Unit 13: Undertake Agricultural Crop Production

Unit code: M/600/9127

QCF Level 3: BTEC National

Credit value: 10

Guided learning hours: 60

Aim and purpose

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

Unit introduction

Successful agricultural crop production demands a wide range of practical skills and related knowledge. This unit develops the skills needed for crop establishment and growth, crop protection, harvesting and storage.

Integrated farm management and the economics of agricultural crop production are studied using a wide range of important agricultural crops, to develop managerial skills. This is particularly important as opportunities for new crops emerge and where the market for existing crops may change.

As food security becomes an important issue nationally and globally, the agriculture industry needs a well-trained, creative workforce, conversant with the modern technology found on many farms in the UK. The unit focus is on learner participation in all aspects of modern crop production, the aim being to imitate and experience modern farm practice. Learners will monitor crops at all stages of production in class taught time, with an agronomist and, more importantly, on their own. They will experience crop walks, use modern arable machinery in the field, be involved in harvesting operations and plan future farm policy.

Throughout the unit learners will need to work effectively on their own and as part of a team. There will be a strong emphasis on learner health and safety throughout the unit.

Learning outcomes

On completion of this unit a learner should:

1 Know how to establish agricultural crops

2 Be able to plan the growth of crops

3 Understand how to harvest and store crops

4 Understand production costs and markets.

Unit content

1 Know how to establish agricultural crops

Crop types: cereals; oilseeds; grasses; root crops eg potatoes, beet; brassicas; legumes; alternative/other crops eg linseed, miscanthus

Cultivations: system eg ploughing, non-inversion, direct drilling, ecotillage; seedbed preparation; order of operations; work rate; machinery eg primary cultivators, secondary cultivators, establishment machinery, consolidating implements

Establishment: crop rotation; soil eg type, texture, structure, seedbed requirements; seed rates eg spacing, thousand grain weight (TGW), target plant population, calibration; planting depth; cultivar choice eg recommended lists, market requirements; optimum planting time, choice of machinery; timing eg autumn, spring

2 Be able to plan the growth of crops

Nutrient requirements: pH eg lime, crop tolerance; major nutrients eg nitrogen, phosphate, potassium (NPK), sulphur; minor nutrients eg boron, manganese; organic and inorganic fertilisers; soil indices; Nitrate Vulnerable Zones (NVZs); effect of rotations eg legumes; fertiliser requirements and recommendations, sources of information eg FACTS qualified agronomists RB209, PLANET, detailed soil nutrient maps, remote sensing, variable rate applications; timing eg optimum timings, closed seasons

Crop protection: methods eg cultural, chemical, physical, biological; weeds; diseases eg fungal, viral; pests eg insects, nematodes, birds, mammals; plant growth regulators (PGRs); identifying growth and development stages eg Zadoks; monitoring of crops; codes of practice and legislation eg Food and Environment Protection Act 1985, National Register of Spray Operators (NRoSO), Local Environment Risk Assessments for Pesticides (LERAPs),Voluntary Initiative; sources of information eg BASIS qualified agronomists; UK Pesticide Guide

3 Understand how to harvest and store crops

Harvesting: method of harvesting; machinery; timing eg maturity of crop; preparation eg swathing, desiccating, spraying; transportation eg to storage

Storage: preparation of store; types of storage eg clamp, bulk store, boxes, cooperative stores; drying and conditioning; monitoring crop in store eg moisture, temperature, ventilation, frost protection, sprouting, silage analysis; pest and vermin control; store management eg loading and unloading, separating crop types

4 Understand production costs and markets

Market requirements: target market (eg milling, malting, seed, crisping, feed, bio-fuel); quality standards eg Hagberg Falling Number, moisture, appearance, mycotoxins, protein content; contract requirements; crop assurance schemes; cooperative/central processing facilities

Crop yields: target yield; methods of reducing losses eg correct setting of harvesting machinery, bruising prevention, drying, clamping

