

Cambridge TECHNICALS LEVEL 3

APPLIED SCIENCE

Cambridge
TECHNICALS
2016

Unit 19 – Crop production and soil science
DELIVERY GUIDE

Version 2

CONTENTS

Introduction	3
Related Activities	4
Key Terms	5
Misconceptions	6
Suggested Activities:	
Learning Outcome (LO1)	8
Learning Outcome (LO2)	12
Learning Outcome (LO3)	15
Learning Outcome (LO4)	18

INTRODUCTION

This Delivery Guide has been developed to provide practitioners with a variety of creative and practical ideas to support the delivery of this qualification. The Guide is a collection of lesson ideas with associated activities, which you may find helpful as you plan your lessons.

OCR has collaborated with current practitioners to ensure that the ideas put forward in this Delivery Guide are practical, realistic and dynamic. The Guide is structured by learning outcome so you can see how each activity helps you cover the requirements of this unit.

We appreciate that practitioners are knowledgeable in relation to what works for them and their learners. Therefore, the resources we have produced should not restrict or impact on practitioners' creativity to deliver excellent learning opportunities.

Whether you are an experienced practitioner or new to the sector, we hope you find something in this guide which will help you to deliver excellent learning opportunities.

If you have any feedback on this Delivery Guide or suggestions for other resources you would like OCR to develop, please email resources.feedback@ocr.org.uk.

OPPORTUNITIES FOR ENGLISH AND MATHS SKILLS DEVELOPMENT AND WORK EXPERIENCE

We believe that being able to make good progress in English and maths is essential to learners in both of these contexts and on a range of learning programmes. To help you enable your learners to progress in these subjects, we have signposted opportunities for English and maths skills practice within this resource. We've also identified any potential work experience opportunities within the activities. These suggestions are for guidance only. They are not designed to replace your own subject knowledge and expertise in deciding what is most appropriate for your learners.



English



Maths



Work

Please note

The timings for the suggested activities in this Delivery Guide **DO NOT** relate to the Guided Learning Hours (GLHs) for each unit.

Assessment guidance can be found within the Unit document available from www.ocr.org.uk.

The latest version of this Delivery Guide can be downloaded from the OCR website.

UNIT AIM

The development of human society has been dependent on growing crops. With agriculture, enough food could be produced to sustain an urban society. The first city, Ur, was dependent on the mutation of grass into wheat.

In the past 6,000 years, agriculture has contributed to how our society has been able to develop. So it is of fundamental importance that as a society we understand both crop production and how to maintain healthy soil by protecting it from possible threats such as erosion, organic matter decline, compaction and contamination.

This unit will develop your knowledge and understanding of the biological concepts of plant growth as well as the maintenance of soil content, structure and methods to prevent erosion.

You will also gain laboratory practical skills investigating the structure of plants, the factors that affect plant growth and soil quality that supports crop production.

Unit 19 Crop production and soil science

LO1	Understand how common crops are grown for commercial production in the UK
LO2	Understand factors affecting the growth of crops
LO3	Be able to monitor the growth of a crop plant species
LO4	Be able to carry out soil testing

To find out more about this qualification, go to: <http://www.ocr.org.uk/qualifications/vocational-education-and-skills/cambridge-technicals-applied-science-level-3-certificate-extended-certificate-foundation-diploma-diploma-extended-diploma-05847-05849-05879-05874-2016-suite/>

Cambridge
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2016

2016 Suite

- New suite for first teaching September 2016
- Externally assessed content
- Eligible for Key Stage 5 performance points from 2018
- Designed to meet the DfE technical guidance

RELATED ACTIVITIES

The Suggested Activities in this Delivery Guide listed below have also been related to other Cambridge Technicals in Applied Science units/Learning Outcomes (LOs). This could help with delivery planning and enable learners to cover multiple parts of units.

