

# Unit 32: Undertake Horticultural Production Techniques – Protected

<b>Unit code:</b>	<b>L/600/9975</b>
<b>QCF Level 3:</b>	<b>BTEC National</b>
<b>Credit value:</b>	<b>10</b>
<b>Guided learning hours:</b>	<b>60</b>

## ● Aim and purpose

This unit aims to introduce learners to the skills and knowledge needed to use horticultural production techniques in protective environments, 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.

Learners will be able to understand the requirements of production horticulture in protected environments and produce and prepare crops for market.

## ● Unit introduction

The use of protective structures for the production of a wide range of crops is a specialised sector within the horticulture industry and is a key employer of specialist horticulture staff.

This unit covers production techniques within protected environments. The range of stock considered includes traditional cut flower, pot plant, bedding and food crops, and also includes more exotic crops that are becoming popular within the UK and require specialised growing conditions.

The unit will look at the whole process of the production of crops within the protective environment beginning with the selection and sourcing of plant material, choice of protective structures, propagation and production techniques, through to harvesting, storage and marketing. The crops involved in this process will cover container and ground production.

On completion of the unit learners will have a clear understanding of horticulture production techniques used within protective environments. This includes both practical and theory elements, and will develop learners' practical and technical capabilities. Health and safety and environmental issues are of utmost importance and learning will focus on these points. These elements will also be included in the assessment of both the practical and technical parts of the unit. In addition, learners will be able to understand the process used when choosing protective structures and the types of protective environments available. This includes choice of services available and the requirements and methods of monitoring and controlling the environment. Learners will be able to undertake a variety of tasks involving the selection of media, containers, propagation requirements, growing on, planting out, containerisation, pest and disease control and waste management. Learners will have a clear understanding of and be involved in the harvesting, grading, storage and marketing of crops.

## ● Learning outcomes

### On completion of this unit a learner should:

- 1 Know how to plan production of crops in protected growing environments
- 2 Be able to establish crops in containers in protected environments
- 3 Be able to establish crops in the ground in protected environments
- 4 Understand the maintenance, harvesting and grading requirements of protected horticultural crops.

# Unit content

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## 1 Know how to plan production of crops in protected growing environments

*Propagation requirements:* scheduling from seed, cuttings, micro-propagation or other appropriate propagation method; temperature control; supplementary and replacent lighting; humidity control; hygiene; propagation media; preparation of propagules; timing; record keeping

*Maintenance:* growing on; planting out; containerisation; facility and media preparation; space maximisation; cropping plans and layout; irrigation; nutrition; supports; environmental requirements; mechanisation of the process; record keeping

*Hygiene:* pest and disease control including chemical and biological, integrated, and sterilisation; recycling and hygiene measures

*Health and safety:* relevant legislation eg Food and Environment Protection Act 1985 (FEPA) and Control of Substances Hazardous to Health 2002 (COSHH); personal protective equipment (PPE); risk assessments

## 2 Be able to establish crops in containers in protected environments

*Protective environments:* glasshouses; polytunnels; polycarbonate houses; shade tunnels; retractable roof structures; cloches; cold frames; growing rooms; hydroponics units

*Crops:* pot plants; bedding plants; edible crops

*Production:* types of containers including sizes; media including peat based, peat free and combination mixes; seed; cuttings; pre-grown seedlings and plugs; rooted cuttings; growing on; irrigation; nutrition; environmental control; health and safety considerations; pest, disease and weed control

## 3 Be able to establish crops in the ground in protected environments

*Protective environments:* glasshouses; polytunnels; polycarbonate houses; shade tunnels; retractable roof structures; cloches; frames

*Crops:* cut flowers; edible crops

*Production:* soil types; pH; soil conditioners/improvers; sterilisation, supports; seed; cuttings; pre-grown seedlings and plugs; rooted cuttings growing on; irrigation; nutrition; environmental control; health and safety considerations; pest, disease and weed control

## 4 Understand the maintenance, harvesting and grading requirements of protected horticultural crops

*Harvesting and grading:* specifications, eg colour, size, stage of development; presentation; packaging; labelling; mechanisation and handling methods; waste materials and management; environmental impact; health and safety considerations; risk assessments; personal protective equipment (PPE); relevant current legislation eg Health and Safety at Work Act, Health and Safety Regulations and Environment Act

