condition and decontaminated to minimise the risk of operator contamination. Substitutes for pesticides are to be used when operating sprayers.

During delivery, it should be emphasised that success in this unit will not entitle operators to apply pesticides unless the relevant certification is held.

To meet the requirements of legislation and Chemical Regulatory Directorate (CRD) and to apply pesticides for commercial use, learners are required to achieve PA1 and the appropriate application unit(s) (PA2–PA13) from the Level 2 Award in the Safe Use of Pesticides (QCF) or Level 2 Certificate of Competence in the Safe Use of Pesticides. Achievement of this unit (352 Understand and Use Agricultural spreaders and Sprayers) does not cover the legislative requirements for applying pesticides.

A useful teaching aid for this unit will include the use of visiting speakers. Local employers directly influenced by the application of pesticides could give a valuable perspective of how pesticides are regulated and used.

For the delivery of Learning outcome 1, learners would benefit from practical demonstrations on the use of machinery to apply fertilisers and pesticides to agricultural crops. This outcome could be delivered along with Outcome 2 for the practical demonstrations.

For Learning outcome 1, local employers can be used to explain the need for spraying. Visits to arable farms and guest speakers could be used to highlight the need for pesticide and fertiliser application. Visits to farms that use organic techniques could also be used to balance the arguments for and against the two farming styles.

The delivery of this Learning outcome 2 could benefit from visits to agricultural sites where spreaders and sprayers are being used. Local employers can be used to demonstrate best practice in the preparation, use and maintenance of spreaders and sprayers. Examples of costs and savings through well maintained equipment and maintenance schedules would be useful.

The classroom delivery of Learning outcome 3 could be assisted by discussions, presentations and visits to agricultural sites. Learning outcome 4 could also be delivered in the classroom along with practical demonstrations.

For Learning outcomes 3 and 4, local employers can showcase new and emerging technologies. These can be demonstrated and described using cost analysis and examples of the benefits of accuracy and efficiency with spreaders and sprayers. Local employers can describe the legislation that applies to them and the potential sanctions of not complying. Topics like NRoSO (National Register of Sprayer Operators) points would be of particular interest to the learners.



## Suggested learning resources

### Books

Farm Machinery Culpin, C  
Published by: Blackwell Science, 1992  
ISBN: 0-632-03159-X

Farm Machinery Bell, B  
Published by: Old Pond Publishing, 2005  
ISBN: 978-1903366684

Farm Workshop Bell, B  
Published by: Farming Press Books and Videos, 1992  
ISBN: 978-0852362372

Pesticide Application Methods  
Matthews, G; Bateman, R; Miller, P  
Published by: Wiley-Blackwell, 2014  
ISBN: 978-1118351307

Using Pesticides: A complete guide to Safe, Effective Spraying Riby, H  
Published by: British Crop Protection Council, 1999  
ISBN: 978-1901396010

### Publications

- Defra Codes of practice for LERAP
- NVZ
- Pesticides Application
- Using plant protection products
- Farmers Weekly

### Websites

- Department for Environment, Food and Rural Affairs <http://www.defra.gov.uk>
- Welsh Assembly Government <http://www.wales.gov.uk>
- Scottish Executive Environment and Rural Affairs Dept <http://www.scotland.gov.uk>
- Department of Agriculture and Rural Affairs (NI) <http://www.dardni.gov.uk>
- Environment Agency <http://www.environment-agency.gov.uk>
- City & Guilds <http://www.cityandguilds.com>
- Profi International <http://www.profi.com>
- British Crop Protection Council <http://www.bcp.org>
- Health and Safety Executive <http://www.hse.gov.uk>
- The Voluntary Initiative <http://www.voluntaryinitiative.org.uk>

## Unit 327

## Repair land-based compression-ignition, diesel engines

<b>UAN:</b>	H/507/6989
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

The purpose of this unit is to enable learners to understand and repair land-based compression-ignition, diesel engines. These engines are fitted to a wide and varied range of land-based vehicles and equipment, including tractors.

### Learning outcomes

In this unit, learners will:

1. Understand land-based compression-ignition, diesel engines
2. Test, repair and rebuild a land-based compression-ignition, diesel engine.

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

## Learning outcome:

### 1. Understand land-based compression-ignition, diesel engines

## Topics

- 1.1 The function and working principles of land-based compression-ignition (diesel) engines.
- 1.2 Land-based compression-ignition, diesel engine lubrication systems.
- 1.3 Land-based compression-ignition, diesel engine cooling systems.
- 1.4 Land-based compression-ignition, diesel engine fuel systems.
- 1.5 Land-based compression-ignition, diesel engine emissions control systems.

### Topic 1.1

Learners will understand the function and working principles of land-based compression-ignition (diesel) engines.

Topics will include:

- Function of an engine
- Relationship between power, torque and speed
- The 4-stroke cycle
- The compression-ignition principle
- Number and configuration of cylinders (inline, V, firing order)
- Engine construction (long/short stroke, wet/dry liner)
- Materials used (steel, cast iron, aluminium)
- Main engine components (block, cylinder, liner, cylinder head, crankshaft, flywheel, balancer, timing gears/pulleys/belts, camshaft, connecting rods, pistons, piston rings, head gasket, valves, valve stems, valve springs, rocker shaft, rocker arms, inlet and exhaust manifolds, turbocharger, intercooler)
- Typical component failure, trouble-shooting and repairs

### Topic 1.2

Learners will understand land-based compression-ignition (diesel) engine lubrication systems.

Topics will include:

- Function of lubrication systems
- Oil pump and pressure valves
- Oil filters, bypass valves and strainers
- Oil ways, galleries and sealing components
- Methods of component lubrication (force-feed, splash-feed)
- Oil selection (type, grade, quality, additives)
- Typical component failure, trouble-shooting and repairs

### Topic 1.3

Learners will understand land-based compression-ignition (diesel) engine cooling systems.

Topics will include:

- Function of cooling systems
- Methods of dissipating heat

- Air cooling versus liquid cooling systems
- Air cooling system components (fan, fan belt, jackets and shrouds, cooling fins)
- Liquid cooling system components (water pump, radiator, fan, fan belt, thermostat, bypass)
- Liquid coolant (ethylene glycol, dilution rate)
- Cavitation within liquid cooling systems (causes, effects, solutions)
- Engine overheating (causes, effects, solutions)
- Typical component failure, trouble-shooting and repairs

#### **Topic 1.4**

Learners will understand land-based compression-ignition (diesel) engine fuel systems.

Topics will include:

- Function of fuel systems
- Mechanically-controlled versus electronically-controlled fuel systems
- Fuel system components (tank, lift pump, fuel pump, injection pump, common rail, fuel injectors, electronic injectors, unit injectors, mechanical governors, metering devices, sensors, Electronic Control Unit (ECU), fuel return, fuel bleeding, cold start devices)
- Fuel selection (cetane rating, filtration, quality)
- Fuel system contamination (causes, effects, solutions)
- Typical component failure, trouble-shooting and repairs

#### **Topic 1.5**

Learners will understand land-based compression-ignition (diesel) emissions control systems.

Topics will include:

- Function of emissions control systems
- Typical pollutants (hydrocarbons, particulates, oxides of nitrogen)
- Exhaust Gas Recirculation (EGR)
- Diesel Particulate Filter (DPF)
- Diesel Exhaust Fluid (DEF) (Ad-Blue)
- Selective Catalytic Reduction (SCR)
- Typical component failure, trouble-shooting and repairs.

### **Learning outcome:**

## **2. Test, repair and rebuild a land-based compression-ignition, diesel engine**

### **Topics**

2.1 Test a land-based compression-ignition, diesel engine for a range of faults.

2.2 Inspect, assess, repair and rebuild a land-based compression-ignition diesel engine.

#### **Topic 2.1**

Learners will test a land-based compression-ignition (diesel) engine for a range of faults. Activities will be carried out on a substantial 4-stroke, liquid-cooled engine, preferably an engine suitable for use in a tractor or similar land-based machine.

For each test, learners will record and evaluate their findings. They will compare these findings with the manufacturer's specifications and explain or justify any deviations.

Activities will include:

- Cylinder compression test

- Oil pressure test
- Static timing check/test and dynamic timing test
- Coolant system pressure test
- Coolant fluid hydrometer test
- Fuel injector test (mechanical fuel injector pop test) and/or fuel injection system test
- Dynamometer test (power, torque, torque back-up)

### Topic 2.2

Learners will inspect, assess, repair and rebuild a land-based compression-ignition (diesel) engine. Activities will be carried out on a substantial 4-stroke, liquid-cooled engine, preferably an engine suitable for use in a tractor or similar land-based machine.

For each inspection or measurement, learners will assess the component's fitness for purpose or reason for failure.