This unit (Unit 19)	Title of suggested activity	Other units/LOs	
LO1	Organic farming or integrated farming?	Unit 19 Crop production and soil science	LO2 Understand factors affecting the growth of crops
	Is it ethical to maximise food production?	Unit 1 Science fundamentals	LO3 Understand cell organisation and structures
		Unit 13 Environmental surveying	LO1 Understand environmental impacts of human activity and natural processes
	How best to grow tomatoes in the UK?	Unit 19 Crop production and soil science	LO3 Be able to monitor the growth of a crop plant species
LO2	What are the optimum fertility requirements of soil for growth?	Unit 19 Crop production and soil science	LO4 Be able to carry out soil testing
	What are the environmental factors affecting crop growth?	Unit 16 Waste management	LO1 Understand how to manage waste
		Unit 19 Crop production and soil science	LO1 Understand how common crops are grown for commercial production in the UK
	Can our dependence on pesticides be reduced?	Unit 14 Environmental management	LO2 Be able to identify pollution in the environment LO3 Understand how legislation, regulation and agreements impact on managing natural and built environments
		Unit 19 Crop production and soil science	LO1 Understand how common crops are grown for commercial production in the UK
	What is genetic modification?	Unit 1 Science fundamentals	LO3 Understand cell organisation and structures
		Unit 5 Genetics	LO4 Understand the impact of an innovation in an application of genomics
Is genetic modification wrong?	Unit 19 Crop production and soil science	LO1 Understand how common crops are grown for commercial production in the UK	
LO3	What measurements indicate plant growth?	Unit 3 Analytical techniques	LO1 Be able to use mathematical techniques to analyse data
	How does pH affect growth?	Unit 2 Laboratory techniques	LO1 Understand the importance of health and safety and quality systems to industry
	How do nutrients affect plant growth?	Unit 2 Laboratory techniques	LO1 Understand the importance of health and safety and quality systems to industry LO4 Be able to examine and record features of biological samples
	How does temperature affect growth?	Unit 2 Laboratory techniques	LO1 Understand the importance of health and safety and quality systems to industry
LO4	How is soil sampled?	Unit 13 Environmental surveying	LO3 Be able to use field and laboratory techniques to conduct environmental investigations
	How is soil tested?	Unit 2 Laboratory techniques	LO1 Understand the importance of health and safety and quality systems to industry LO5 Be able to identify cations and anions in samples
	What mathematical analysis techniques indicate soil characteristics?	Unit 3 Analytical techniques	LO1 Be able to use mathematical techniques to analyse data
	What are the benefits and disadvantages of various testing equipment?	Unit 2 Laboratory techniques	LO5 Be able to identify cations and anions in samples

KEY TERMS

Explanations of the key terms used within this unit, in the context of this unit	
Key term	Explanation
Accuracy	A measurement result is considered accurate if it is judged to be close to the true value; the degree of accuracy is a measure of how close a reading (such as the value of resistance obtained from experiment) is to the true (calculated) value.
Anomaly (outlier)	A value in a set of results that is judged not to be part of the inherent variation; a result which does not agree with other results in the data set, such as a result which lies well off the line of best fit.
Calculate	Generate a numerical answer, with workings shown; calculate correctly to the appropriate numbers of significant figures – note this will depend on the sensitivity of the meters used and the precision with which the measurement can be taken.
Precision	A quality denoting the closeness of agreement (consistency, low variability of) between measured values obtained by repeated measurements; how close the agreement is between measured values, such as titration results: 1.30cm ³ ; 1.20cm ³ ; 1.25cm ³ .
Range (of a variable)	The maximum and minimum values of the independent or dependent variables; e.g. choosing to use pH values from pH2 to pH12.
Record	Appropriate measurements, values or observations recorded in a relevant format; e.g: <ul style="list-style-type: none">• measurements taken are relevant to the investigation• measurements are reliable (can be repeated for the same accuracy)• measurements read correctly (eye in correct position, enough light)• measurements are recorded clearly and with correct units.
Repeatability	Precision obtained when measurement results are produced in one laboratory, by a single operator, using the same equipment under the same conditions, over a short timescale; how close (precise) values are when repeated by the same person with the same equipment.
Reproducibility	Precision obtained when measurement results are produced by different laboratories (and therefore by different operators using different pieces of equipment); how close (precise) values are when repeated by different people using different equipment.
Resolution	Smallest change in the quantity being measured (input) of a measuring instrument that gives a perceptible change in the indication (output); smallest change in a value that can be detected by an instrument. For example, in a titration it would be usual to use a burette and record readings to 0.5 division on the scale.
Select	Carefully choose as being the most suitable for a task or purpose. For example, if 9ml of liquid is to be measured out then a 10ml measuring cylinder is used rather than a 100ml cylinder so greater accuracy can be achieved when measuring the liquid. A 1ml cylinder is not used as nine measurements would need to be taken so increasing the chance of errors.
Set up	Prepare a system or set of equipment for operation. For example, practical equipment might be: <ul style="list-style-type: none">• set up on a stable platform (table, or appropriate stand)• set up in enough space to carry out measurements• set up so that it can be reached easily and with correct line of sight when taking measurements.
Uncertainty	Interval within which the true value can be expected to lie, with a given level of confidence or probability; the likelihood of a measurement falling close to the true value. A big range in the measurements of the dependent variable implies a high level of uncertainty. Use of range bars will help to show level of uncertainty.
Validity (of experimental design)	Suitability of the investigative procedure to answer the question being asked.
Valid conclusion	A conclusion supported by valid data, obtained from an appropriate experimental design and based on sound reasoning.