*Maintaining shelf life:* storage; cool chain; trolley systems; transport methods

*Markets:* retail; wholesale; multiple; contract growing; specialist EU standards; plant passports; accreditation schemes; relevant current legislation eg Food Safety Act and the Trade Descriptions Act

## 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:
<b>P1</b> evaluate facilities and environments for protected plant production including green/glass houses and other structures [IE]	<b>M1</b> produce a production calendar for crops in containers and crops in the ground	<b>D1</b> discuss the importance of good hygiene and the use and implementation of health and safety within the protected environment
<b>P2</b> describe the required physical and human resources for plant production in protected environments [IE]		
<b>P3</b> describe the preparation of a potting schedule, including required resources [IE]	<b>M2</b> discuss the use and choice of different types of pots and media for a range of crops and evaluate environmental controls used in the production of these crops	
<b>P4</b> prepare growing media for protected crops [RL, TW, SM, EP]		
<b>P5</b> pot plants to commercially accepted standards [RL, TW, SM, EP]		
<b>P6</b> plan and prepare sites to receive plants [CT, RL, SM, EP]		
<b>P7</b> establish plants to optimise plant development [CT, RL, TW, SM, EP]	<b>M3</b> discuss and evaluate the preparation of ground for crop establishment including methods of soil sterilisation	<b>D2</b> plan pest and disease control for crops within a range of protected environments
<b>P8</b> ensure that protection and suitable growing conditions are provided [RL, SM, EP]	<b>M4</b> evaluate different ways of providing protection for container grown and border grown crops.	

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:
<b>P9</b> describe means of minimising adverse environmental impacts as part of the process [CT, RL, TW, SM, EP]		
<b>P10</b> compare the maintenance requirements of specific crops in containers to crops in the ground [CT, RL, SM, EP]		
<b>P11</b> analyse the equipment and methods used to harvest, prepare for sale and grade protected crops [CT, RL, SM, EP]	<b>M5</b> explain how the condition of a selected horticultural crop could be optimised during and after harvest.	<b>D3</b> discuss and evaluate how the potential markets can impact on the production methods and specifications used for selected horticultural crops.
<b>P12</b> summarise the storage requirements of specific crops. [IE]		

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

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

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## Delivery

Delivery of this unit will involve practical assessments, written assessment, visits to suitable nurseries and will link to work experience placements.

The use of as wide a range of techniques as possible is essential. These could include lectures, seminars, nursery visits, production practicals, work placements within a protective environment, and internet and library-based research. Delivery should stimulate, motivate, educate and enthuse learners and utilise the framework of personal, learning and thinking skills.

Tutors must stress the importance of safe working practices, legal obligations and effective management in ensuring production operations have a minimal impact on the environment. It is essential that full risk assessments are undertaken before any practical activity.

Tutors should consider integrating the delivery, private study and assessment for this unit with other relevant units and assessment instruments learners are taking as part of their programme of study.

All four learning outcomes are linked in that they follow the production process from the planning process (learning outcome 1) through harvesting and marketing (learning outcome 4). Learning outcomes 2 and 3 deal with the actual production process.

Learning outcome 1 is likely to be delivered through a series of lectures, discussions, visits to nurseries and talks by leading nurserymen. Learner research is an essential part of this unit, and learners will need computer and internet access, plus access to the latest trade magazines and back issues. Lectures and discussions will focus on propagation, crop maintenance and hygiene. These will be backed up by visits and talks by visiting specialists to broaden learners' experience and allow them to understand and undertake the practical elements within learning outcomes 2, 3 and 4. Emphasis will be given to health and safety and environmental issues.

Learning outcomes 2, 3 and 4 will have a practical emphasis, with learning outcomes 2 and 3 dealing with general production and learning outcome 4 dealing with harvesting, storage and marketing.

It is essential that learners have access to a full range of modern protective environments. Learners should also be able to access and use environmental control systems, irrigation equipment and a range of specialised nurseries, depending on the crops grown and tasks carried out.

It is intended that the majority of practical activities for learning outcomes 2 and 3 will be undertaken within the centre, and there should be sufficient benched areas, setting out areas, and open ground within protective environments for learners to be able to undertake the practical elements of this unit.

