2016 Suite

OCR
Oxford Cambridge and RSA

Cambridge **TECHNICALS LEVEL 3**

# APPLIED SCIENCE

Cambridge TECHNICALS 2016

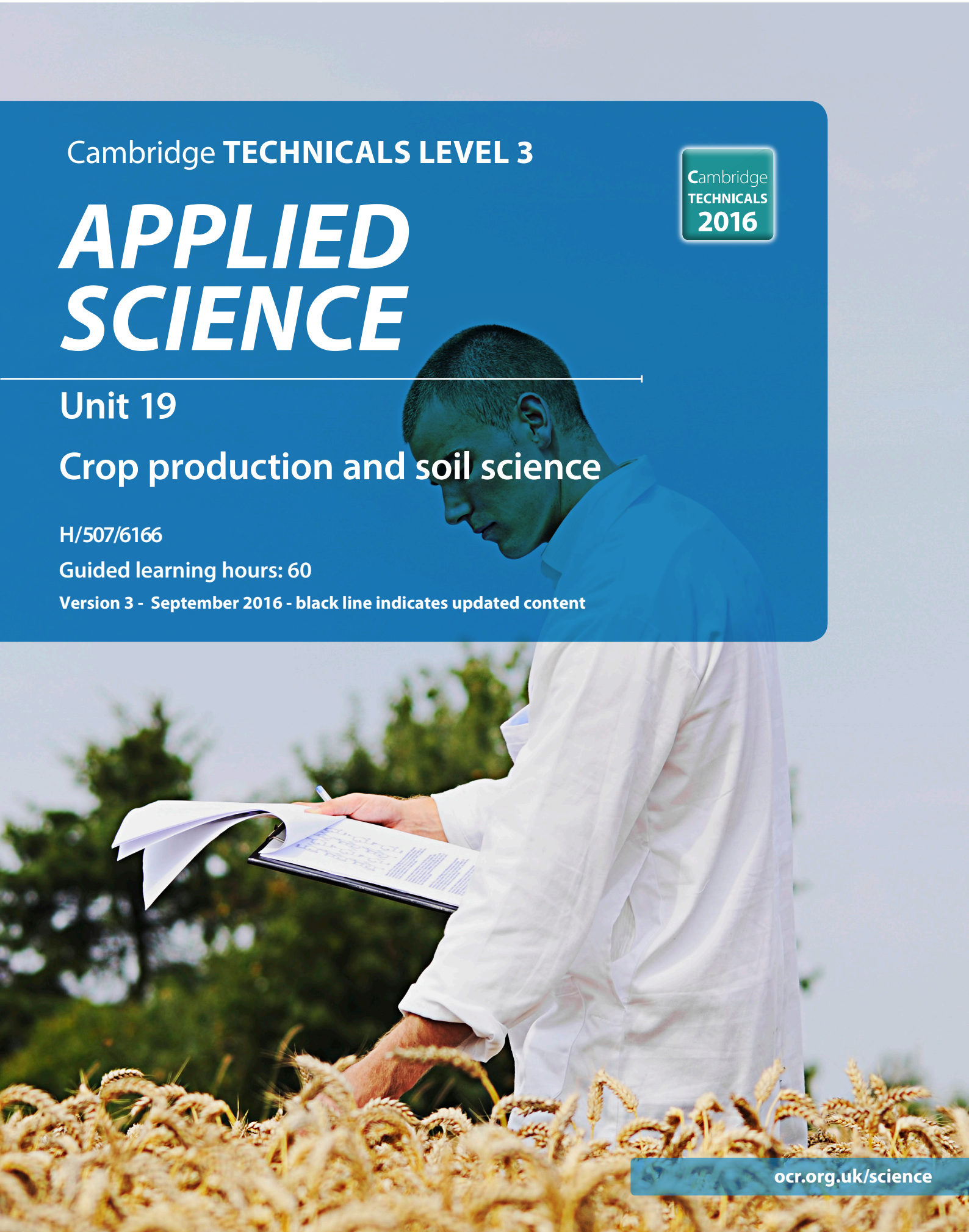
## Unit 19

## Crop production and soil science

H/507/6166

Guided learning hours: 60

**Version 3 - September 2016 - black line indicates updated content**



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# LEVEL 3

# UNIT 19: Crop production and soil science

# H/507/6166

## Guided learning hours: 60

## Essential resources required for this unit:

Practical apparatus to:
1 Be able to examine the structures within a plant that support the processes and mechanisms for growth.