Activities will include (if applicable):

- Disassemble the engine to be worked on. Remove the head, connecting rods, pistons, camshaft, crankshaft, timing components, gaskets/residues/sealants
- Chemically clean and degrease components (where required)
- Inspect the cylinders/block
- Inspect the crankshaft and measure journal ovality, lift and/or end-float
- Inspect the main bearings, big-end bearings and thrust washers
- Inspect the connecting rods and pistons (alignment, matched weighting)
- Inspect the piston rings and measure the piston ring gaps
- Inspect the cylinder bore/liner (leaking seals, cavitation damage) and measure ovality and/or taper
- Inspect the timing gears/pulleys/belts
- Inspect the flywheel (run-out) and/or balancer
- Assess and/or measure cylinder head distortion
- Inspect the head gasket
- Inspect the camshaft and rocker components
- Inspect the cam followers, pushrods and valve rotators (if applicable)
- Inspect the valves (protrusion) and seats and measure the valve stems, guides, springs and operating system (tappet) clearance
- Inspect the inlet and exhaust manifolds
- Inspect ancillary components (pumps, filters)
- Repair and/or replace components, taking account of the manufacturer's specifications (as required)
- Rebuild and fully reinstate the engine and any ancillary components
- Verify the integrity of the repair/overhaul
- Recommend actions for future servicing or maintenance.

## Guidance for delivery

Centres are encouraged to introduce employers and product specialists from industry to provide interesting and relevant information to learners. It would be helpful for teachers and centres to maintain close contact with industry to ensure ongoing access to suitable and up-to-date equipment for learners to work on.

It is accepted that some formal lectures will be necessary at level 3 but for this unit it is essential that they are they are linked directly with interactive workshop lessons working on real equipment.

## Suggested learning resources

### Books

- |  |          |
|--|----------|
| Farm Machinery, 5 <sup>th</sup> Edition<br>Published by: Old Pond Publishing, 2005<br>ISBN: 9781903366684                                | Bell, B  |
| Farm Machinery, 12 <sup>th</sup> Edition<br>Published by: Wiley-Blackwell, 1992<br>ISBN: 9780632031597                                   | Culpin C |
| Hillier's Fundamentals of Motor Vehicle Technology, 6 <sup>th</sup> Edition<br>Published by: Nelson Thornes, 2012<br>ISBN: 9781408515181 | Calex UK |

Miscellaneous manufacturers' publications and manuals

### Journals

Profi International

### Websites

- CDX Automotive (Light Vehicle / Heavy Vehicle) <http://www.cdxetextbook.com>
- Health and Safety Executive <http://www.hse.gov.uk>
- How Stuff Works <http://www.howstuffworks.com>
- Institution of Agricultural Engineers <http://www.iagre.org>
- Land-based Engineering <http://landbasedengineering.com>

## Unit 328

## Repair land-based spark-ignition, petrol engines

<b>UAN:</b>	Y/507/6990
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

The purpose of this unit is to enable learners to understand and repair spark-ignition petrol engines. These engines are fitted to a wide and varied range of land-based vehicles and equipment.

### Learning outcomes

In this unit, learners will:

1. Understand land-based spark-ignition petrol engines
2. Test, repair and rebuild a land-based spark-ignition petrol engine.

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

## Learning outcome:

### 1. Understand land-based spark-ignition, petrol engines

## Topics

- 1.1 The function and working principles of land-based spark-ignition petrol engines.
- 1.2 Land-based spark-ignition petrol engine lubrication systems.
- 1.3 Land-based spark-ignition petrol engine cooling systems.
- 1.4 Land-based spark-ignition petrol engine fuel systems.
- 1.5 Land-based spark-ignition petrol engine emissions control systems.

Engine-related electric systems are covered in Unit 307 Repair Land-based Electric Systems. Engine-related electronic systems are covered in Unit 308 Test Land-based Electronic Systems.

### Topic 1.1

Learners will understand the function and working principles of land-based spark-ignition (petrol) engines.

Topics will include:

- Function of an engine
- Relationship between power, torque and speed
- The 2-stroke and 4-stroke cycles
- The spark-ignition principle
- Number and configuration of cylinders (inline, V, firing order)
- Engine construction (long/short stroke, wet/dry liner)
- Materials used (steel, cast iron, aluminium)
- Main engine components (block, cylinder, liner, cylinder head, crankshaft, flywheel, balancer, timing gears/pulleys/belts, camshaft, connecting rods, pistons, piston rings, head gasket, valves, valve stems, valve springs, rocker shaft, rocker arms, inlet and exhaust manifolds, turbocharger, intercooler)
- Typical component failure, trouble-shooting and repairs

### Topic 1.2

Learners will understand land-based spark-ignition (petrol) engine lubrication systems.

Topics will include:

- Function of lubrication systems
- 2-stroke and 4-stroke lubrication systems
- Oil pump and pressure valves
- Oil filters, bypass valves and strainers
- Oil ways, galleries and sealing components
- Methods of component lubrication (force-feed, splash-feed)
- Oil selection (type, grade, quality, additives)
- Typical component failure, trouble-shooting and repairs

### Topic 1.3

Learners will understand land-based spark-ignition (petrol) engine cooling systems.

Topics will include:

- Function of cooling systems
- Methods of dissipating heat
- Air cooling versus liquid cooling systems
- Air cooling system components (fan, fan belt, jackets and shrouds, cooling fins)
- Liquid cooling system components (water pump, radiator, fan, fan belt, thermostat, bypass)
- Liquid coolant (ethylene glycol, dilution rate)
- Cavitation within liquid cooling systems
- Engine overheating (causes, effects, solutions)
- Typical component failure, trouble-shooting and repairs

#### **Topic 1.4**

Learners will understand land-based spark-ignition (petrol) engine fuel systems.

Topics will include:

- Function of fuel systems
- Mechanically-controlled versus electronically-controlled fuel systems
- Fuel system components (tank, lift pump, fuel pump, carburettor, spark plugs, fuel injectors, electronic injectors, metering devices, sensors, Electronic Control Unit (ECU), fuel return, fuel bleeding, cold start devices)
- Fuel selection (octane rating, filtration, quality)
- Fuel system contamination (causes, effects, solutions)
- Typical component failure, trouble-shooting and repairs

#### **Topic 1.5**

Learners will understand land-based spark-ignition (petrol) engine emissions control systems.

Topics will include:

- Function of emissions control systems
- Typical pollutants (hydrocarbons, particulates, oxides of nitrogen)
- Emissions control systems and components
- Typical component failure, trouble-shooting and repairs.

### **Learning outcome:**

## **2. Test, repair and rebuild a land-based spark-ignition petrol engine**

### **Topics**

2.1 Test a land-based spark-ignition (petrol) engine for a range of faults.

2.2 Inspect, assess, repair and rebuild a land-based spark-ignition (petrol) engine.

Engine-related electric systems are covered in Unit 307 Repair Land-based Electric Systems. Engine-related electronic systems are covered in Unit 308 Test Land-based Electronic Systems.

#### **Topic 2.1**

Learners will test a land-based spark-ignition (petrol) engine for a range of faults. Activities will be carried out on a suitable engine, preferably an engine suitable for use in a land-based machine or vehicle.

If service engineering practices in the locality mean that there will be no ready access to such equipment, it will be permissible to undertake activities on a compression-ignition (diesel) engine. Refer to Unit 304 Repair Land-based Compression-Ignition (Diesel) Engines Topic 2.1 for permissible compression-ignition (diesel) engines. It will not be permissible to use the same compression-ignition (diesel) engine to satisfy both Unit 305 Repair Land-based Spark-Ignition (Petrol) Engines and Unit 304 Repair Land-based Compression-Ignition (Diesel) Engines. An additional, different compression-ignition (diesel) engine will be needed.

For each test, learners will record and evaluate their findings. They will compare these with the manufacturer's specifications and explain or justify any deviations.

Activities will include (if applicable):

- Cylinder/crankcase compression test
- Oil pressure test
- Static timing check/test and dynamic timing test
- Coolant system pressure test
- Coolant fluid hydrometer test
- Fuel injector test (mechanical fuel injector pop test) and/or injection system test

### **Topic 2.2**

Learners will inspect, assess, repair and rebuild a land-based spark-ignition (petrol) engine.

Activities will be carried out on a substantial engine, preferably an engine suitable for use in a land-based machine or vehicle.

If service engineering practices in the locality mean that there will be no ready access to such equipment, it will be permissible to undertake activities on a compression-ignition (diesel) engine. Refer to Unit 304 Repair Land-based Compression-Ignition (Diesel) Engines Topic 2.2 for permissible compression-ignition (diesel) engines. It will not be permissible to use the same compression-ignition (diesel) engine to satisfy both Unit 305 Repair Land-based Spark-Ignition (Petrol) Engines and Unit 304 Repair Land-based Compression-Ignition (Diesel) Engines. An additional, different compression-ignition (diesel) engine will be needed.

For each inspection or measurement, learners will assess the component's fitness for purpose or reason for failure.