It is accepted that centres will not have all the protective environments listed within the unit content. However, it should be arranged for learners to visit other nurseries so that they gain a knowledge of all the facilities involved within a protective environment.

Sufficient time should be allowed for learners to undertake research and there should be sufficient theory sessions to underpin practical activities.

Learning outcome 4 is closely linked with learning outcomes 2 and 3 and, as part of this process, learners should have the opportunity to harvest, store and market the crops they have produced. Time should be allowed for learners to research possible market providers, and guest speakers from wholesale and retail outlets should be invited to give presentations to learners. This can be reinforced through lectures and discussions.

Consideration should be given to learners undertaking work experience at specialist nurseries in situations

when all the assessment criteria cannot be covered in the centre's facilities.

This unit does include a wide range of practical activities and it is imperative that full risk assessments are undertaken before any practical activity. Where indicated by the risk assessments appropriate PPE should be worn. As far as possible, waste should be minimised and activities organised so there is minimum adverse impact on the environment, and this should be emphasised with learners.

## 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
Introduce and overview of the unit.
<b>Assignment 1: Crop production planning</b> (P1, P2, M1, D1)
Tutor introduces the assignment.
Theory sessions: protective environments, structures and facilities.
Theory sessions: crop production planning including hygiene control.
Health and safety legislation and environmental considerations.
Learner research.
Visiting speakers.
Visits to nurseries.
<b>Assignment 2: Container crop production</b> (P3, P4, P5, P6, P10, M2, M4, D2)
Tutor introduces the assignment.
Theory session: container crop production techniques.
Practical sessions: container crop production.
Learner research.
Visiting speakers.
Visits to specialist nurseries.
<b>Assignment 3: Crops in the ground production</b> (P7, P8, P9, M3, M4, D2)
Tutor introduces the assignment.
Theory session: crops in the ground production techniques.
Practical sessions: crops in the ground production.
Learner research.
Visiting speakers.
Visits to specialist nurseries.
<b>Assignment 4: Harvesting, grading, storing and marketing</b> (P11, P12, M5, D3)
Tutor introduces the assignment.
Theory session: harvesting, grading and storing.
Theory session: marketing.

## Topic and suggested assignments/activities and/assessment

Practical activity: harvesting, grading, storing and marketing.

Learner research.

Visiting speakers.

Visits to retail and wholesale units.

Unit review.

## Assessment

Where possible, to ensure assessment is fair the size and complexity of all tasks within the assignment should be the same for all learners.

For P1 and P2, learners are required to research and have a thorough knowledge of facilities, environments, and the physical and human resources required for plant production in protected environments. Evidence could be a report or PowerPoint presentation to the class.

For P3, learners are required to produce a potting schedule. This could be assessed in two parts with the first part of the task being the production of a potting schedule which could be completed using Microsoft Excel. The second part of the assessment would be for learners to demonstrate, during practical activities, that the schedule worked. This could be linked to P5 where learners are required to pot plants to commercially acceptable standards, including working to a commercial speed.

P4 and P6 are linked to P3 and P5 as they are all concerned with the production of plants in containers. Learners can be assessed during practical activities through structured questioning and observation sheets.

For P10, learners are required to compare the maintenance requirements of plants in containers to those in the ground. Therefore to ensure fairness to learners it is envisaged that this part of the assessment is undertaken when both learning outcomes 2 and 3 are complete. This will enable learners to gain a complete understanding of what is required. This can be assessed through structured questioning and the answers recorded by the tutor.

For P7, P8 and P9, learners will need to demonstrate that they have a thorough knowledge and practical understanding of production techniques for crops grown in containers and in the ground. Assessment can be carried out during practical activities using observation and question sheets.

For P11 and P12, learners will need a thorough knowledge of the equipment and methods used to harvest, grade and prepare for sale protected crops. This could be linked to the crops produced for learning outcomes 2 and 3 and partly assessed during practical activities using observation and question sheets. To ensure all criteria are covered, learners could also produce an information leaflet for operatives involved in harvesting, grading and sales preparation.

For M1, learners will need to produce a production calendar either as a spreadsheet or a PowerPoint presentation.

For M2, learners will need to demonstrate they know the uses of different types of pots and media and that they have a thorough understanding of environmental control. Assessment would be best carried out during practical activities and should be linked with P3, P4, P5 and P6 using the same assessment techniques.