2 Be able to carry out soil testing for crop production

## This unit is internally assessed and externally moderated by OCR.

## 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.

## TEACHING CONTENT

The teaching content in every unit states what has to be taught to ensure that learners are able to access the highest grades.

Anything which follows an i.e. details what must be taught as part of that area of content. Anything which follows an e.g. is illustrative, it should be noted that where e.g. is used, learners must know and be able to apply relevant examples in their work, although these do not need to be the same ones specified in the unit content.

For internally assessed units you need to ensure that any assignments you create, or any modifications you make to an assignment, do not expect the learner to do more than they have been taught, but must enable them to access the full range of grades as described in the grading criteria.

| Learning outcomes<br><br>The Learner will: | Teaching content<br><br>Learners must be taught: |
|---|---|
| 1 Understand how common crops are grown for commercial production in the UK | 1.1 The range of crops grown in the UK and their production cycles i.e.:<br>• wheat (the most widely grown arable crop in the UK)<br>• barley<br>• oats<br>• potatoes<br>• sugar beet<br>• vegetables<br>• oil seed rape<br>• fruits<br><br>1.2 Modern farming approaches and their effectiveness i.e.:<br>• organic<br>• conventional<br>• integrated<br><br>1.3 Commercial farming techniques i.e.:<br>• field<br>• greenhouse<br>• hydroponics |
| 2 Understand factors affecting the growth of crops | 2.1 Factors influencing the type of crops produced in the UK i.e.:<br>• physical conditions (e.g. geography, topography, geology, water)<br>• climate conditions (e.g. sunlight, rainfall, wind, seasons)<br>• commercial drivers (e.g. commodities markets)<br><br>2.2 Environmental factors affecting crop growth i.e.:<br>• temperature<br>• water supply<br>• mineral and organic nutrients<br>• light intensity<br>• carbon dioxide concentration<br>• pests<br>• diseases |

| Learning outcomes<br><br>The Learner will: | Teaching content<br><br>Learners must be taught: |
|---|---|
| | 2.3 Environmental and human impacts on soils i.e.:<br>• erosion<br>• organic matter decline<br>• compaction<br>• salinisation<br>• landslides<br>• contamination<br>• soil sealing – covering so that it is unusable<br>• irrigation<br>• drainage<br><br>2.4 Farming practices to improve soil health i.e.:<br>• pesticides (e.g. chemical, biological)<br>• ploughing, cultivation<br>• crop rotation<br>• hedgerows<br>• cover crops (e.g. wind protection)<br><br>2.5 Farming practices to improve plant health i.e.:<br>• selective breeding (e.g. yield, disease resistance)<br>• GM crop development<br>• fertilisers (e.g. organic, synthetic)<br>• international co-operation in species conservation |
| 3 Be able to monitor the growth of a crop plant species | 3.1 Appropriate conditions for plant growth i.e.:<br>• temperature<br>• nutrient concentration<br>• pH<br><br>3.2 Measurements used to monitor plant growth, i.e.:<br>• height<br>• stem diameter<br>• fresh mass<br>• dry mass<br>• leaf area<br>• appearance |
| 4 Be able to carry out soil testing | 4.1 Soil types i.e.:<br>• sandy and light silty soils<br>• medium soils<br>• heavy soils<br>• chalk and limestone soils<br>• peaty soils<br><br>4.2 Properties of soil that affect crop growth i.e.:<br>• pH<br>• organic matter<br>• mineral nutrients, such as phosphorus (P), potassium (K) and nitrogen (N)<br>• particulate size<br>• compaction |

| Learning outcomes<br><br>The Learner will: | Teaching content<br><br>Learners must be taught: |
|---|---|
| | 4.3 Standard procedures for soil sampling i.e.:<br>• sampling plan (e.g. locations)<br>• label and record samples<br>• store and transport samples safely<br><br>4.4 Alternative techniques to enhance accuracy and sensitivity i.e.:<br>• ion chromatography<br>• atomic emission spectroscopy (AES)<br>• pH meter<br>• auto-titration<br>• mass spectrometer |