MISCONCEPTIONS

Some common misconceptions and guidance on how they could be overcome		
What is the misconception?	How can this be overcome?	Resources which could help
<p>There are only limited, low-paid roles within the farming industry</p>	<p>Learners may not realise the range of opportunities that there are in the farming industry. Tutors could use career pathways as an introduction into the unit, so making the course more appealing as the individual learner could see a possible career that is of interest to them.</p> <p>As the average age of the workforce in the farming industry is 58, the industry will require 60,000 new employees by 2020 with some farm management roles, at present, paying in excess of £60,000 per year.</p> <p>The agricultural industry is supported by a variety of academic backgrounds such as science, technology, engineering and maths. Those leaving university and gaining a place on an agricultural graduate scheme can expect to earn the same amount as a graduate in the business sector but because of the restricted level of competition an agricultural graduate is more likely to achieve rapid career progression.</p> <p>There is a variety of opportunities such as communications and business management, and including farm and herd managers, feed nutritionists, agronomists, research scientists and specialist mechanical engineers as well as hands-on farming roles.</p> <p>To broaden learners' appreciation of possible career pathways, learners could select and research a role within the farming industry.</p>	<p>Drive to inspire young to choose farming career Farmers Weekly http://www.fwi.co.uk/news/drive-to-inspire-young-to-choose-farming-career.htm Article about the promotion of farming to schoolchildren.</p> <p>Explore your career Bright Crop http://www.brightcrop.org.uk/ A site dedicated to helping young people to explore the vast range of career opportunities in the agriculture industry.</p>
<p>Farming is a second-rate family industry</p>	<p>Learners may not appreciate the importance of the farming industry to the nation. Tutors could emphasise that farming is a business and that the agricultural food industry plays a vital economic role in the UK and supports 3.6 million jobs and contributes more than £97 billion to the economy. Tutors, using the section headings from the Oxford Farming Conference Report, could show how farming can be seen as a business.</p> <p>Learners could compare the relevant statistics of a variety of UK industries and match them against the farming industry to see the importance of farming industry amongst UK industries.</p>	<p>The Best British Farmers – What gives them the edge? Oxford Farming Conference http://www.ofc.org.uk/files/ofc/papers/ofcreport2015.pdf The 2015 Oxford Farming Conference Report gives an overview on how British farmers can maintain a vibrant industry.</p> <p>Industrial Strategy: UK Sector Analysis Department for Business, Innovation and Skills https://www.gov.uk/government/publications/industrial-strategy-uk-sector-analysis Evidence on the sectors that will contribute to future UK economic growth and employment.</p>