Activities will include (if applicable):

- Disassemble the engine to be worked on. Remove the head, connecting rods, pistons, camshaft, crankshaft, timing components, gaskets/residues/sealants
- Chemically clean and degrease components (where required)
- Inspect the cylinders/block
- Inspect the crankshaft and measure journal ovality, lift and/or end-float
- Inspect the main bearings, big-end bearings and thrust washers
- Inspect the connecting rods and pistons (alignment, matched weighting)
- Inspect the piston rings and measure the piston ring gaps
- Inspect the cylinder bore/liner (leaking seals, cavitation damage) and measure ovality and/or taper
- Inspect the timing gears/pulleys/belts
- Inspect the flywheel (run-out) and/or balancer
- Assess and/or measure cylinder head distortion
- Inspect the head gasket

- Inspect the camshaft and rocker components
- Inspect the cam followers, pushrods and valve rotators (if applicable)
- Inspect the valves (protrusion) and seats and measure the valve stems, guides, springs and operating system (tappet) clearance
- Inspect the inlet and exhaust manifolds
- Inspect ancillary components (pumps, filters)
- Repair and/or replace components, taking account of the manufacturer's specifications (as required)
- Rebuild and fully reinstate the engine and any ancillary components
- Verify the integrity of the repair/overhaul
- Recommend actions for future servicing or maintenance

### Guidance for delivery

Centres are encouraged to introduce employers and product specialists from industry to provide interesting and relevant information to learners. It would be helpful for teachers and centres to maintain close contact with industry to ensure ongoing access to suitable and up-to-date equipment for learners to work on.

It is accepted that some formal lectures will be necessary at level 3 but for this unit it is essential that they are they are linked directly with interactive workshop lessons working on real equipment.

### Suggested learning resources

#### Books

Farm Machinery, 5<sup>th</sup> Edition  
Published by: Old Pond Publishing, 2005  
ISBN: 9781903366684

Bell, B

Farm Machinery, 12<sup>th</sup> Edition  
Published by: Wiley-Blackwell, 1992  
ISBN: 9780632031597

Culpin C

Hillier's Fundamentals of Motor Vehicle Technology, 6<sup>th</sup> Edition  
Published by: Nelson Thornes, 2012  
ISBN: 9781408515181

Calex UK

Miscellaneous manufacturers' publications and manuals

#### Journals

Profi International

#### Websites

- CDX Automotive (Light Vehicle / Heavy Vehicle) <http://www.cdxetextbook.com>
- Health and Safety Executive <http://www.hse.gov.uk>
- How Stuff Works <http://www.howstuffworks.com>
- Institution of Agricultural Engineers <http://www.iagre.org>

## Unit 329

## Repair land-based cultivation or drilling machinery

<b>UAN:</b>	M/507/7000
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

The purpose of this unit is to enable learners to understand and repair land-based cultivation and drilling machinery. This machinery plays a vital role in the land-based sector, enabling the establishment of a wide and varied range of crops.

### Learning outcomes

In this unit, learners will:

1. Understand land-based cultivation and drilling machinery
2. Inspect, repair and overhaul a land-based cultivation or drilling machine.

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

## Learning outcome:

### 1. Understand land-based cultivation and drilling machinery

## Topics

- 1.1 The function and working principles of land-based cultivation machinery.
- 1.2 The function and working principles of land-based drilling harvesting.

### Topic 1.1

Learners will understand the function and working principles of land-based cultivation machinery.

Topics will include:

- Ploughs
- Stubble cultivators
- Tine and disc harrows
- Power harrows
- Rotavators
- Bed formers and tillers
- The role of primary and secondary cultivators
- Powered versus non-powered cultivators
- Impact of operator settings/behaviour on machine performance and component longevity
- Impact of soil type and ground conditions on machine performance and component longevity
- Typical component failure, trouble-shooting and repairs

### Topic 1.2

Learners will understand the function and working principles of land-based drilling machinery.

Topics will include:

- Seed drills
- Mechanical versus pneumatic seed delivery systems
- Non-powered cultivator/drill combinations
- Power harrow/drill combinations
- Min-till drills
- Strip-till drills
- No-till drills
- Precision planters
- Importance of correct calibration and drilling/planting rate
- Impact of operator settings/behaviour on machine performance and component longevity
- Impact of soil type and ground conditions on machine performance and component longevity
- Typical component failure, trouble-shooting and repairs.

## Learning outcome:

### 2. Inspect, repair and overhaul a land-based cultivation or drilling machine

#### Topics

##### 2.1 Inspect, repair and overhaul a land-based cultivation or drilling machine.

#### Topic 2.1

Learners will inspect, repair and overhaul a land-based cultivation or drilling machine. The selected machine will be relevant to local needs.

Activities will include:

- Wear appropriate PPE
- Prepare the work area and the machine to be worked on
- Inspect the machine's frame and/or structural elements
- Inspect the machine's hopper/tank (if applicable)
- Inspect the machine's soil-engaging components and wearing parts
- Inspect the machine's driveline components (if applicable)
- Inspect the machine's seed metering/delivery systems (if applicable)
- Evaluate the condition of the components, assessing the fitness for purpose of each
- Repair and/or replace components
- Carry out repairs and/or overhaul procedures
- Reinstall the machine
- Verify the integrity of the repair/overhaul
- Recommend actions for future servicing or maintenance
- Attach the machine to a suitable tractor (if applicable)
- Check settings and alignment and prepare the machine for use
- Calibrate the machine for a number of different seed types (if applicable).

## Guidance for delivery

Centres are encouraged to introduce employers and product specialists from industry to provide interesting and relevant information to learners. It would be helpful for teachers and centres to maintain close contact with industry to ensure ongoing access to suitable and up-to-date equipment for learners to work on.

It is accepted that some formal lectures will be necessary at level 3 but for this unit it is essential that they are they are linked directly with interactive workshop lessons working on real equipment.

## Suggested learning resources

### Books

Farm Machinery, 5<sup>th</sup> Edition  
Published by: Old Pond Publishing, 2005  
ISBN: 9781903366684

Bell, B

Farm Machinery, 12<sup>th</sup> Edition  
Published by: Wiley-Blackwell, 1992  
ISBN: 9780632031597

Culpin C

Miscellaneous manufacturers' publications and manuals

### Journals

Profi International

### Websites

- Health and Safety Executive <http://www.hse.gov.uk>
- How Stuff Works <http://www.howstuffworks.com>
- Institution of Agricultural Engineers <http://www.iagre.org>
- Land-based Engineering <http://landbasedengineering.com>

## Unit 330

## Repair land-based application machinery

<b>UAN:</b>	T/507/7001
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

The purpose of this unit is to enable learners to understand and repair land-based application machinery. This machinery plays a vital role in the land-based sector, enabling the growth, care and protection of a wide and varied range of crops.

### Learning outcomes

In this unit, learners will:

1. Understand land-based application machinery
2. Inspect, repair and overhaul a land-based application machine.

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

## Learning outcome:

### 1. Understand land-based application machinery

## Topics

- 1.1 The function and working principles of land-based application machinery for solid waste.
- 1.2 The function and working principles of land-based application machinery for liquid waste.
- 1.3 The function and working principles of land-based application machinery for artificial granular fertiliser.
- 1.4 The function and working principles of land-based application machinery for liquid chemicals.

### Topic 1.1

Learners will understand the function and working principles of land-based application machinery for solid waste.

Topics will include:

- Rotary side spreaders
- Dual spreaders
- Rear discharge spreaders( with and without slurry doors)
- Impact of operator settings/behaviour on machine performance and component longevity
- Impact of material/ waste type on machine performance and component longevity
- Typical component failure, trouble-shooting and repairs

### Topic 1.2

Learners will understand the function and working principles of land-based application machinery for liquid waste.

Topics will include:

- Slurry tankers
- Umbilical spreading systems (pumps, reels)
- Dribble bars
- Trailing shoes
- Injectors (tine-based, disc-based)
- Macerators/choppers
- Impact of operator settings/behaviour on machine performance and component longevity
- Impact of material/ waste type on machine performance and component longevity
- Typical component failure, trouble-shooting and repairs

### Topic 1.3

Learners will understand the function and working principles of land-based application machinery for artificial granular fertiliser.

Topics will include:

- Mounted and trailed fertiliser broadcasters
- Spreading mechanisms (single-disc, twin-disc, reciprocating spout, etc)
- Direction of disc rotation on twin-disc machines (inward-turning versus outward-turning discs)

- Headland/boundary spreading systems/kits
- Coefficient of Variation (CV) and tray tests
- Impact of operator settings/behaviour on machine performance and component longevity
- Impact of fertiliser type on machine performance and component longevity
- Typical component failure, trouble-shooting and repairs

#### **Topic 1.4**

Learners will understand the function and working principles of land-based application machinery for liquid chemicals.

Topics will include:

- Mounted, trailed and self-propelled sprayers
- Types of pump (diaphragm, piston, etc)
- Types of nozzle (flat fan, flood, cone, etc)
- Induction/mixing tank/hopper
- Impact of operator settings/behaviour on machine performance and component longevity
- Typical component failure, trouble-shooting and repairs.

### **Learning outcome:**

#### **2. Inspect, repair and overhaul a land-based application machine**

### **Topics**

#### **2.1 Inspect, repair and overhaul a land-based application machine.**

#### **Topic 2.1**

Learners will inspect, repair and overhaul a land-based application machine. The selected machine will be relevant to local needs.