Market prices and production costs: monitoring crop prices eg market reports, trends, timing of sales, pool marketing; benchmarking eg HGCA benchmarking tools)

Assessment and grading criteria

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

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	**To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:**	**To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:**
P1 identify appropriate crops and varieties		
P2 select appropriate equipment for seedbed preparations		**D1** justify the use of cultivation equipment for a specified operation and the varietal choice for a specified crop
P3 identify correct planting specifications	**M1** calculate sowing rates for selected crops	
P4 describe a crop rotation suitable for a given soil types [IE, CT, RL]		
P5 plan a fertiliser programme for named crops	**M2** explain why given crops need the correct soil pH and major trace nutrients	
P6 describe weed, pest and disease control procedures appropriate to production of a named crop [TW, SM, EP]		**D2** evaluate the production programme for a chosen crop and the environmental impact of the programme
P7 describe correct legislative and environmental guidelines		
P8 explain harvesting operations for named crops		
P9 discuss suitable storage conditions for named crops	**M3** monitor the storage of a harvested crop over a given timescale.	
P10 evaluate control methods for storage pests and diseases		
P11 evaluate market requirements		
P12 analyse crop yields		
P13 compare market prices		
P14 compare production costs for different crops.		**D3** evaluate the production costs for a specified crop.

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

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

Essential guidance for tutors

Delivery

Delivery of this unit will involve practical and written assessments and visits to suitable locations. It will link to work-related experience placements.

This unit focuses on learners being involved in all operations of farm crop production, and tutors need to offer learners as wide a selection of learning opportunities as possible. This will involve lectures, regular crop walks, (in taught and learners' own time), farm practicals, work experience, talks, visits and access to an agronomist.

For the unit to be effective, tutors will need to choose the timing of the assessments carefully because of the importance of seasonality. In addition, the tutor needs to ensure that all relevant crops are included ie combinable crops, grass, brassicas, legumes and root crops. Consideration to 'alternative' crops should also be given, such as miscanthus, linseed and others.

Learners will need access to farm recording data and previous crop history.

Learning outcome 1 will need to be delivered at the start of the programme, such as in the autumn. Learners may have been working with and involved in autumn cultivations and seedbed preparation. Alternatively, a spring sown crop would also lend itself within the same year of the programme.

Learning outcome 2 will need to be delivered to coincide with crop growth, which will probably be autumn and spring.

Learning outcomes 3 and 4 will need to look at previous crop history, since learners will not be in the centre during the summer to monitor and gather current crop harvesting, storage and marketing data.

Tutors will need to time assessments very carefully. The merit criteria have been written with a view to imitate industry practice in regular crop observation and walking, in order to assess the situation of a crop at all stages of production. Crop walks in taught and learners' own time are to be maximised.

Outline learning plan

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

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

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

Topic and suggested assignments/activities and/assessment
Introduction to unit and unit overview.
Assignment 1: Cultivations and Crop Establishment (P1, P2, P3, P4, M1, D1) Briefing.
Practical crop walks to observe post-harvest field conditions before drilling/planting.
Theory session: crop rotations, soils and soil structure relevant to sustainable guidelines.
Practical session: carry out cultivations, visit to a cultivation event, care, use and maintenance of machinery, crop walking and inspection of drilled/planted crop.

