

# Unit 40: Understand the Principles of Plant Health and Protection

<b>Unit code:</b>	<b>L/600/9863</b>
<b>QCF Level 3:</b>	<b>BTEC National</b>
<b>Credit value:</b>	<b>5</b>
<b>Guided learning hours:</b>	<b>30</b>

## ● Aim and purpose

This unit aims to provide learners with an understanding of the principles of plant health and protection and how these can be applied in practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or further education and training.

## ● Unit introduction

This unit focuses on pests, diseases and weeds in relation to plant health. When garden designers plan and build 'dream' gardens they do not plan to deal with weeds, pests and disease, but these are ever present and, without careful management and monitoring, can damage and destroy garden plant collections and lawns, or worse cause a company to lose a crop.

In reality, most plants will experience problems at some point from competition with weeds to a destructive pest or disease. However, gardeners and horticulturalists need to anticipate these problems, monitor their plants, know their environment and be aware of conditions in their surroundings.

Dealing with plant health problems is a major part of domestic gardening, the horticulture industry and the scientific industry where production of chemical and organic control treatments is big business.

This unit aims to teach learners how to identify plant problems, the damage these problems may cause to plants and how best to deal with problems.

## ● Learning outcomes

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

1. Be able to identify pests, diseases, disorders and weeds
2. Understand problems caused by pests, diseases, disorders and weeds
3. Understand methods to deal with plants problems.

# Unit content

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## 1 Be able to identify pests, diseases, disorders and weeds

*Pests:* definition; vertebrate pests eg rabbits, squirrels, deer, mice, voles, birds, domesticated pets; insect pests eg cabbage white butterflies, wireworms, cockchafer grubs, turnip flea beetle, gooseberry sawfly, codling moth, apple sawfly, vine weevil, brown-tail moth, European pine sawfly, aphids, white fly, scale insects; mollusc pests eg slugs, snails; mites; eelworms

*Diseases:* definition; fungal diseases eg botrytis, cane spot, spur blight, damping off, rust, tulip fire; bacterial diseases eg fire blight, crown rot, parsnip canker, halo blight; viral diseases eg tomato mosaic virus, spotted wilt virus, potato leaf roll virus

*Disorders:* definition, nutrient disorders eg nitrogen, phosphorus, potassium, magnesium; environmental disorders eg frost, high temperature, lightning damage, lack of light, water

*Weeds:* definition; turf weeds eg buttercup; annual weeds eg sun spurge, red dead nettle, scentless mayweed; ephemeral weeds eg groundsel, shepherd's purse; biennial weeds eg ragwort; herbaceous perennial weeds eg dandelion; woody perennial weeds eg bramble

## 2 Understand problems caused by pests, diseases, disorders and weeds

*Pests:* physical damage eg root destruction, bark removal, broken branches, insect larvae eating plants, lower quality vegetables/flowers, leaf damage; life cycles of pests eg vine weevil, cabbage white butterfly, asparagus beetle

*Diseases:* loss of yield; loss of quality; damping off of seedlings; physical deformity; wilting; rot; life cycle and fungal growth

*Disorders:* discolouration; stunted growth; leaf damage; fruit/flower damage/failure; frost lift; death of tissues; cracking or scarring of tree bark; rot

*Weeds:* competition with other plants for light, nutrients, water; hosts of pests and diseases; effects on drainage; decorative effects; weed life cycles

## 3 Understand methods to deal with plants problems

*Pests:* cultural control eg rabbit proof plants; physical control eg tree guards; biological control eg introduction of a predator species; chemical control eg insecticide use, repellents; health and safety requirements eg Control of Pesticide Regulations 1986, necessary training and certification

*Diseases:* use of fungicides; crop rotation; hygiene; resistant varieties and certified virus-free material

*Disorders:* correct nutrition; frost protection; wind protection; extreme temperature protection; watering regimes

*Weeds:* cultural control eg mulches, green manuring, groundcover plants; mechanical eg hand weeding, stale seedbed technique, ploughing; chemical eg herbicides, selective herbicides; health and safety involved in use of herbicides eg legal requirements, spraying safety, the Poisons Act 1972, Health and Safety at Work Act 1974