Activities will include:

- Wear appropriate PPE
- Prepare the work area and the machine to be worked on
- Inspect the machine's frame and/or structural elements
- Inspect the machine's hopper/tank (if applicable)
- Inspect the machine's wearing parts
- Inspect the machine's driveline components
- Inspect the machine's conveyor, metering or delivery system
- Inspect the machine's spreading, broadcasting or distribution system
- Evaluate the condition of the components, assessing the fitness for purpose of each
- Repair and/or replace components
- Carry out repairs and/or overhaul procedures
- Reinstall the machine
- Verify the integrity of the repair/overhaul
- Recommend actions for future servicing or maintenance
- Attach the machine to a suitable tractor (if applicable)
- Check settings and prepare the machine for use

### **Guidance for delivery**

Centres are encouraged to introduce employers and product specialists from industry to provide interesting and relevant information to learners. It would be helpful for teachers and centres to maintain close contact with industry to ensure ongoing access to suitable and up-to-date equipment for learners to work on.

It is accepted that some formal lectures will be necessary at level 3 but for this unit it is essential that they are they are linked directly with interactive workshop lessons working on real equipment.

### **Suggested learning resources**

#### **Books**

Farm Machinery, 5<sup>th</sup> Edition Bell, B  
Published by: Old Pond Publishing, 2005  
ISBN: 9781903366684

Farm Machinery, 12<sup>th</sup> Edition Culpin C  
Published by: Wiley-Blackwell, 1992  
ISBN: 9780632031597

Miscellaneous manufacturers' publications and manuals

#### **Journals**

Profi International

#### **Websites**

- Health and Safety Executive <http://www.hse.gov.uk>
- How Stuff Works <http://www.howstuffworks.com>
- Institution of Agricultural Engineers <http://www.iagre.org>
- Land-based Engineering <http://landbasedengineering.com>

## Unit 331

## Repair land-based forage harvesting machinery

<b>UAN:</b>	A/507/7002
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

The purpose of this unit is to enable learners to understand and repair land-based forage harvesting machinery. Forage harvesting machinery includes a wide array of equipment, such as mowers, tedders, rakes, balers, self-loading forage wagons and forage harvesters.

### Learning outcomes

In this unit, learners will:

1. Understand land-based forage harvesting machinery
2. Inspect, repair and overhaul a land-based forage harvesting machine.

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

## Learning outcome:

### 1. Understand land-based forage harvesting machinery

## Topics

- 1.1 The function and working principles of land-based mowers, conditioners and mower-conditioners.
- 1.2 The function and working principles of land-based tedders and rakes
- 1.3 The function and working principles of land-based balers and wrappers
- 1.4 The function and working principles of land-based self-loading forage wagons
- 1.5 The function and working principles of land-based forage harvesters.

### Topic 1.1

Learners will understand the function and working principles of land-based forage harvesting machinery.

Topics will include:

- Mowers (discs, drums, flails, etc)
- Groupers (belts, deflectors, motors, etc)
- Conditioners (tines, impellers, etc)
- Impact of operator settings/behaviour on machine performance and component longevity
- Impact of crop type/condition on machine performance and component longevity
- Typical component failure, trouble-shooting and repairs

### Topic 1.2

Learners will understand the function and working principles of land-based tedders and rakes.

Topics will include:

- Tedders (tines, rotors, mounted, trailed, etc)
- Rakes (tines, rotors, mounted, trailed, single-rotor, twin-rotor, centre-delivery, side-delivery, etc)
- Impact of operator settings/behaviour on machine performance and component longevity
- Impact of crop type/condition on machine performance and component longevity
- Typical component failure, trouble-shooting and repairs

### Topic 1.3

Learners will understand the function and working principles of land-based balers and wrappers.

Topics will include:

- Round and square balers (pick-up reels, feed augers, rotors, knife banks, plungers, chambers, tying/netting systems, etc)
- Bale wrappers (mounted, trailed, loading arms, turntables, belts, rollers, film dispensers, unloading ramps, etc)
- Impact of operator settings/behaviour on machine performance and component longevity
- Impact of crop type/condition on machine performance and component longevity
- Typical component failure, trouble-shooting and repairs

#### **Topic 1.4**

Learners will understand the function and working principles of land-based self-loading forage wagons.

Topics will include:

- Self-loading forage wagons (pick-up reels, feed augers, rotors, knife banks, chain and slat conveyors, height-adjustable drawbars, steering axles, etc)
- Impact of operator settings/behaviour on machine performance and component longevity
- Impact of crop type/condition on machine performance and component longevity
- Typical component failure, trouble-shooting and repairs

#### **Topic 1.5**

Learners will understand the function and working principles of land-based forage harvesters.

Topics will include:

- Forage harvesters (pick-up reels, feed augers, feed rollers, chopping cylinders/drums/flywheels, crop blowers/accelerators, trailed, self-propelled, etc)
- Impact of operator settings/behaviour on machine performance and component longevity
- Impact of crop type/condition on machine performance and component longevity
- Typical component failure, trouble-shooting and repairs.

### **Learning outcome:**

#### **2. Inspect, repair and overhaul a land-based forage harvesting machine**

### **Topics**

**Topic 2.1:** Inspect, repair and overhaul a land-based forage harvesting machine.

#### **Topic 2.1**

Learners will inspect, repair and overhaul a land-based forage harvesting machine. The machine will be a mower-conditioner, baler, self-loading forage wagon or forage harvester.

Activities will include

- inspect the crop cutting, lifting and/or processing systems, including wearing parts and driveline components, prior to disassembly
- disassemble the machine (as required), to enable access to the components
- inspect the components following disassembly
- evaluate the condition of the components, assessing the fitness for purpose of each
- repair and/or replace components
- carry out repairs and/or overhaul procedures
- reinstate the machine
- verify the integrity of the repair/overhaul
- recommend actions for future servicing or maintenance
- check settings and prepare the machine for operation.

### **Guidance for delivery**

Centres are encouraged to introduce employers and product specialists from industry to provide interesting and relevant information to learners. It would be helpful for teachers and centres to

maintain close contact with industry to ensure ongoing access to suitable and up-to-date equipment for learners to work on.

It is accepted that some formal lectures will be necessary at level 3 but for this unit it is essential that they are they are linked directly with interactive workshop lessons working on real equipment.

### **Suggested learning resources**

#### **Books**

Farm Machinery, 5<sup>th</sup> Edition  
Published by: Old Pond Publishing, 2005  
ISBN: 9781903366684

Bell, B

Farm Machinery, 12<sup>th</sup> Edition  
Published by: Wiley-Blackwell, 1992  
ISBN: 9780632031597

Culpin C

Miscellaneous manufacturers' publications and manuals

#### **Journals**

Profi International

#### **Websites**

- Health and Safety Executive
- How Stuff Works
- Institution of Agricultural Engineers

<http://www.hse.gov.uk>

<http://www.howstuffworks.com>

<http://www.iagre.org>

## Unit 332

## Repair land-based combinable or root crop harvesting machinery

<b>UAN:</b>	F/507/7003
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

The purpose of this unit is to enable learners to understand and repair land-based combinable and root crop harvesting machinery. Combinable and root crop harvesting machinery includes combine harvesters and root crop harvesting equipment.

### Learning outcomes

In this unit, learners will:

1. Understand land-based combinable and root crop harvesting machinery
2. Inspect, repair and overhaul a land-based combinable or root crop harvesting machine.

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

## Learning outcome:

### 1. Understand land-based combinable and root crop harvesting machinery

## Topics

1.1 The function and working principles of land-based swathers and combine harvesters

1.2 The function and working principles of land-based beet harvesters

1.3 The function and working principles of land-based potato harvesters.

### Topic 1.1

Learners will understand the function and working principles of land-based swathers and combine harvesters.

Topics will include:

- Swathers (cutter-bars, crop lifters, knives, reels, feed augers, etc)
- Combine harvesters (cutter-bars, crop lifters, knives, reels, feed augers, stripper headers, crop elevators, drums, concaves, rasp bars, secondary/additional drums, straw walkers, rotors, sieves, fans, grain pans, clean grain elevators, returns systems, re-threshers, tanks, unloading augers, etc)
- Conventional (straw walker) combine harvesters versus rotary combine harvesters
- Rotary combine harvesters versus hybrid rotary combine harvesters
- Impact of operator settings/behaviour on machine performance and component longevity
- Impact of crop type/conditions on machine performance and component longevity
- Typical component failure, trouble-shooting and repairs

### Topic 1.2

Learners will understand the function and working principles of land-based beet harvesters.

Topics will include:

- Beet harvesters (scalper-blade toppers, feeler-wheel toppers, topper discs, lifters, shares, turbines, carousels, rollers, elevators, webs, bunkers, trailed, self-propelled, wheeled, tracked, etc)
- Different approaches to crop extraction/lifting
- Specialist beet cleaning/loading equipment
- Impact of operator settings/behaviour on machine performance and component longevity
- Impact of crop type/conditions on machine performance and component longevity
- Typical component failure, trouble-shooting and repairs

### Topic 1.3

Learners will understand the function and working principles of land-based potato harvesters.

