

Unit 34: Undertaking Agricultural Combinable Crop Production

Unit code:	R/503/4916
QCF Level 3:	BTEC National
Credit value:	10
Guided learning hours:	60

● Aim and purpose

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 the sector or onto further/higher education.

● Unit introduction

This unit covers crops that are usually harvested using a combine harvester. Combinable crop production requires the achievement of high yields and careful cost control in order to make acceptable profits in line with legal requirements. Decisions regarding soil type, location, crop husbandry, marketing and sales influences the viability of crop enterprises and as such, need to be carefully considered. Important themes covered include the cost-effective use of inputs, production for market and environmental responsibility. It also includes study of the growth of a range of combinable crops throughout the country and can be focused to a local context.

● Learning outcomes

On completion of this unit a learner should:

- 1 Know how to establish combinable crops
- 2 Be able to plan the management of combinable crops
- 3 Understand how to harvest and store combinable crops
- 4 Understand combinable crop production costs and markets.

Unit content

1 Know how to establish combinable crops

Choice of site: factors (location, soil type, topography, field size); climate; weather; factors affecting place in rotation

Crop groups: cereals eg barley, wheat, oats; oilseeds eg oilseed rape, linseed; protein/pulses eg field beans, peas; alternative (minor) combinable crops eg miscanthus, rye, durum wheat, triticale, sunflowers, borage, evening primrose, lupins, soya, navy beans; vernalisation requirements

Soil management: drainage; application and conservation of organic matter; seedbed requirements for autumn and spring sown crops; seedbed preparation, eg primary and secondary cultivations; conservation of soil moisture; prevention and rectification of soil compaction; soil pans; soil capping and soil erosion

Establishment methods: techniques eg drilling; seed quality; seed vigour; seed treatments; seed rates and factors affecting them (crop type and variety, seedbed conditions, target plant populations, sowing date); sowing depth and spacing, plant population; seed rate calculation eg using thousand grain/seed weight (TGW, TSW); use of certified seed, home-saved seed

Cultivar choice: suitability to growing conditions; market requirements eg barley (malting, distilling, feed), wheat specification groups one to four; interpretation of recommended lists eg potential yield, crop quality, seed size, disease resistance, harvest dates; consideration of genetically modified (GM) crops where available

2 Be able to plan the management of combinable crops

Combinable crop growth and development: identification of growth stages eg decimal scale; timing of inputs eg plant protection products, crop nutrients, plant growth regulators; components of yield, recording of plant populations (m^{-2}) at establishment, emergence and tillering, winter kill, grains/ear m^{-2} , 1000 grain weight

Combinable crop nutrition: principles eg soil indices, soil and tissue analysis; major nutrients eg N, P, K, S, and lime; deficiency symptoms; nutrient mapping; nutrient removal; fertiliser recommendations; timing of application eg split applications, variable rates; legal constraints to timing and application rates

Minor and Trace nutrients: range eg boron, calcium, copper, magnesium and manganese; definition; availability; identification and resolution of deficiency symptoms

Crop protection: weed, pest and disease identification; incidence; economic thresholds; control methods eg integrated control of weeds, pests and diseases; chemical control (herbicides, insecticides, fungicides); cultural control (stubble cleaning, rotation, varietal resistance); types and role of plant growth regulators

Legislation and regulation: Control of Substances Hazardous to Health (COSHH); environmental risk assessments; Nitrate Vulnerable Zones (NVZ), Fertiliser Manual RB209, Food and Environment Protection Act 1985; certificates of competence and professional qualifications eg BASIS and FACTS

3 Understand how to harvest and store combinable crops

Harvesting of crop: signs of ripeness; market requirements; pre-harvest treatment; harvesting methods; identifying sources of losses; measuring and preventing losses and damage; transporting crops; appropriate road traffic legislation eg gross train weight, escort requirements

Crop storage: store requirements, calculating capacity; cooperative/central or on-farm storage; store hygiene, including importance of store design and fumigation; conditioning of crop, including temperature, humidity and chemical according to end use of crop eg assurance requirements, food hygiene; control of store pests and identification of damage caused; monitoring crops in store; mycotoxin risks; health and safety in store; personal protective equipment (PPE)

4 Understand combinable crop production costs and markets

Preparation of crop for end use: outlets for crops; meeting market requirements eg biofuels, vegetable oils, industrial oils, seed, crimping, malting, milling, livestock feed/flour; value added; quality indicators eg Hagberg falling number, oil content; value of crop residues eg straw

Costings: gross output; variable costs; gross margins and net margins; analysis of costings eg effective use of inputs and to maintain/improve returns; crop assurance schemes; marketing strategies eg timing of sales, futures markets, options, use of pool marketing, spot prices, benchmarking

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 assessment 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	M1 report on establishment methods and potential problems for a selected combinable crop in the achievement of optimum crop yields	D1 evaluate the production programme for a chosen crop including <ul style="list-style-type: none"> • environmental impact • pest management • marketability.
P2 select appropriate equipment for seedbed preparations		
P3 describe establishment methods for selected crops including <ul style="list-style-type: none"> • choice of site • soil management • sowing method [IE, CT, RL]		
P4 plan a fertiliser programme for named crops		
P5 describe weed, pest and disease control procedures appropriate to production of a named crop [TW, SM, EP]	M2 evaluate the cost of production of a specified crop.	
P6 describe correct legislative and environmental guidelines relevant to named crops		
P7 explain harvesting operations for named crops		
P8 discuss suitable storage conditions for a named crop		
P9 evaluate control methods of storage pests and diseases		
P10 evaluate market requirements for given combinable crops		
P11 analyse crop yields		
P12 compare market prices and production costs for different crops.		