## GRADING CRITERIA

| LO | Pass | Merit | Distinction |
|---|---|---|---|
| | The assessment criteria are the Pass requirements for this unit. | To achieve a Merit the evidence must show that, in addition to the Pass criteria, the candidate is able to: | To achieve a Distinction the evidence must show that, in addition to the pass and merit criteria, the candidate is able to: |
| 1. Understand how common crops are grown for commercial production in the UK | *P1: Explain the production cycle, and yield of common commercial UK crops | | D1: Evaluate the scientific and ethical debates on modern farming practices |
| | *P2: Describe modern farming practices | | |
| 2. Understand factors affecting the growth of crops | *P3: Describe the environmental factors that affect crop growth | | |
| | *P4: Describe the farming practices that affect plant growth | M1: Assess how crop growth can be maximised by farming practices | |
| 3. Be able to monitor the growth of a crop plant species | *P5: Select and set up equipment to take and record measurements using an appropriate format | M2: Analyse results of tests and report on them | D2: Give a quantitative evaluation of the optimum conditions for plant growth |
| 4. Be able to carry out soil testing | *P6: Select and set up equipment to take and record appropriate measurements | M3: Compare the quality of the tested soils | D3: Give a quantitative evaluation of soils to maximise crop growth |
| | *P7 Discuss the benefits of alternative testing techniques | | |

## ASSESSMENT GUIDANCE

**LO1 Understand how common crops are grown for commercial production in the UK**

Food production is of great importance to the whole nation and the public should understand its importance. Produce information resources for the general public on UK crop production

Your evidence should include quantitative as well as qualitative information.

D1: Evaluate the scientific and ethical debates on modern farming practices

The public should also be aware of the pros and cons of modern farming practices before they can make an ethical choice on how farming should progress.

Material could be in the form of a PowerPoint presentation or a short video, an article (for a magazine) or a leaflet.

**LO2: Understand factors affecting the growth of crops**

Produce information resources on optimising the growth of a crop for a small holder, an allotment holder or a farmer.

Your evidence should include quantitative as well as qualitative information.

Material could be in the form of a PowerPoint presentation or a short video, an article (for a magazine) or a leaflet.

**LO3: Be able to monitor the growth of a crop plant species**

Learners monitor the growth of a plant that has a commercial application, testing the effect of varying your chosen growing conditions.
It is expected that learners will grow a batch of their chosen plants taking measurements over a period of time and deducing the optimum conditions for growth for each chosen condition.

D2: Give a quantitative evaluation of the optimum conditions for plant growth
Based on their analysis learners then recommend the optimum conditions, using quantitative data, required for plant growth.

**LO4: Be able to carry out soil testing**

Learners collect samples using standard sampling techniques and test the samples for:

- soil acidity (pH)
- soil organic matter
- mineral nutrients, such as P, K and M
- soil particulates
- soil compaction

(API strips could be used to identify mineral nutrients)
Learners carry tests to compare the quality of two different soil types and evaluate the tests that they have used against alternative testing techniques.

D3: Give a quantitative evaluation of soils to maximise crop growth
Learners must make recommendations based on their analysis of soil testing data to maximise plant growth.

Feedback to learners: you can discuss work-in-progress towards summative assessment with learners to make sure it's being done in a planned and timely manner. It also provides an opportunity for you to check the authenticity of the work. You must intervene if you feel there's a health and safety risk.

Learners should use their own words when producing evidence of their knowledge and understanding. When learners use their own words it reduces the possibility of learners' work being identified as plagiarised. If a learner does use someone else's words and ideas in their work, they must acknowledge it, and this is done through referencing. Just quoting and referencing someone else's work will not show that the learner knows or understands it. It has to be clear in the work how the learner is using the material they have referenced to inform their thoughts, ideas or conclusions.

For more information about internal assessment, including feedback, authentication and plagiarism, see the centre handbook. Information about how to reference is in the OCR Guide to Referencing available on our website: http://www.ocr.org.uk/i-want-to/skills-guides/.