Topics will include:

- Potato harvesters (toppers, pulverisers, diabolo rollers, feed rolls, elevators, separator rolls, conveyors, picking tables, manned/unmanned, bunkers, trailed, self-propelled, wheeled, tracked, etc)
- Different approaches to crop extraction/lifting
- Impact of operator settings/behaviour on machine performance and component longevity

- Impact of crop type/conditions on machine performance and component longevity
- Typical component failure, trouble-shooting and repairs.

### Learning outcome:

## 2. Inspect, repair and overhaul a land-based combinable or root crop harvesting machine

### Topics

#### 2.1 Inspect, repair and overhaul a land-based combinable or root crop harvesting machine.

##### Topic 2.1

Learners will inspect, repair and overhaul a land-based combinable or root crop harvesting machine. The machine will be a combine harvester or a root crop harvester (potato harvester, beet harvester, etc).

If service engineering practices in the locality mean that there will be no ready access to such equipment, it will be permissible to undertake activities on a forage harvesting machine. Refer to Unit 317 Repair Land-based Forage Harvesting Machinery Topic 2.1 for permissible forage harvesting machines. It will not be permissible to use the same forage harvesting machine to satisfy both Unit 317 Repair Land-based Forage Harvesting Machinery and Unit 318 Repair Land-based Combinable or Root Crop Harvesting Machinery. An additional, different forage harvesting machine will be needed.

Activities will include:

- Wear appropriate PPE
- Prepare the work area and the machine to be worked on
- Inspect the crop cutting, lifting and/or processing systems, including wearing parts and driveline components, prior to disassembly
- Disassemble the machine (as required), to enable access to the components
- Inspect the components following disassembly
- Evaluate the condition of the components, assessing the fitness for purpose of each
- Repair and/or replace components
- Carry out repairs and/or overhaul procedures
- Reinstall the machine
- Verify the integrity of the repair/overhaul
- Recommend actions for future servicing or maintenance
- Check settings and prepare the machine for operation.

## Guidance for delivery

Centres are encouraged to introduce employers and product specialists from industry to provide interesting and relevant information to learners. It would be helpful for teachers and centres to maintain close contact with industry to ensure ongoing access to suitable and up-to-date equipment for learners to work on.

It is accepted that some formal lectures will be necessary at level 3 but for this unit it is essential that they are they are linked directly with interactive workshop lessons working on real equipment.

## Suggested learning resources

### Books

Farm Machinery, 5<sup>th</sup> Edition  
Published by: Old Pond Publishing, 2005  
ISBN: 9781903366684

Bell, B

Farm Machinery, 12<sup>th</sup> Edition  
Published by: Wiley-Blackwell, 1992  
ISBN: 9780632031597

Culpin C

Miscellaneous manufacturers' publications and manuals

### Journals

Profi International

### Websites

- Health and Safety Executive
- How Stuff Works
- Institution of Agricultural Engineers
- Land-based Engineering

<http://www.hse.gov.uk>

<http://www.howstuffworks.com>

<http://www.iagre.org>

<http://landbasedengineering.com>

## Unit 333

## Repair land-based mechanical power transmission systems

<b>UAN:</b>	A/507/6996
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

The purpose of this unit is to enable learners to understand and repair land-based mechanical power transmission systems. These systems underpin a wide and varied range of land-based machines and vehicles.

### Learning outcomes

In this unit, learners will:

1. Understand land-based mechanical power transmission systems.
2. Inspect, test and repair land-based mechanical power transmission systems.

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

## Learning outcome:

### 1. Understand land-based mechanical power transmission systems

## Topics

- 1.1 The function and working principles of land-based mechanical power transmission systems.
- 1.2 Land-based mechanical power transmission system failure and trouble-shooting.

### Topic 1.1

Learners will understand the function and working principles of mechanical power transmission systems.

Topics will include:

- Relationship between power, torque and speed
- Drive shafts and universal joints (pto shaft risks and hazards)
- Protection and overrun devices (shear bolts, slip clutches)
- Bushings or friction bearings (steel, bronze, nylon)
- Bearings (ball, roller, tapered roller, radial, thrust, sealed, sintered)
- Belt drive systems (v, multi-strand, pulleys)
- Chain drive systems (rollers, links, sprockets, size, pitch, dimension)
- Gear drive systems (spur, helical, bevel, hypoid)

### Topic 1.2

Learners will understand land-based mechanical power transmission system failure and trouble-shooting.

Topics will include:

- Types and symptoms of component failure due to excessive load, friction, heat, speed
- Types and symptoms of component failure due to excessive wear, fatigue
- Types and symptoms of component failure due to misalignment
- Types and symptoms of component failure due to lack of lubrication
- Trouble-shooting methodologies
- Repair strategies

## Learning outcome:

### 2. Inspect, test and repair land-based mechanical power transmission systems

## Topics

- 2.1 Inspect, test and repair land-based mechanical power transmission systems

### Topic 2.1

Learners will inspect, test and repair the following mechanical power transmission systems. Activities will be carried out on land-based machines or vehicles.

- Universal joint (including the removal and replacement of a cross and/or yoke).
- Overrun device

- Bushing or friction bearing (including removal from a shaft using an appropriate puller and/or press and replacement/reinstatement)
- Ball/roller bearing (including removal from a shaft using an appropriate puller and/or press and replacement/reinstatement)
- Belt drive system (including the removal and replacement/reinstatement of a belt and pulley)
- Chain drive system (including the removal and replacement/reinstatement of a chain and sprocket)
- Gear drive system (including the removal and replacement/reinstatement of a gear wheel/cog)

Activities will include:

- Inspect and test the operation of each system prior to disassembly (assessing wear, damage, misalignment, vibration, noise)
- Disassemble each system (as required), to enable access to the components
- Inspect the components following disassembly
- Diagnose and evaluate faults
- Carry out repairs and/or overhaul procedures
- Reinstall each system
- Verify the integrity of the repairs/overhauls
- Recommend actions for future servicing or maintenance

## Guidance for delivery

Centres are encouraged to introduce employers and product specialists from industry to provide interesting and relevant information to learners. It would be helpful for teachers and centres to maintain close contact with industry to ensure ongoing access to suitable and up-to-date equipment for learners to work on.

It is accepted that some formal lectures will be necessary at level 3 but for this unit it is essential that they are they are linked directly with interactive workshop lessons working on real equipment.

## Suggested learning resources

### Books

Farm Machinery, 5<sup>th</sup> Edition  
Published by: Old Pond Publishing, 2005  
ISBN: 9781903366684  
Bell, B

Farm Machinery, 12<sup>th</sup> Edition  
Published by: Wiley-Blackwell, 1992  
ISBN: 9780632031597  
Culpin C

Miscellaneous manufacturers' publications and manuals

### Journals

- Profi International

### Websites

CDX Automotive (Light Vehicle / Heavy Vehicle)	<a href="http://www.cdxtextbook.com">http://www.cdxtextbook.com</a>
Health and Safety Executive	<a href="http://www.hse.gov.uk">http://www.hse.gov.uk</a>
How Stuff Works	<a href="http://www.howstuffworks.com">http://www.howstuffworks.com</a>
Institution of Agricultural Engineers	<a href="http://www.iagre.org">http://www.iagre.org</a>
Land-based Engineering	<a href="http://landbasedengineering.com">http://landbasedengineering.com</a>

## Unit 334

## Farm animal science

<b>UAN:</b>	R/507/6874
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

The purpose of this unit is for learners to develop their knowledge and understanding of the anatomical and physiological systems of livestock. Learners will also investigate the science of reproduction and reproductive systems of mammalian and avian livestock. Learners will gain a sound knowledge of the basis of how the animal body functions under normal conditions and the biological technology for enhancing livestock production

### Learning outcomes:

In this unit, learners will be able to

1. understand biological systems of livestock
2. understand digestion and excretion in livestock
3. understand reproductive systems in livestock
4. understand genetics and reproductive technology in relation to livestock

## Scope of content

### Livestock

Eg Cattle, sheep, goats, pigs, chickens, ducks, geese, turkeys

### Learning outcome:

#### 1. Understand biological systems of livestock

### Topics

- 1.1 Cardiovascular system
- 1.2 Respiratory system
- 1.3 Endocrine system
- 1.4 Nervous system

### Biological systems

Learners will understand major organs, functions of organs and the interactions between systems.

#### Topic 1.1

Learners will understand features and functions of the cardiovascular systems of livestock, including:

- blood
- blood vessels: capillaries, veins and arteries
- heart: four chambers, aorta, vena cava, pulmonary vein, pulmonary artery.

#### Topic 1.2

Learners will understand features and functions of the respiratory systems of livestock, including: nasal cavity, larynx, trachea, lungs, bronchi, bronchioles, alveoli, air sacs.

#### Topic 1.3

Learners will understand features and functions of the endocrine systems of livestock, including: pituitary gland, thymus, thyroid, pancreas, adrenals, pineal gland (melatonin), ovary, testes, hormones, hypothalamus.

#### Topic 1.4

Learners will understand features and functions of the nervous systems of livestock, including:

- central nervous system: brain, spinal cord)
- peripheral nervous system: nerves, neurons.