Some common misconceptions and guidance on how they could be overcome		
What is the misconception?	How can this be overcome?	Resources which could help
Farmers check on crop growth just by eye when walking across fields	<p>Learners may not know about the technological strides made in crop management such as remote sensing using satellites and/or ground-based sensors. Tutors could use this to support the idea of farming as a business, and an industry with many diverse roles.</p> <p>Tutors could show the videos found on the Farmers Weekly web page and explain the principle and the benefits of remote sensing. This will link into the use of fertilisers when improving soil health.</p>	<p>Fertiliser 2: Remote sensing Farmers Weekly http://www.fwi.co.uk/academy/lesson/fertiliser-2-remote-sensing Article including videos of tractors spraying nitrogen fertiliser with the rate of spray controlled by remote sensors.</p>
Organic food is chemical free	<p>Learners tend to think organic foods are chemical-free; however, foods certified as organic can be grown with the use of chemicals, albeit from a list approved by various organisations across Europe and the UK.</p> <p>Learners could examine a range of food labels and list the chemicals found in organic foods, while noting the variety of foods that are available. This could serve as an introduction into organic farming.</p> <p>Food labels are explained by the Food Standards Agency. Labels can be checked against the requirements laid down by government regulation and explained. Learners can then focus on organic food labelling and packaging as explained from the point of view of trading standards.</p> <p>Examining food labels would be a natural link into understanding how common crops are grown for commercial production in the UK (LO1).</p>	<p>Just does what organic mean? BBC News http://news.bbc.co.uk/1/hi/business/8415576.stm Public perception of organic foods.</p> <p>Food labels Food Standards Agency http://tna.europarchive.org/20120419000433/http://www.food.gov.uk/multimedia/pdfs/foodlabels0808.pdf Explanation of food labelling.</p> <p>Food labelling and packaging UK Government https://www.gov.uk/food-labelling-and-packaging/overview An overview of what a food label must contain.</p> <p>Labelling and describing organic food Hampshire Trading Standards http://www3.hants.gov.uk/tradingstandards/tradingstandards-business/ts-business-food/tsguide-organic-products.htm Describes what is organic food and how this can then be labelled.</p>
	<p>The misconceptions can be used as an introduction to the unit, by emphasising that farming is a diverse, dynamic, up-to-date industry:</p> <ul style="list-style-type: none"> • the diversity of farming is shown by the vast variety of job roles • the dynamism of farming can be judged when compared against other UK businesses • remote sensing demonstrates how technology is used in farming • examining what we eat brings home how important the farming industry is to all of us. 	

SUGGESTED ACTIVITIES

LO No:	1		
LO Title:	Understand how common crops are grown for commercial production in the UK		
Title of suggested activity	Suggested activities	Suggested timings	Also related to
What crops do we grow in the UK?	<p>Tutors could ask learners to research crops grown across the UK. Tutors could direct learners to relevant organisations such as Defra to obtain statistical information and discuss how the information could be visualised.</p> <p>Learners could produce a series of UK maps with crop production quantities as well as indicating the geography and climate relevant to the production.</p> <p>Agriculture in the United Kingdom Gov.uk https://www.gov.uk/government/collections/agriculture-in-the-united-kingdom Links to annual statistics about UK agriculture. The annual publications include data on farm incomes, land use, livestock numbers, prices, production of key commodities (e.g. wheat, milk, vegetables), overseas trade, organic farming and the environment.</p>	2 hours	

Title of suggested activity	Suggested activities	Suggested timings	Also related to
<p>How does geographical location affect the type of crops grown in the UK?</p> 	<p>Monthly crop production operations can vary considerably according to weather and geographical location, with crop production being measured in yield per hectare.</p> <p>Tutors could discuss with learners which organisations are more likely to produce reliable crop information. Learners could select a geographical area and produce a series of charts showing the variety of crop production throughout a yearly cycle.</p> <p>Farming Statistics: Provisional crop areas, yields and livestock populations: At June 2014 - United Kingdom Department for Environment Food and Rural Affairs (Defra) https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/364157/structure-jun2013prov-UK-16oct14.pdf Crop yields for 2014.</p> <p>UK food harvest: What's produced in the UK? BBC http://www.bbc.co.uk/food/0/23980594 Summary of crops grown in the UK, shown on a map.</p> <p>Environmental Factors: What and How Do They Affect Crop Growth and Yield CropsReview.Com http://www.cropsreview.com/environmental-factors.html Article about the impact of environmental factors on crop yields.</p> <p>Maps of crop areas in 2000 and 2010 across England Defra https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/183108/defra-stats-foodfarm-landuselivestock-june-detailedresults-cropmaps111125.pdf Series of maps showing crop production in the UK.</p> <p>UK farming statistics The Poultry Site http://www.thepoultrysite.com/reports/?id=1385 Statistical charts of agricultural production.</p>	2 hours	