For M3, learners are required to discuss and evaluate the preparation of ground, including soil sterilisation techniques. Assessment can be carried out during practical activities and evidence recorded on observation and question sheets as for M2

For M4, learners should describe and critically evaluate the different methods used to protect border grown and containerised crops and this is linked to Assignments 2 and 3. Evidence could be a written report or a

verbal or PowerPoint presentation.

For M5, learners need to demonstrate that they understand and know how the condition of selected horticultural crops could be optimised during and after harvest. Evidence could be the same as for M2 and M3, and it could be included within the leaflet produced for P11.

For D1, learners will need to demonstrate that they understand the importance of good hygiene and the implementation of health and safety within the protective environment. Evidence for this could be presented as an instruction leaflet which could be used by people working within protective environments.

For D2, learners need to evaluate the types of growing media and their nutrient status. During practicals learners will use a wide range of media, and will, therefore, be able to evaluate what they are using. This can be recorded on a specially devised form or in a notebook which can be handed in on completion of the practical sessions.

For D3, learners are required to discuss and evaluate how potential markets can impact on the production methods and specifications used. This could be included in the leaflet produced for P11 and M5.

### 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, M1, D1	Crop Production Planning	You are required by a local nursery to evaluate the facilities and protective environments for producing a container crop and crops in the ground, together with producing a cropping schedule. This should be presented to the nursery owners using a PowerPoint, backed up with a report.	Report. PowerPoint.
P3, P4, P5, P6, P10, M2, M4, D2	Container Crop Production	You are required to carry out a range of container production techniques as directed by your tutor. You are also required to evaluate the materials and methods you are using.	Practical.
P7, P8, P9, M3, M4, D2	Crops in the Ground Production	You are required to carry out a range of practical activities involving crop production in the ground, as directed by your tutor. These should include preparation of ground, selection of plant material and maintenance of the crop.	Practical.
P11, P12, M5, D3	Harvesting, Grading, Storing and Marketing	You are now required to harvest, grade, store and market the crops you have produced, as directed by your tutor. This will include the production of an explanatory leaflet describing the methods used.	Practical and leaflet.

## 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
Participate in Protected Horticultural Crop Production	PH5 Promote the growth and development of crops PH6 Control the preparation of a site for planting PH7 Control the planting of crops PH12 Plan and maintain the collection of orders
	Establish and Manage Exterior Plant Displays
	Undertake Horticultural Production Techniques – Outdoors
	Manage Advanced Nursery Stock Production
	Understand the Principles of Organic Crop Production

### Essential resources

Centres offering this unit should ensure that learners have supervised access to appropriate resources, either at the centre or at nearby commercial premises. Facilities required for this unit must include access to a range of protected crop production resources. Sufficient cropping areas and plant types are required to give learners adequate experience of the work environment. The facilities must reflect those found in professional horticultural organisations in the local area, and allow learners the opportunity to develop their practical ability.

The equipment and consumables required include glasshouses and other protected structures with suitable environmental control systems, a range of plants including both edible and ornamental crops, a range of suitable growing media, hand tools, pedestrian controlled equipment, packing and grading facilities, crop support and irrigation equipment.

### Employer engagement and vocational contexts

In order to deliver this unit it is essential that centres have close links with a range of specialist nurseries, wholesalers, and retailers in order that visits can be arranged and guest speakers utilised

Centres will also need to create and develop links with professional organisations and decision makers within the industry. In order to further develop learners' skills and techniques in protected plant production, they could be encouraged to gain work experience with a local nursery.

In addition, there is a range of trade shows organised nationally and regionally, and within their visits programme centres should allow at least one visit to one of these shows to enable learners to gather technical information and speak to people within the industry.