### Learning outcome:

#### 2. Understand digestion and excretion in livestock

### Topics

- 2.1 Digestive systems
- 2.2 Digestive process
- 2.3 Excretory system

### Topic 2.1

Learners will understand digestive systems in livestock:

- types: ruminant, monogastric, avian, herbivores, omnivores
- features: mouth, beak, teeth, tongue, oesophagus, oesophageal groove, stomach (abomasum, omasum, rumen, reticulum), duodenum, jejunum, ileum, caecum, colon, rectum, anus, crop, gizzard, cloaca.

### Topic 2.2

Learners will understand digestive processes in livestock:

- essential nutrients (water, protein, fat, carbohydrates, vitamins, minerals), ruminant digestion, fermentation, microbes (volatile fatty acids), monogastric digestion, absorption, elimination, enzymes (pepsinogen, rennin, lipase)
- effects on livestock health if the functions of these processes are disrupted by incorrect feeding, deficiencies or stress, including digestive disorders (eg acidosis, ketosis, bloat)

### Topic 2.3

- Learners will understand excretory system in livestock:
- kidneys (ultrafiltration and reabsorption), ureters, bladder, urethra, urea, uric acid.

## Learning outcome:

### 3. Understand reproductive systems in livestock

#### Topics

- 3.1 Male reproductive system
- 3.2 Female reproductive system
- 3.3 Oestrus cycle
- 3.4 Gestation and parturition

### Topic 3.1

Learners will understand the location, structure and function of reproductive systems of male livestock: penis, prepuce, urethra, bulbus glandus, epididymis, vas deferens, testis (testosterone, oestrogen) and prostate gland.

### Topic 3.2

Learners will understand the location, structure and function of reproductive systems of female livestock, including: vulva, vagina, cervix, uterus, oviduct and ovaries.

### Topic 3.3

Learners will understand the oestrus cycle in livestock:

- stages of cycle, hormonal control (oestrogen, progesterone, LH and FSH), ovulation, corpus luteum, photoperiod
- sexual reproduction, signs of oestrus, copulation, fertilization, implantation.

### Topic 3.4

Learners will understand gestation in livestock: length of gestation, parturition (prolactin and oxytocin), egg production, hatching.



## Learning outcome:

### 4. Understand genetics and reproductive technology in relation to livestock

#### Topics

- 4.1 Genetics
- 4.2 Selective breeding
- 4.3 Reproductive technology
- 4.4 Reproductive problems

##### Topic 4.1

Learners will understand genetics:

genotype and phenotype, meiosis, chromosomes, deoxyribonucleic acid (DNA), genes, alleles, mutation (eg muscular hypertrophy), heterozygous, homozygous, sex linkage (eg poultry dwarfing gene, feather growth, colour), lethal genes, estimated breeding values (EBVs).

##### Topic 4.2

Learners will understand selective breeding: mendelian inheritance, dominant and recessive traits (eg polled and horned), heritable traits, pedigree analysis, artificial selection, inbreeding, outcrossing, hybrids, nucleus breeding systems.

##### Topic 4.3

Learners will understand reproductive technology: synchronizing oestrus, artificial insemination, sexed semen/embryos, embryo transfer, cloning, transgenesis, pregnancy diagnosis.

##### Topic 4.4

Learners will understand reproductive problems: infertility, freemartins, dystocia, nutritional deficiencies, inherited disorders.

#### Guidance for delivery

A wide range of approaches may be used in delivery of this unit, including lectures, discussions, seminar presentations, supervised dissections and live animal handling. Much of the learning is likely to be classroom-based. Where dissections are used, this should be conducted in accordance with centres' ethical policies.

The need for safe working should be emphasised throughout the unit. It is expected that the learners are guided towards safe working practices and maintaining the welfare of animals by recognising and minimising stress.

During delivery, comparisons should be made between different types of livestock to ensure learners know of the full range. It is expected that centres will focus upon regionally significant livestock found at local farms.

For the purposes of Learning outcome 1, structures of body systems can be observed through photographs, preserved specimens, or practical dissections.

In addition to classroom lectures, when working towards learning outcome 4, learners would benefit from visits from guest speakers and to farms utilising breeding technologies to enhance genetic diversity and productivity.

## Unit 335

## All-Terrain vehicles and rough terrain telescopic forklifts

<b>UAN:</b>	Y/507/6875
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

This unit aims to introduce learners to the skills and knowledge needed for agricultural All-Terrain Vehicles (ATV) and Rough Terrain Telescopic Forklifts (RTFL), and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into employment in the agriculture sector or into further or higher education.

The learner will know the equipment, techniques and technologies used to handle materials and traverse terrain, the routine maintenance and use of ATVs and RTFL, and the legislation that applies to their operation. They will develop practical skills needed to safely operate and maintain ATVs and RTFLs.

### Learning outcomes:

In this unit, learners will be able to

1. know the function of key components found within All-Terrain Vehicles and Rough Terrain Telescopic Forklifts
2. understand the operating principles and applications of All-Terrain Vehicles and Rough Terrain Telescopic Forklifts
3. prepare and operate All-Terrain Vehicles and Rough Terrain Telescopic Forklifts with associated attachments
4. maintain and service All-Terrain Vehicles and Rough Terrain Telescopic Forklifts

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

### ATVs and RTFLs

ATV: CVT transmission, Petrol, Diesel, Semi-automatic, trailer,

RTFL: Hydrostatic/torque converter drive, grab, bucket, pallet forks.

### Learning outcome:

#### 1. Know the function of key components found within All-Terrain Vehicles and Rough Terrain Telescopic Forklifts

### Topics

1.1 Purpose of key components used in ATVs

1.2 Purpose of key components used in RTFLs

1.3 Operator adjustments and inputs on key components used in ATVs

1.4 Operator adjustments and inputs on key components used in RTFLs

#### Topic 1.1

Learners will know key components used in ATVs, including:

Centrifugal clutch, specific low ground pressure tyres, differential (lock/limited slip), throttle control, semi-automatic/fully automatic, suspension systems, engine, fuel system, brake system.

#### Topic 1.2

Learners will know key components used in RTFLs, including:

Transmission system (torque converter/hydrostatic), hydraulic systems, reservoirs, pumps, motors, filters, control valves and systems, oil cooling, pipes and fittings, pressure relief valves, pressure accumulators, steering systems, traction aids.

#### Topic 1.3

Learners will know operator adjustments and inputs on key components used in ATVs:

Clutch adjustment and control, tyre pressure adjustment, traction aids, operator input and use of transmissions, suspension adjustments (machine and operator input).

#### Topic 1.4

Learners will know operator adjustments and inputs on key components used in RTFLs:

Gear selection, pressure and flow control, auxiliary connections and services, open and closed centre hydraulic systems, mechanical and electrical control systems, pressure accumulation, different steering modes, position of controls, manual/automatically selected controls.

### Learning outcome:

#### 2. Understand the operating principles and applications of All-Terrain Vehicles and Rough Terrain Telescopic Forklifts

### Topics

2.1 Operating principles and features of different power units

2.2 Operating principles and features of transmission systems

## 2.3 Operating principles of engineering

### Topic 2.1

Learners will understand the features of:

- four stroke petrol and four stroke diesel power units: engine rpm, weight, fuel consumption, torque and emissions
- four stroke cycle, multi valve engine, direct fuel injection, carburettor, turbo
- chargers, lubrication system (pressure lubrication, splash feed).

### Topic 2.2

Learners will understand lines of drive, reduction gearbox, hydrostatic, torque converter, variator drives and centrifugal clutch:

Centrifugal transmission and CVT transmission: components within each transmission, power consumption, economy, safety, speed, ratios

- Torque converter and hydrostatic transmissions: speed, ratios, traction, gear selection, road/field characteristics, fuel consumption
- Locking differential and limited slip differential: traction, operator control of different differential systems, transmission of power/torque, safety.

### Topic 2.3

Learners will understand:

- ATV lines of drive, tyres, weight distribution
- RTFL lines of drive, steering systems, counter balance

## Learning outcome:

### 3. Prepare and operate All-Terrain Vehicles and Rough Terrain Telescopic Forklifts with associated attachments

#### Topics

- 3.1 Preparation of ATVs
- 3.2 Preparation of RTFL
- 3.3 Operation of ATVs
- 3.4 Operation of RTFL

### Topics 3.1 and 3.2

Learners will prepare ATVs and RTFLs, including:

- Removal from storage, cleaning, damage inspection, hitching, free movement of working components/controls, connection to power unit, wheel and tyre maintenance, braking and lighting requirements, lubrication, calibration
- Performing pre-start checks: decontaminated, safety overload devices, fuel/oil requirements, tyre pressures and conditions, lighting controls including brakes, belt tensions, general condition, security of all fittings and attachments
- Ensuring safety requirements are met: guards, safety rails, steps, safe attachment to power unit, component security, information decals.