Title of suggested activity	Suggested activities	Suggested timings	Also related to
<p>Organic farming or integrated farming?</p> 	<p>Farming practices have needed to evolve over time especially with the increase in population and the decrease in food self-sufficiency. With the move away from the countryside and the urbanisation of a manufacturing population, the general population has become divorced from farming practices.</p> <p>To make informed decisions concerning the use of the countryside people should be aware of how food is produced by farming. Tutors could discuss with learners their initial feelings on the countryside and whether farming should have any special considerations.</p> <p>Learners could research the different farming techniques and list the advantages and disadvantages of each technique.</p> <p>Benefits or Advantages of Integrated Farming System Agriinfo.in http://www.agriinfo.in/?page=topic&superid=1&topicid=684 Information on farming systems and sustainable farming.</p> <p>Organic Living Soil Association http://www.soilassociation.org/Whatisorganic/Organicfarming Organic farming facts.</p>	1 hour	Unit 19 LO2
<p>Is it ethical to maximise food production?</p> 	<p>To maximise crop production farmers use various practices; some of these practices may lead to long-term alterations to the soil as well as impacting on the environment. There is a public debate on which farming practices should be used: whether maximum food production is more important than the stewardship of the environment.</p> <p>Having researched farming systems, learners could debate the question: maximum food production or environmental stewardship?</p>	1 hour	Unit 1 LO3 Unit 13 LO1

Title of suggested activity	Suggested activities	Suggested timings	Also related to
<p>How best to grow tomatoes in the UK?</p> 	<p>Certain farming systems produce one commercial crop. This is an opportunity for learners to focus on one crop. Tutors may suggest a crop such as tomatoes as there is a wide range of different tomatoes readily available.</p> <p>Learners could research the various methods of growing tomatoes in the UK, giving the advantages and disadvantages of each one.</p> <p>Learners' knowledge of tomatoes may support the concepts of genetic modification covered in Learning Outcome 2.</p> <p>Growing In Water – Hydroponics Greenhouse Sensation http://www.greenhousesensation.co.uk/planters-and-pots/hydroponic-growing-in-water/?gclid=CNzJhPKw4MkCFagewwodOakEzA Products that support a hydroponic growing system.</p> <p>How to grow tomatoes (without a greenhouse!) Eden Project https://www.edenproject.com/learn/for-everyone/how-to-grow-tomatoes-without-a-greenhouse Tips on how to grow tomatoes outside, when growers don't have the luxury of a greenhouse.</p> <p>Tomato Facts British Tomato Growers' Association http://www.britishtomatoes.co.uk/tomato-facts/ There is a section discussing greenhouse or outdoor growing.</p>	2 hours	Unit 19 LO3