## Indicative reading for learners

### Textbooks

Avent T – *So You Want to Start a Nursery* (Timber Press, 2005) ISBN 978-0881925845

Beckett K – *Growing under Glass* (Mitchell Beazley, 1989) ISBN 978-0855337070

Bell B and Cousins S – *Machinery for Horticulture, Second Edition* (Old Pond Publishing, 1997) ISBN 978-0852363690

Lamb K, Kelly J and Bowbrick P – *Nursery Stock Manual* (Grower Books, 1995) ISBN 978-1899372041

### Journals

*Commercial Greenhouse Grower*

*Good Fruit Grower Magazine*

*Horticulture Week*

*Nurseryman and Garden Centre*

*Vegetable Grower Magazine*

### Websites

[www.assuredproduce.co.uk](http://www.assuredproduce.co.uk)

Assured Produce

[www.cgma.gov.uk](http://www.cgma.gov.uk)

New Covent Garden Market

[www.defra.gov.uk](http://www.defra.gov.uk)

Department for Environment, Food and Rural Affairs

[www.environment-agency.gov.uk](http://www.environment-agency.gov.uk)

Environment Agency

[www.hdc.org.uk](http://www.hdc.org.uk)

Horticulture Development Committee

[www.hsa.gov.uk](http://www.hsa.gov.uk)

Health and Safety Executive

[www.hta.gov.uk](http://www.hta.gov.uk)

Horticultural Trades Association

[www.lantra.co.uk](http://www.lantra.co.uk)

Lantra Sector Skills Council

[www.pestmanagement.co.uk](http://www.pestmanagement.co.uk)

Integrated Pest Management Resource Centre

## 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 ...
<b>Independent enquirers</b>	identifying and evaluating facilities and environments for protected plant production analysing equipment and methods used to harvest, prepare for sale and grade protected crops
<b>Creative thinkers</b>	comparing the maintenance requirements of crops in containers to crops in the ground
<b>Reflective learners</b>	undertaking practicals and adapting ideas as required
<b>Self-managers</b>	organising themselves to undertake practical activities
<b>Effective participators</b>	marketing container crops and crops grown in the ground.

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 ...
<b>Independent enquirers</b>	researching information using the internet
<b>Creative thinkers</b>	undertaking practical activities and trying out new techniques and ideas
<b>Reflective learners</b>	evaluating their performance during practicals
<b>Team workers</b>	working with other learners whilst undertaking practical activities
<b>Self-managers</b>	organising time and resources and prioritising actions in relation to assignments
<b>Effective participators</b>	discussing and debating with tutor and other learners, during timetabled sessions.

## ● Functional Skills – Level 2

Skill	When learners are ...
<b>ICT – Use ICT systems</b>	
Select, interact with and use ICT systems independently for a complex task to meet a variety of needs	using the internet to research information producing reports and schedules
Use ICT to effectively plan work and evaluate the effectiveness of the ICT system they have used	
Manage information storage to enable efficient retrieval	
Follow and understand the need for safety and security practices	
Troubleshoot	
<b>ICT – Find and select information</b>	
Select and use a variety of sources of information independently for a complex task	
Access, search for, select and use ICT-based information and evaluate its fitness for purpose	
<b>ICT – Develop, present and communicate information</b>	
Enter, develop and format information independently to suit its meaning and purpose including: <ul style="list-style-type: none"> <li>• text and tables</li> <li>• images</li> <li>• numbers</li> <li>• records</li> </ul>	
Bring together information to suit content and purpose	
Present information in ways that are fit for purpose and audience	using IT systems for PowerPoint presentations
Evaluate the selection and use of ICT tools and facilities used to present information	
Select and use ICT to communicate and exchange information safely, responsibly and effectively including storage of messages and contact lists	

Skill	When learners are ...
<b>Mathematics</b>	
Understand routine and non-routine problems in a wide range of familiar and unfamiliar contexts and situations	Calculating the size of areas and number of plants for crop production pricing and marketing crops
Identify the situation or problem and the mathematical methods needed to tackle it	
Select and apply a range of skills to find solutions	
Use appropriate checking procedures and evaluate their effectiveness at each stage	
Interpret and communicate solutions to practical problems in familiar and unfamiliar routine contexts and situations	
Draw conclusions and provide mathematical justifications	
<b>English</b>	
Speaking and listening – make a range of contributions to discussions and make effective presentations in a wide range of contexts	presenting information to tutor and other learners during classroom presentations debating and discussing in classroom situations
Reading – compare, select, read and understand texts and use them to gather information, ideas, arguments and opinions	gathering information from journals/textbooks and websites
Writing – write documents, including extended writing pieces, communicating information, ideas and opinions, effectively and persuasively	compiling reports, records and other written evidence.