## SYNOPTIC LEARNING AND ASSESSMENT

It will be possible for learners to make connections between other units over and above the unit containing the key tasks for synoptic assessment. Please see Section 6 of the Qualification Handbook for more details. We have indicated in the unit where these links are with an asterisk.

| Name of other unit and related LO | This unit: |
|---|---|
| **Unit 1 Science Fundamentals**<br>LO1 Understand the chemical structures of elements and compounds<br>LO2 Understand reactions in chemical and biological systems<br>LO4 Understand the principles of carbon chemistry<br>LO6 Understand the structures, properties and uses of materials | LO2 Understand factors affecting the growth of crops (P3, P4) |
| **Unit 2 Laboratory Techniques**<br>LO1 Understand the importance of health and safety and quality systems to industry<br>LO2 Be able to separate, identify and quantify the amount of substances present in a mixture<br>LO3 Be able to determine the concentration of an acid or base using titration<br>LO4 Be able to examine and record features of biological samples | LO3 Be able to monitor the growth of a crop plant species (P5)<br>LO4 Be able to carry out soil testing (P6) |
| **Unit 3 Scientific Analysis and Reporting**<br>LO1 Be able to use mathematical techniques to analyse data<br>LO2 Be able to use graphical techniques to analyse data<br>LO4 Be able to analyse and evaluate the quality of data<br>LO5 Be able to draw justified conclusions from data<br>LO6 Be able to use modified, extended or combined laboratory techniques in analytical procedures<br>LO7 Be able to record, report on and review scientific analyses | LO3 Be able to monitor the growth of a crop plant species (P5)<br>LO4 Be able to carry out soil testing (P6) |

| Name of other unit and related LO | This unit: |
|---|---|
| **Unit 5 Genetics**<br>LO1. Understand the importance of meiosis<br>LO2. Be able to apply techniques used in genetics crosses<br>LO3. Understand the techniques of DNA mapping and genomics<br>LO4. Understand the impact of an innovation in an application of genomics | LO1 Understand how common crops are grown for commercial production in the UK (P1, P2)<br>LO2 Understand factors affecting the growth of crops (P3, P4) |
| **Unit 6 Control of Hazards in the Laboratory**<br>LO1 Understand the types of hazard that may be encountered in a laboratory<br>LO2 Be able to use health and safety procedures to minimise the risk presented by hazards in a laboratory | LO3 Be able to monitor the growth of a crop plant species (P5)<br>LO4 Be able to carry out soil testing (P6) |
| **Unit 10 Testing Consumer Products**<br>LO2 Understand how product testing determines the development of consumer products (P2, P3)<br>LO4 Be able to use extraction and separation techniques on consumer products (P5, P6) | LO4 Be able to carry out soil testing (P6) |
| **Unit 13 Environmental Surveying**<br>LO1 Understand environmental impacts of human activity and natural processes<br>LO2 Understand environmental surveying<br>LO3 Be able to use field and laboratory techniques to conduct an environmental investigation<br>LO4 Be able to analyse and present and environmental survey findings | LO1 Understand how common crops are grown for commercial production in the UK (P1, P2)<br>LO2 Understand factors affecting the growth of crops (P3, P4)<br>LO3 Be able to monitor the growth of a crop plant species (P5)<br>LO4 Be able to carry out soil testing (P6) |

| Name of other unit and related LO | This unit: |
|---|---|
| **Unit 14 Environmental Management**<br>LO1 Understand principal characteristics of environments<br>LO2 Be able to identify pollution in the environment<br>LO3 Understand how legislation, regulation and agreements impact on managing natural and built environments<br>LO4 Understand environmental management assessment<br>LO5 Be able to carry out an environmental management study | LO1 Understand how common crops are grown for commercial production in the UK (P1, P2)<br>LO2 Understand factors affecting the growth of crops (P3, P4) |
| **Unit 17 Food Technology**<br>LO1 Understand the main features of food manufacturing operations<br>LO2 Understand the importance of food safety in food manufacture<br>LO3 Understand the importance of quality control in food manufacture<br>LO4 Be able to test product samples | LO1 Understand how common crops are grown for commercial production in the UK (P1, P2)<br>LO2 Understand factors affecting the growth of crops (P3, P4) |
| **Unit 18 Microbiology**<br>LO1 Be able to classify and identify microorganisms<br>LO2 Understand the use of microorganisms in agriculture<br>LO3 Be able to use microbiology in food production<br>LO4 Understand the action of antimicrobials on microorganisms | LO2 Understand factors affecting the growth of crops (P3, P4)<br>LO4 Be able to carry out soil testing (P6) |

To find out more
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Alternatively, you can email us on **vocational.qualifications@ocr.org.uk**



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