SUGGESTED ACTIVITIES

LO No:	2		
LO Title:	Understand factors affecting the growth of crops		
Title of suggested activity	Suggested activities	Suggested timings	Also related to
What are the optimum fertility requirements of soil for growth?	<p>Maximising commercial plant growth is extremely important in ensuring our growing population has enough food. Scientists use soil quality indicators to evaluate how well a soil functions.</p> <p>Tutors could ask learners to research and identify the physical, chemical and biological indicators that can be used to assess the quality of a soil.</p> <p>Soil Quality Indicators: Measures of Soil Functional State Soil Quality for Environmental Health http://soilquality.org/indicators.html Indicators used to monitor soil quality.</p>	1 hour	Unit 19 LO4
What are the environmental factors affecting crop growth?	<p>Soil health, which is vital for crop production, is dependent on environmental conditions and farming practices.</p> <p>Learners could research and identify the environmental factors that affect crop growth.</p> <p>Soil management standards for farmers Environment Agency https://www.gov.uk/guidance/soil-management-standards-for-farmers Soil use and cross compliance.</p>	1 hour	Unit 16 LO1 Unit 19 LO1
How can fertilisers improve yield?	<p>A range of factors can affect crop growth; one such is mineral nutrients.</p> <p>Learners could research and identify the macronutrients and micronutrients that affect plant growth and then how the correct levels of mineral nutrients can be maintained.</p> <p>Fertiliser recommendations for crops Environment Agency https://www.gov.uk/guidance/fertiliser-recommendations-for-crops Crop fertiliser recommendations from the Defra Fertiliser Manual RB209; covers choosing, applying and managing fertilisers.</p> <p>British survey of fertiliser practice 2013 Defra https://www.gov.uk/government/statistics/british-survey-of-fertiliser-practice-2013 Using fertilisers on a farm.</p>	2 hours	

Title of suggested activity	Suggested activities	Suggested timings	Also related to
Can our dependence on pesticides be reduced?	<p>Although pesticides can increase growth production by eliminating pests, their side effects can be harmful to the environment.</p> <p>Learners could make recommendations on how pesticides could be reduced, giving the advantages but also any disadvantages.</p> <p>Use of advanced technology can reduce pesticides The Ecological Council http://www.ecocouncil.dk/releases/articles-pressreleases/agriculture-and-water-articles-and-press-releases/1839-use-of-advanced-technology-can-reduce-pesticides Article on how the reduction of pesticides in agriculture is necessary to stop the decline in biodiversity and to ensure a more resource efficient approach.</p> <p>Pesticide Reduction United States Environmental Protection Agency http://www3.epa.gov/region5/waste/solidwaste/p2pages/pdfs/tb-pesticides.pdf Handout on how the use of pesticides can be reduced.</p> <p>Breaking the Pesticide Chain Friends of the Earth http://www.foe.co.uk/sites/default/files/downloads/breaking_the_pesticide_chain.pdf Report on how the use of pesticides can be reduced.</p>	1 hour	Unit 14, LO2, LO3 Unit 19 LO1
What is genetic modification?	<p>Farmers need to maintain the biodiversity of plant species for agriculture. One way is to use the technique of genetic engineering in plants, and it can be used to introduce desirable genes and characteristics into commercially grown plants.</p> <p>Learners could identify a range of GM plants using the GMO database.</p> <p>GMO Database search GMO Compass http://www.gmo-compass.org/eng/gmo/db/ A database that contains information about genetically modified plants that are approved or waiting to be approved by the EU.</p>	2 hours	Unit 1 LO3 Unit 5 LO4 Unit 19 LO1

Title of suggested activity	Suggested activities	Suggested timings	Also related to
<p>Is genetic modification wrong?</p> 	<p>Tutors could suggest that learners should understand some of the scientific, moral and ethical objections to genetic engineering.</p> <p>Genetically modified crops are plants used in agriculture in which the DNA has been modified using genetic engineering techniques. In most cases this aims to introduce a new trait into the plant which does not occur naturally in the species.</p> <p>Following on from their studies on farming practices and the present use of GM plants and crops learners could debate the advantages and disadvantages of genetic engineering.</p> <p>Exploring ethical issues in biology and medicine: Concerns about GM crops Nuffield Council on Bioethics http://nuffieldbioethics.org/report/gm-crops-developing-countries-2/concerns-gm-crops/ Conclusions on the concerns surrounding the use of GM crops.</p>	1 hour	Unit 19 LO1