### Topics 3.3 and 3.4

Learners will operate ATVs and RTFLs:

- Safe use at all times
- Site risk assessments to be carried out prior to operation,
- Appropriate PPE to be worn at all times,
- Driver to use operator instruction manual where necessary when carrying out a calibration check on the RTFL
- Special care to be taken regarding: machine speeds, loading of materials, machine output checks/quality of work, field procedures, terrain, ground conditions/undulations, public access.
- Due regard to the Health and Safety at Work etc Act (1974),
- Follow guidelines from: manufacturers' recommendations, dealer installation process, operator instruction manuals, manufacturer websites.

### Learning outcome:

#### 4. Maintain and service All-Terrain Vehicles and Rough Terrain Telescopic Forklifts

### Topics

4.1 Routine maintenance on ATVs

4.2 Routine maintenance on RTFLs

#### Topics 4.1 and 4.2

Learners will carry out routine maintenance on ATVs and RTFLs to include:

- **Operator maintenance**  
Manufacturers' service schedules/instructions, lubrication, cleaning, assessment of wear tolerances, component replacement disposal of waste.
- **Detect and carry out repairs**  
Framework inspection and repair, joints, distortion, fractures, leaking pipes, connections, electrical system.
- **Detection of potential faults**  
Uneven tyre pressures, incorrect oil and water levels, brake efficiency/balance incorrect, safe load indicator giving inaccurate readings, components exceeding wear tolerances.
- **Detection of defective parts**  
Belts, chains, bearings, loose pins, split hoses, broken bolts, fuel system, cooling system, hydraulic components.
- **Use documentation to record maintenance tasks**  
Check list, job card, date of service, type of service, replacement components used, vehicle recognition, serial and registration numbers, indication on machine of when future service is due.

## Guidance for delivery

This unit is designed for learners who will be handling materials in a variety of situations from off-road material movement to the use of loading devices to load and move materials. It will provide an insight into machine availability and capability, safe working practices and the servicing requirements of machines designed to handle materials.

The range of machinery covered should include CVT automatic ATVs and semi-automatic ATVs, as well as independent rear suspension and solid rear axle suspension systems found on ATVs. Rough Terrain Telescopic Forklifts with hydrostatic and torque converter style transmissions should also be used where possible.

The following considerations should be emphasised throughout delivery of this unit:

- safe, legal practices
- working to manufacturers' recommended procedures
- care of machines, tools and work areas
- attention to detail when recording information.

For Learning outcome 1, learners will understand the rationale behind the key components of selected All-Terrain Vehicles and Rough Terrain Telescopic. The learners will understand the safety, cost, practicality, efficiency, ergonomics and effect on overall performance associated with the developed key components found on ATVs and RTFLs.

In the delivery of Learning outcome 2, learners will also develop forward thinking for the need for basic tools that may be required on the work site where unscheduled maintenance tasks may have to be performed, hence the need for basic tools to be available on the vehicle or machine. Due to the complexity of modern vehicles and machines, it is essential that learners understand that maintenance of machines and vehicles must be carried out to manufacturers' recommendations. Service documentation should be available and accurately followed when performing tasks.

For Learning outcome 3, learners will prepare the machines (ATV, RTFL and attachments) for general operations and ensure that the attachment is matched and correctly connected to a suitable machine. Learners will explain safe operational procedures and carry out risk assessment prior to carrying out the specified tasks. Suitable procedures are to be demonstrated, regular checks to be made on machine performance and necessary adjustments made to both machine and power unit to meet given task criteria.

For Learning outcome 4, learners will carry out pre-storage maintenance and inspections to identify and rectify any faults. Wearing components will need to be assessed and replaced if wear limits are reached.

## Suggested learning resources

### **Books**

- |   |           |
|---|-----------|
| Farm Machinery<br>Published by: Blackwell Science, 1992<br>ISBN: 0-632-03159-X    | Culpin, C |
| Farm Machinery<br>Published by: Old Pond Publishing, 2005<br>ISBN: 978-1903366684 | Bell, B   |

Farm Workshop

Bell, B

Published by: Farming Press Books and Videos, 1992

ISBN: 978-0852362372

***Publications***

- Farmers Weekly
- Profi International
- Farm Ideas

***Websites***

- The welding Institute  
**<http://www.twi.co.uk>**
- City & Guilds  
**<http://www.cityandguilds.com>**
- Profi International  
**<http://www.profi.com>**
- Health and Safety Executive  
**<http://www.hse.gov.uk>**

## Unit 336

## Combinable crop production

<b>UAN:</b>	D/507/6876
<b>Level:</b>	3
<b>GLH:</b>	60

### What is this unit about?

This unit aims to introduce learners to the skills, knowledge and understanding needed for agricultural combinable crop production and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into employment in the agricultural sector or onto further or higher education.

The learner will study a range of major and niche cereal crops, combinable oilseeds and pulse crops grown in the UK. Topics will include principles of production and their practical application linking to the requirements of the current quality assured market. Planning and management skills demanded by such a system will be developed. Husbandry will be underpinned by an integrated husbandry approach.

### Learning outcomes

In this unit, learners will be able to

1. Know how to establish combinable crops
2. Plan the management of combinable crops
3. Understand how to harvest and store combinable crops
4. Understand combinable crop production costs and markets

## Scope of content

This section gives details of the scope of content to be covered in the teaching of the unit to ensure that all the learning outcomes can be achieved.

Crops could include wheat, barley, oats, triticale, rye, oilseed rape, linseed, grain peas, field beans and niche crops

## Learning outcome:

### 1. Know how to establish combinable crops

#### Topics

- 1.1 Crop planning, sites and rotations
- 1.2 Seeds
- 1.3 Cultivation and drilling systems

#### Topic 1.1

Learners will know how to plan crops for given situations including: identifying crops, plan appropriate cropping rotations selecting crops to match soil type. 3 Choose suitable varieties for markets, link to crop sub groups eg milling wheats and malting barleys. Rotation planning could include the 3 crop rule and Greening requirements.

#### Topic 1.2

Learners will select appropriate seed for sowing including: calculating seed rates, identify the role of seed dressings, compare certified seed with home saved seed.

#### Topic 1.3

Learners will understand establishment methods for selected crops including: equipment choice eg: stubble rakes, subsoilers, plough, deep and shallow non inversion tillage equipment, secondary cultivation equipment, combination drills, cultivator drills, direct drills, identify soil condition, select appropriate cultivation and drilling systems to achieve optimal establishment.

## Learning outcome:

### 2. Plan the management of combinable crops

#### Topics

- 2.1 Fertiliser programmes
- 2.2 Weed, pest and disease control procedures
- 2.3 Legislative and environmental guidelines

#### Topic 2.1

Learners will plan a fertiliser programme for named crops including: Identify the role of soil indices in planning fertiliser application and produce a soil nitrogen index for given situations. Identify crop nutrient requirements for given indices and produce an application plan for a given situation. Use of PLANET and RB 209 fertiliser manual.

#### Topic 2.2

Learners will describe weed, pest and disease control procedures appropriate to the production of combinable crops including:

- link to integrated crop management eg integrated control of blackgrass – cultivation, drilling timing, stale seed beds.
- use of thresholds for pollen beetle control in OSR.
- disease control in a winter wheat crop: timings, protectant and erradicant actions of fungicides, use of variety resistance.
- Extension Task: identify common pests, weeds and diseases of combinable crops and discuss their control in the context of their lifecycle eg: Blackgrass, brome, ryegrass, cleavers, poppies, charlock, Aphids as BYDV vectors, leatherjackets, orange blossom midge, cabbage stem flea beetle, pollen beetle, bruchid beetle, *Septoria tritici*, yellow rust, *fusarium*, *phoma*, *sclerotinia*, chocolate spot.

### Topic 2.3

Learners will describe legislative and environmental guidelines relevant to named crops including:

- Control of Substances Hazardous to Health (COSHH);
- Nitrate Vulnerable Zones (NVZ);
- Plant Protection Products (sustainable use) Regulations 2012;
- Local Environmental Risk Assessments for Pesticides (LERAPs);
- Certificates of competence and professional qualifications eg Pa 1/2 4 11, BASIS and FACTS. GAEC's and SMR's

## Learning outcome:

### 3. Understand how to harvest and store combinable crops

#### Topics

3.1 Harvesting operations

3.2 Storage conditions

3.3 Control methods of storage pests and diseases

### Topic 3.1

Learners will explain harvesting operations for crops including:

- identify pre-harvest treatments and when you use them
- identify how to assess when crops are ready to harvest
- explain the function of combine harvester and the methods of adjustment to ensure efficient harvesting and achieving a suitable sample quality. Eg bed setting, drum setting, sieve settings and grain loss assessments.
- explain the requirements for transport of grain from field to store eg: tractor and trailer or chased bin and lorry, requirements of Red Tractor quality assurance scheme.

### Topic 3.2

Learners will discuss suitable storage conditions for crops including:

- Identify the essential requirements of a grain store and discuss how different buildings achieve this Eg flat stores, bin stores, drying systems, blowing systems.
- Describe the management of grain in store to maintain quality and meet Red Tractor standards, to include store preparation, moisture content of grain/seed, temperature control, monitoring systems, record keeping
- Compare on farm storage with co-operative storage.