Topic and suggested assignments/activities and/assessment
Assignment 2: Growing Healthy Crops (part 1 fertilisers) (P5, P7, M2)
Briefing.
Theory session: crop nutrients and crop recommendations, RB209 and PLANET programmes, NVZ's, environmental and single farm payment guidelines.
Practical session: crop walks, observation and monitoring crop growth stages.
Assignment 3: Growing Healthy Crops (part 2 disease prevention) (P6, M3, D2)
Briefing.
Theory session: crop growth stages, types and use of sprays, environmental guidelines, PA1 and 2 competence certificates, timing of sprays, growth regulators.
Practical session: regular crop walks to observe disease, damage and any response to sprays.
Assignment 4: Harvesting and Storing Crops (P8, P9, P10)
Briefing.
Theory session: harvesting machinery and crop flow, timing of harvest to match crop maturity, types of crop storage, protection of crop in store.
Practical session: carry out /assist with harvesting operations such as silage, hay, visit to a crop store/co-op, prepare a clamp for various crops.
Assignment 5: Crop Marketing and Market Prices (P11, P12, P13, P14, D3)
Briefing.
Theory session: different uses of crops, crop quality and assurance standards, market requirements.
Practical session: visit to a relevant enterprise/visiting speaker.
Theory session: market prices and trends, gross margin calculations and unit costs of production.
Unit review.

Assessment

For P1, P2 and P3, tutors will need to hand out the assessments early in the programme. For P1, learners need to recognise a wide range of crops and identify the uses of varieties of crops. To complete P2, learners will need to observe a range of cultivation machinery and understand the principles of soil management for which the machinery could be used. Tutors should encourage learners to draw on any previous work experience. For P3, learners need to identify how a range of crops should be planted and drilled. They need to understand the importance of row widths, plant/seed spacing and the amount of seed/plants used per hectare.

For P4, learners could use a farm's rotation plan and comment on and produce a plan for the next cropping year. For P5,P6 and P7, learners should be encouraged to monitor crops regularly so that they can achieve these criteria over the requisite period of time.

For P8, P9 and P10 learners could be given a crop to describe. Tutors will again need to plan the timing of assessments carefully, especially if they want learners to witness harvesting and storage. Crops that lend themselves to this during an academic year would be silages or hay. For P11, P12, P13 and P14, learners must be aware of crop price fluctuations. The use of weekly market trend reports in the published farming press would be very useful in addition to any published standard data. Data for P12 will probably need to be taken from previous farm crop yields or from standard information.

For M1, M2, M3 and M4, learners need to monitor crops regularly. Evidence could be in the form of field reports, diaries or blogs.

For D1, learners should put forward cogent reasoning for a farm's use of cultivation machinery and choice of crop, as well as alternatives that might have been used. Use of current farm management data will be necessary. As an alternative, tutors could allow learners to work in groups for the assignment and present their findings to a farm manager. For D2, learners must be able to evaluate an agronomist's recommendations for the use of sprays and observe and record the state of the crop before the choice of spray. Learners will need to show that they can recognise crop damage and disease , are conversant with the UK Pesticide guide, and understand the use of buffer strips. For D3, learners will need regular access to a farm's physical and financial crop information in order to complete this assignment.

Programme of suggested assignments

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

Criteria covered	Assignment title	Scenario	Assessment method
P1, P2, P3, P4, M1, D1	Cultivations and Crop Establishment	Produce a list of suitable crops to grow on a given farm and monitor their growth during the year. Use the farm's previous rotation programme and propose a rotation for the next season. Choose the necessary cultivation machinery to establish the crops and justify your choice.	Practical observation. Written evidence/diary/ blog.
P5, P7, M2	Growing Healthy Crops (part 1 fertilisers)	Produce a diary for monitoring a crop fertiliser programme. State all organic and inorganic fertilisers used.	Practical observation. Written evidence/diary/ blog.
P6, M3, D2	Growing Healthy Crops (part 2 disease prevention)	Produce a diary for monitoring a crop spray programme. Justify the use of the sprays in line with crop needs and the environment.	Practical observation. Written evidence/diary/ blog.
P8, P9, P10	Harvesting and Storing Crops	Plan the harvesting and storage of a crop, and how the crop will be monitored once in store.	Practical observation. Written evidence/diary/ blog.
P11, P12, P13, P14, D3	Crop Marketing and Market Prices	Produce a gross margin for a crop, indicating past, current and likely future prices based on current figures and farm information.	Practical observation. Written evidence/diary/ blog.