SUGGESTED ACTIVITIES

LO No:	3		
LO Title:	Be able to monitor the growth of a crop plant species		
Title of suggested activity	Suggested activities	Suggested timings	Also related to
What conditions support crop growth?	<p>Tutors could direct learners to relevant sources so learners obtain a general overview of conditions needed for successful crop growth.</p> <p>Requirements for Plant Growth University of Illinois http://www.aces.uiuc.edu/vista/html_pubs/hydro/require.html An investigation into plant growth using hydroponics.</p> <p>This is an opportunity for learners to visit plant nurseries, allotment associations or garden centres to gather information on how commercial enterprises maintain conditions for optimum plant growth.</p>	1 hour	
How could conditions be controlled to vary plant growth?	<p>Learners will be carrying out practical investigations on the conditions that affect plant growth. Before they carry out these investigations tutors should be sure learners have the necessary practical investigative abilities.</p> <p>Tutors could direct learners to a series of practical investigations at a relevant standard. Learners could examine a range of practical investigations.</p> <p>Tutors could discuss how an practical investigation is constructed and make sure learners fully understand the relevant key words that might be used in an investigation write-up.</p> <p>Learners could then design investigative practicals into plant growth covering the requirements of the specifications.</p> <p>A-level set practicals – factors affecting rates of photosynthesis Science & Plants for Schools http://www.saps.org.uk/secondary/teaching-resources/1354-a-level-set-practicals-factors-affecting-rates-of-photosynthesis A range of practical investigations.</p>	3 hours	
What measurements indicate plant growth?	<p>Tutors could discuss the mathematical techniques required such as measurement, accuracy, precision, significant numbers, statistical evaluation.</p> <p>Learners could carry out a number of mathematical techniques based on questions set by the tutor to consolidate their mathematical understanding.</p>	2 hours	Unit 3 LO1



Title of suggested activity	Suggested activities	Suggested timings	Also related to
How does pH affect growth?	<p>Before learners actually carry out specific investigations they need to research the effects of specific conditions.</p> <p>Tutors could direct learners to useful research so they have an understanding of the effect of pH on plant growth.</p> <p>From their understanding of practical investigations learners could design an investigation into pH effect on crop growth. Learners could consider the necessary equipment, the measurements to be taken and the accuracy to which measurements can be taken.</p> <p>Managing factors that can limit plant growth Agriculture Victoria http://agriculture.vic.gov.au/agriculture/dairy/pastures-management/fertilising-dairy-pastures/managing-factors-that-can-limit-plant-growth Explanations of the factors that affect plant growth.</p>	1 hour	Unit 2 LO1
How do nutrients affect plant growth?	<p>Tutors could direct learners to useful research so they have an understanding of the effect of nutrients on plant growth.</p> <p>From their understanding of practical investigations learners could design an investigation into nutrient effect on crop growth. Learners could consider the necessary equipment, the measurements to be taken and the accuracy to which measurements can be taken.</p> <p>Fertiliser recommendations for crops Environment Agency https://www.gov.uk/guidance/fertiliser-recommendations-for-crops Crop fertiliser recommendations from Defra including choosing, applying and managing fertilisers.</p> <p>Investigating fertilisers: the effects of minerals on plant growth Science & Plants for Schools http://www.saps.org.uk/secondary/teaching-resources/105-investigating-fertilisers-the-effects-of-different-levels-of-minerals-on-plant-growth Investigation into plant growth and mineral nutrients.</p> <p>What is Plant Nutrition vs Animal Nutrition, Notes on Its Historical Development CropsReview.com http://www.cropsreview.com/plant-nutrition.html Summary of requirements for plant growth.</p>	1 hour	Unit 2, LO1, LO4

Title of suggested activity	Suggested activities	Suggested timings	Also related to
How does temperature affect growth?	<p>Tutors could direct learners to useful research so they have an understanding of the effect of temperature on plant growth.</p> <p>From their understanding of practical investigations learners could design an investigation into temperature effect on crop growth. Learners could consider the necessary equipment, the measurements to be taken and the accuracy to which measurements can be taken.</p> <p>Climatic Factors Can Promote or Inhibit Plant Growth and Development CropsReview.com www.cropsreview.com/climatic-factors.html Explanation of the influence of environmental conditions on plant growth.</p>	1 hour	Unit 2 LO1