### Topic 3.3

Learners will evaluate control methods of storage pests and diseases including:

- identify common pests of stored grain and describe control methods eg: Saw toothed grain beetle, grain weevil, flour mite, rats mice, birds
- cooling and drying to control pests
- use of insecticides, rat baiting systems

### Learning outcome:

#### 4. Understand combinable crop production costs and markets

### Topics

4.1 Market requirements

4.2 Crop yields analysis

4.3 Market prices and production costs

### Topic 4.1

Learners will describe market requirements for given combinable crops including:

- the quality specifications for different grain markets eg. Breadmaking wheat, biscuit wheat, malting barley,
- *High Oleic, Low Linolenic (HOLL)* oil seed rape,
- beans exported for human consumption.
- local markets for grain.

### Topic 4.2

Learners will analyse crop yields including:

reasons for season to season fluctuation, field to field variations and within field yield variation. Eg weather, soil type, rotation, previous cropping, drainage, localized pest attack.

### Topic 4.3

Learners will compare market prices and production costs for different crops including:

- the costs of production of different combinable crops – extension task to consider impact on cashflow.
- seasonal fluctuations in grain price and the different values of different crops (eg: yield and price).
- gross margins for different combinable crops.

### Guidance for delivery

This unit will involve practical delivery, theory sessions, and visits to suitable locations; it will also have links to industrial experience placements. Tutors need to offer the learner as wide a selection of learning opportunities as possible. This will involve lectures, regular crop walks, farm practical work experience, talks, visits (eg local machinery dealers), and use of an agronomist if possible. In addition, the tutor needs to ensure that all relevant crops are included: wheat, barley, oats, triticale, rye, oilseed rape, linseed, grain peas, field beans and niche crops (concentrating more on the crops typical to their locality). Learners will need access to farm recording data and relevant previous crop history.

Crop walks both in taught time and learners' own time are to be maximised. Health and safety must be regularly enforced especially with regard to machinery and chemicals.

Learning outcome 1 will need to be delivered at the start of the unit. In the autumn, learners may well have been working and involved in autumn cultivations and seedbed preparation. Crop walks at this time of year will primarily involve observing cultivations and seedbeds for specific crops in the range. Alternatively, spring-sown crops would equally lend themselves to observation for the purposes of this learning outcome.

Learning outcome 2 will likely be all year round. Crop walks and visits to local arable farms can be used to cover this outcome. Tutors could ensure that the learner has access to a farm's fertiliser programme for selected crops. An introduction to a farm agronomist would also be useful. Learners will need to have access to soil analysis data, as well as fertiliser software such as MANNER or PLANET and/or the RB209 book. Weeds, pests and diseases can be identified throughout the year using crop walks. Lectures could also help to identify current legislation, thresholds and weeds, pests and diseases not found on practical sessions

Learning outcome 2 links to unit 304 Agricultural Crop Production, topic 2.2.

Learning outcome 3 will need to look at previous crop history, since learners will not be in college during the summer to monitor and gather current crop harvesting information. Learners could visit a range of grain stores to help them evaluate combinable crop storage and drying systems.

Classroom based activities will be needed to develop and understanding of harvest requirements and audiovisual material to highlight storage pests and diseases not identified on grain store visits.

Learning outcome 2 links to unit 304 Agricultural Crop Production, topic 4.2.

Learning outcome 4 will need to look at previous crop history, since learners will not be in college during the summer to monitor and gather current and historic market information. The learner will need access to farm information and current market prices, such as those in the regular farming press or on the internet. Classroom work and/or independent study will be needed to explain specific market requirements of combinable crops. A visit from a grain trader would also be useful

## Suggested learning resources

### Books

Arable plants- a field guide

Wilson, P. King, M.

Published by: Princeton University Press, 2004

ISBN 978-1903657027

Resource management: soil

Davies, D. Finney, B, Eagle D.

Published by: Farming Press , 2001

ISBN 978-0852365595

Lockhart & Wiseman's Crop Husbandry including grassland

Finch, H. Samuel, A. Lane, G.

Published by: Woodhead publishing, 9<sup>th</sup> Edition 2014

ISBN 978-1782423713

Farm Machinery.

Bell, B.

Published by: Old Pond Publishing, 2005

ISBN 978-1903366684

Farm Management Pocketbook, 45th Edition. Nix, J.  
Published by: Agro Business Consultants Ltd, 2015  
ISBN 978-0957693913

The Agricultural Notebook, 20th Edition. Soffe, R.  
Published by: Wiley-Blackwell, 2003  
ISBN 978-0632058297

Fertiliser Manual RB209, 8th Edition. DEFRA  
Published by: The Stationery Office Books, 2010  
ISBN 978-0112432869- also on line

UK Pesticide guide 2015, 28<sup>th</sup> Edition Lainsbury, M.  
Published by: CABI Publishing,  
ISBN 978-1780645773

The Agricultural Budgeting and Costing Book, 79 Edition ABC  
Published by: Agro Business Consultants. 2014,  
ASIN: B00EGO3HQK

### **Journals**

- Crops
- Farm Contractor
- Farmers Guardian
- Farmers Weekly
- Farm Business

### **Websites**

- Department for Environment, Food and Rural Affairs [www.defra.gov.uk](http://www.defra.gov.uk)
- DEFRA Basic payment guidance <https://www.gov.uk>
- Farmers Weekly Interactive [www.fwi.co.uk](http://www.fwi.co.uk)
- Home Grown Cereals Authority [www.hgca.com](http://www.hgca.com)
- HGCA Grain storage guide [www.hgca.com](http://www.hgca.com)
- UK website for Syngenta Crop Protection [www.newfarmcrops.co.uk](http://www.newfarmcrops.co.uk)
- National Institute of Agricultural Botany [www.niab.com](http://www.niab.com)
- Welsh Assembly Government [www.wales.gov.uk](http://www.wales.gov.uk)
- Scottish Executive Environment and Rural Affairs Department [www.scotland.gov.uk](http://www.scotland.gov.uk)
- Department of Agriculture and Rural Affairs (Northern Ireland) [www.dardni.gov.uk](http://www.dardni.gov.uk)
- Combine World [www.combineworld.co.uk](http://www.combineworld.co.uk)

## Appendix 1 Sources of general information

The following documents contain essential information for centres delivering City & Guilds qualifications. They should be referred to in conjunction with this handbook. To download the documents and to find other useful documents, go to the **Centres and Training Providers homepage** on [www.cityandguilds.com](http://www.cityandguilds.com).

### *City & Guilds Centre Manual*

This document provides guidance for organisations wishing to become City & Guilds approved centres, as well as information for approved centres delivering City & Guilds qualifications. It covers the centre and qualification approval process as well as providing guidance on delivery, assessment and quality assurance for approved centres.

It also details the City & Guilds requirements for ongoing centre and qualification approval, and provides examples of best practice for centres. Specifically, the document includes sections on:

- the centre and qualification approval process
- assessment, internal quality assurance and examination roles at the centre
- registration and certification of candidates
- non-compliance and malpractice
- complaints and appeals
- equal opportunities
- data protection
- management systems
- maintaining records
- internal quality assurance
- external quality assurance.

### *Our Quality Assurance Requirements*

This document explains the requirements for the delivery, assessment and awarding of our qualifications. All centres working with City & Guilds must adopt and implement these requirements across all of their qualification provision. Specifically, this document:

- specifies the quality assurance and control requirements that apply to all centres
- sets out the basis for securing high standards, for all our qualifications and/or assessments
- details the impact on centres of non-compliance

The **centre homepage** section of the City & Guilds website also contains useful information on

- **Walled Garden:** how to register and certificate candidates on line
- **Events:** dates and information on the latest Centre events
- **Online assessment:** how to register for e-assessments.

## Useful contacts

### UK learners

General qualification information

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E: [learnersupport@cityandguilds.com](mailto:learnersupport@cityandguilds.com)

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### International learners

General qualification information

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E: [intcg@cityandguilds.com](mailto:intcg@cityandguilds.com)

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### Centres

Exam entries, Certificates, Registrations/enrolment, Invoices, Missing or late exam materials, Nominal roll reports, Results

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E: [centresupport@cityandguilds.com](mailto:centresupport@cityandguilds.com)

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### Single subject qualifications

Exam entries, Results, Certification, Missing or late exam materials, Incorrect exam papers, Forms request (BB, results entry), Exam date and time change

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E: [singlesubjects@cityandguilds.com](mailto:singlesubjects@cityandguilds.com)

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### International awards

Results, Entries, Enrolments, Invoices, Missing or late exam materials, Nominal roll reports

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E: [intops@cityandguilds.com](mailto:intops@cityandguilds.com)

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### Walled Garden

Re-issue of password or username, Technical problems, Entries, Results, e-assessment, Navigation, User/menu option, Problems

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E: [walledgarden@cityandguilds.com](mailto:walledgarden@cityandguilds.com)

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### Employer

Employer solutions, Mapping, Accreditation, Development Skills, Consultancy

E: [business@cityandguilds.com](mailto:business@cityandguilds.com)

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## **City & Guilds**

**5-6 Giltspur Street**

**London EC1A 9DE**

**[www.cityandguilds.com](http://www.cityandguilds.com)**

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