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

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

Level 2	Level 3
Introduction to Crop Establishment	Element AgC9.1 Prepare and monitor sites for cultivation Element AgC9.2 Cultivate sites for planting crops Element AgC10.1 Monitor and maintain the healthy growth of extensive crops Element AgC10.2 Minimise risks to crops from pests, diseases and disorders Element AgC11.1 Prepare planting equipment Element AgC11.2 Plant and establish extensive crops Element AgC12.1 Maintain and control harvesting operations Element AgC12.2 Prepare harvested crops
Assist with Agricultural Crop Production	Understand Principles of Plant Science
	Understand Principles of Soil Science

Essential resources

Learners will need access to fields covering a range of crops, possibly both in a centre farm situation and on local farms where different crops are grown. They will need to be aware of a farm's policy with regard to the environment, such as use of conservation/buffer margins, and where a farm has entered the Entry Level Scheme. Learners must also be able to carry out certain field operations in a safe manner, using tractors and relevant machinery.

Farm visits/talks are to be encouraged to local farms and associated enterprises or co-ops experience the full scope of the unit. A farm's physical and financial records should be available at relevant times for the learners during the programme.

Employer engagement and vocational contexts

The unit focuses on learner participation in all the stages of crop production. This will involve not only the centre's farm but also local farms. A useful reciprocal agreement might take place where a farm is used as a case study, and the farmer invited to listen to and comment on the learners' views regarding that farm's cropping management.

Indicative reading for learners

Textbooks

Bell B – *Farm Machinery* (Old Pond Publishing, 2005) ISBN 1 903366 68 2

Culpin C and Bloxham P – *Culpin's Farm Machinery* (Blackwell Science, 2006) ISBN 0632051825

Davies D, Finney B, Eagle D – *Resource management: soil* (Farming Press, 2001) ISBN 0 85236 559 4

Eash N, Green C – *Soil Science Simplified* (Wiley-Blackwell, 2008) ISBN 13: 978-0-8138- 1823-8

Finch H, Samuel A, Lane G – *Lockhart & Wiseman's Crop Husbandry including grassland* (Woodhead publishing, 2002) ISBN 1 85573 5490

Nix J – *Farm Management Pocketbook, 39th Edition* (The Andersons Centre, 2009) ISBN 0954120159

Soffe R – *The Agricultural Notebook, 20th Edition* (Blackwell Science, 2003) ISBN 0632058293

Wilson P, King M – *Arable Plants – a field guide* (Wildguides, 2003) ISBN 1 903657 02 4

Younie D, Taylor B – *Organic Cereals and Pulses* (Chalcombe publications 2002) ISBN 0 948617 47 0

Other publications

DEFRA – *Fertiliser Recommendations for Agricultural and Horticultural Crops RB209, 8th Edition* (The Stationery Office Books, 2008)

UK Pesticide Guide (CABI, 2009) ISBN 978 1 845934 16 3

Websites

www.bayercropscience.co.uk	Bayer Crop Science
www.defra.gov.uk	Department for Environment, Food and Rural Affairs
www.efma.org	European Fertiliser Manufacturers Association
www.hgca.com	Home Grown Cereals Authority
www.newfarmcrops.co.uk	New Farm Crops
www.niab.com	National Institute of Agricultural Botany

Delivery of personal, learning and thinking skills (PLTS)

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

Skill	When learners are ...
Independent enquirers	monitoring crops themselves
Creative thinkers	monitoring and planning aspects of crop production
Reflective learners	monitoring and planning aspects of crop production
Team workers	engaged in practical activities, work experience and team planning an assignment to present to a farmer
Self-managers	carrying out farm duties and being responsible for own punctuality
Effective participators	engaged in practical activities, work experience and team planning an assignment to present to a farmer.

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

Skill	When learners are ...
Reflective learners	visiting local farms and relevant enterprises
Effective participators	visiting local farms and relevant enterprises.