SUGGESTED ACTIVITIES

LO No:	4		
LO Title:	Be able to carry out soil testing		
Title of suggested activity	Suggested activities	Suggested timings	Also related to
What types of soil can be found in the UK?	<p>Crop production will depend on the quality of the soil. Chemical indicators can be used to produce data on the soil water and the nutrients within it; physical indicators produce data on the stability of the ground and how it will support the crop physically as well as water drainage within it; biological indicators produce data on biodiversity in the soil (such as earthworms, pests) and filtering of water as well as nutrients in organic matter.</p> <p>Tutors could direct learners to useful research so they have an understanding of the range of soils that could be found on a farm. Learners could then create a summary manual of soil types.</p> <p>Soil types Royal Horticultural Society https://www.rhs.org.uk/advice/profile?PID=179 Descriptions of soil types.</p> <p>Managing soil types Environment Agency https://www.gov.uk/guidance/managing-soil-types Information on how to identify the five main soil types, outlining their main characteristics and how to maintain good soil structure.</p> <p>Tutors could demonstrate the physical properties of soils, such as drainage, erosion and compaction.</p>	2 hours	
How is soil sampled?	<p>Before learners carry out an investigation, they need to research soil sampling methods. Tutors could direct learners to useful research so they have an understanding of how to take soil samples. Learners could design a sampling model for a location and consider the precision of possible measurements.</p> <p>Sampling soils for testing University of Wisconsin - Extension http://www.soils.wisc.edu/extension/pubs/A2100.pdf Soil sampling system.</p> <p>Soil Analysis: Key to Nutrient Management Planning Potash Development Association http://www.ahdb.org.uk/projects/documents/SoilAnalysis_000.pdf Guide to soil analysis with a detailed section on soil sampling.</p>	1 hour	Unit 13 LO3

Title of suggested activity	Suggested activities	Suggested timings	Also related to
How is soil tested?	<p>Tutors could direct learners to useful research on soil testing for them to gain an understanding of what is being tested, and why.</p> <p>Soil Analysis: Key to Nutrient Management Planning Potash Development Association http://www.ahdb.org.uk/projects/documents/SoilAnalysis_000.pdf Guide to soil analysis with sections on what is measured when testing soil, sampling, and analysis and interpretation of results.</p> <p>Tutors could source a soil testing kit so learners can carry out soil testing following the test kit manual. Learners could consider the necessary equipment, the measurements to be taken and the accuracy to which measurements can be taken. There is an opportunity for Learners to visit local plant nurseries, allotment associations or garden centres to gather information on how commercial enterprises monitor soil constituents.</p>	2 hours	Unit 2 LO1, LO5
What mathematical analysis techniques indicate soil characteristics? 	<p>Tutors could discuss the mathematical techniques required such as measurement, accuracy, precision, significant numbers, statistical evaluation.</p> <p>Learners could carry out a number of mathematical techniques based on questions set by the tutor to consolidate their mathematical understanding.</p>	2 hours	Unit 3 LO1
What are the benefits and disadvantages of various testing equipment?	<p>Having used a test kit tutors could discuss the accuracy and precision of the results gained by the test kit against alternative techniques which learners would have been introduced to in Unit 2.</p> <p>Learners could list the advantages and disadvantages of alternative equipment against the tests they have carried out.</p>	2 hours	Unit 2 LO5

Title of suggested activity	Suggested activities	Suggested timings	Also related to
Developing a basic soil management plan	<p>Well-managed soil is very important in crop production. Poor drainage, erosion and run-off can produce poor soil which leads to patchy crops from uneven germination, poor growth and susceptibility to weeds and disease and so poor crop production.</p> <p>Tutors have introduced learners to the physical environmental conditions and nutrient management that lead to a productive soil. Based on previous activities and their results from analysing soil, learners could develop a basic a soil management plan for a specified area.</p> <p>Soil Analysis: Key to Nutrient Management Planning Potash Development Association http://www.ahdb.org.uk/projects/documents/SoilAnalysis_000.pdf Leaflet giving detailed information on soil nutrient management planning.</p> <p>Producing a Soil Management Plan for Environmental Stewardship Rural Development Service, Defra http://adlib.everysite.co.uk/resources/000/107/821/soil-management-plan.pdf A report providing guidance on how to develop a soil management plan.</p>	1 hour	



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