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 theory assessments and visits to suitable locations. It could link to work-related experience placements.

The unit focuses on learners being involved in all operations of farm crop production. Tutors need to ensure learners have access to as wide a selection of learning opportunities as possible. This could involve lectures, regular crop walks (in delivery 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 consider the timing of the assessments because of the importance of seasonality. In addition, tutors need 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.

Learning outcome 1 will need to be delivered at the start of the programme, ideally 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 use previous crop history, where learners are unlikely to be in the centre during the summer to monitor and gather current crop harvesting, storage and marketing data.

The merit grading 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.

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, M1) 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
Assignment 2: Growing Healthy Crops (part 1 fertilisers) (P4, P6) briefing
Theory session: crop nutrients and crop recommendations, Fertiliser Manual and PLANET programmes, NVZs, cross compliance requirements
Practical session: crop walks, observation and monitoring crop growth stages
Assignment 3: Growing Healthy Crops (part 2 disease prevention) (P5, M2, D1) briefing
Theory session: crop growth stages, types and use of sprays, environmental guidelines, 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 (P7, P8, P9) 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: visit to a crop store/co-op, preparing a store for various crops
Assignment 5: Crop Marketing and Market Prices (P10, P11, P12) 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 and P2, tutors will need to hand out the assessments early in the programme. For P1, learners need to recognise the major combinable crops together with any important minor crops grown in the locality, and identify the equipment used for seedbed operations. To complete P2, learners will need to observe a range of cultivation machinery and be familiar with the principles of soil management for which the machinery could be used. Tutors could encourage learners to draw on any previous work experience.

For P3, learners could use a farm's rotation plan and comment on and produce a plan for the next cropping year. For P4, P5 and P6, learners should be encouraged to monitor crops regularly so that they can achieve these criteria over the requisite period of time.

For P7, P8 and P9 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 P10, P11 and P12, 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 P11 will probably need to be taken from previous farm crop yields or from standard information.

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

For D1, learners must be able to evaluate an agronomist's recommendation for the use of plant protection products, and observe and record the state of the crop before the choice of product. 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.

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, M1	Cultivations and Crop Establishment	You have been tasked with producing a list of suitable crops to grow on a given farm and to 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
P4, P6	Growing Healthy Crops (part 1 fertilisers)	You need to record a monitoring a crop fertiliser programme carried out. State all organic and inorganic fertilisers used.	Practical observation Written evidence/diary/blog
P5, M2, D1	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
P7, P8, P9	Harvesting and Storing Crops	You need to develop a plan for the harvesting and storage of a crop, and how the crop will be monitored once in store.	Practical observation Written evidence/diary/blog
P10, P11, P12	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	<p>Element AgC9.1 Prepare and monitor sites for cultivation</p> <p>Element AgC9.2 Cultivate sites for planting crops</p> <p>Element AgC10.1 Monitor and maintain the healthy growth of extensive crops</p> <p>Element AgC10.2 Minimise risks to crops from pests, diseases and disorders</p> <p>Element AgC11.1 Prepare planting equipment</p> <p>Element AgC11.2 Plant and establish extensive crops</p> <p>Element AgC12.1 Maintain and control harvesting operations</p> <p>Element AgC12.2 Prepare harvested crops</p>
Assist with Agricultural Crop Production	Understand Principles of Plant Science
	Understand Principles of Soil Science

Essential resources

Learners will need access to fields growing a range of crops, possibly both on the centre's own farm and/or on local farms. 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. Alternatively, appropriate 'mock' records could be derived from HGCA or DARDNI benchmark figures.

Employer engagement and vocational contexts

The unit focuses on learner participation in all the stages of crop production. A useful reciprocal agreement might take place where a local 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

Indicative reading for learners

Textbooks

Bell B – *Farm Machinery – Fifth Edition* (Old Pond Publishing, 2008) ISBN 978-1903366684

Culpin C – *Farm Machinery* (Unknown, 2008) ISBN 978-1443703017

Davies D, Finney B, Eagle D – *Soil (Resource management)* (Farming Press, 2002) ISBN 978-0852365595

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

Periodicals

Crops

Farmers Weekly

Other publications

DEFRA – *Fertiliser Recommendations for Agricultural and Horticultural Crops RB209, 8th Edition* (The Stationery Office Books, 2010)

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

Websites

www.pesticides.gov.uk/

Chemicals Regulation Directorate

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

www.defra.gov.uk

Department for Environment, Food and Rural Affairs

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
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	Working with local farms and relevant enterprises