## 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:
<p><b>P1</b> identify a minimum of 60 plant problems relating to a specific horticultural situation, which must include at least</p> <ul style="list-style-type: none"> <li>◇ 5 annual and 5 perennial weeds</li> <li>◇ 10 pests</li> <li>◇ 5 diseases</li> <li>◇ 5 disorders</li> </ul>	<p><b>M1</b> explain why plants develop problems and how new varieties have been developed to resolve this</p>	<p><b>D1</b> describe the process used by scientists to identify a plant problem</p>
<p><b>P2</b> investigate and report on the plant problems found in a specified situation</p>		
<p><b>P3</b> classify plant problems in terms of</p> <ul style="list-style-type: none"> <li>◇ mammals, rodents and birds</li> <li>◇ mites, molluscs, insects and nematodes</li> <li>◇ fungi, viruses and bacteria</li> <li>◇ physiological disorders</li> </ul>	<p><b>M2</b> explain in detail the life cycle of selected pests and diseases</p>	
<p><b>P4</b> review the life cycles, signs and damage of the main plant problems in a specific horticultural situation</p>		
<p><b>P5</b> review host and pathogen relationships</p>		
<p><b>P6</b> explain the damage caused by weeds and their means of spread</p>		

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:
<p><b>P7</b> explain how to comply with environmental and health and safety legislation and codes of practice when dealing with plant problems</p>	<p><b>M3</b> discuss measures that could be carried out on a specified area of land to control weeds, pests and disease.</p>	<p><b>D2</b> discuss the legislation in place to protect animals and the environment from harm.</p>
<p><b>P8</b> evaluate the control measures available for dealing with pests, diseases, disorders and weeds</p>		
<p><b>P9</b> evaluate the integrated management of pests, diseases, disorders and weeds in a specific horticultural situation.</p>		

**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.

<b>Key</b>	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

## Delivery

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

Tutors delivering this unit have opportunities to use as wide a range of techniques as possible. Lectures, discussions, seminar presentations, site visits, supervised identification, monitoring and protection practicals, internet and/or library-based research and the use of personal and/or industrial experience would all be suitable. Delivery should stimulate, motivate, educate and enthuse learners.

Work placements should be monitored regularly in order to ensure the quality of the learning experience. It would be beneficial if learners and supervisors were made aware of the requirements of this unit before any work-related activities are undertaken, so that naturally occurring evidence can be collected at the time. For example, learners may have the opportunity to carry out control procedures for plant problems and they should ask for observation records and/or witness statements to be provided as evidence of this. Guidance on the use of observation records and witness statements is provided on the Edexcel website.

Visiting expert speakers could add to the relevance of the subject for learners. For example, a scientist from a research centre could talk about their work, the situations they face, how they identify new problems and develop new methods of dealing with these problems in their place of work.

Whichever delivery methods are used, it is essential that tutors stress the importance of sound environmental management and the need to manage the resource using legal methods.

Health and safety issues relating to working with fungicides, pesticides and poisons must be stressed and reinforced regularly, and risk assessments must be undertaken before practical activities. Adequate PPE must be provided and used following the production of suitable risk assessments.

Tutors should consider integrating the delivery, private study and assessment for this unit with other relevant units, for example any units requiring work experience.

## 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 and overview of the unit.
<b>Assignment 1: Working at a New Site</b> (P1, P2, M1, D1)
Introduction to assignment.
Research, lectures, guided practical work on plant diseases, disorders, pests and weeds.
<b>Assignment 2: A New Role for the Site</b> (P3, P4, P5, P6, M2)
Introduction to assignment.
Research, lectures, guided practical work on plant problems.

## Topic and suggested assignments/activities and/assessment

### Assignment 3: Sorting out Plant Problems (P7, P8, P9, M3, D2)

Introduction to assignment.

Research, lectures, guided practical work on treatment of plant problems.

Unit evaluation.

## Assessment

For P1, learners must identify 60 plant problems. Evidence could be produced as a booklet, a guide book on plant health problems, an article for a gardening magazine, a series of web pages, or an observed game of matching plant photographs to conditions.

P2 involves reporting on plant problems in a specified location. This could be in the format of a report produced for a company, for potential landscapers or a government agency.

P3 requires learners to classify a number of plant problems. For this learners could produce a number of classification keys. These can be carried out using photographs of what they have observed during practical visits or from the internet. This could also be an observed practical where learners must classify.

For P4, learners must review the life cycles, signs and damage of the main plant problems in a specific situation. This can be assessed through a question and answer session with the tutor, an annotated series of diagrams, a revision clip session, for example BBC Bitesize, a gardening magazine article for beginners, or a web page article.

P5 requires learners to review host-pathogen relationships. This may be completed during a site visit and can be assessed using a witness statement or observation record. Learner notes or a diary, as well as any results and photographs from practical work, can also be used. If a site visit or guest speaker session is not possible then learners could prepare a presentation, a booklet, a guide for other learners, a mock section of a revision guide or a web page for a plant enthusiast website.

P6 requires learners to explain the damage caused by weeds and how they spread. Evidence could be a video piece for a TV programme, an instructional section of a plant health book, a written task, or a presentation style session with question and answer sessions.

P7 requires learners to explain health and safety legislation. This could be assessed using a role play of a court scene where pesticides have contaminated the environment, a TV debate between an organic and a non-organic farmer or as a written task.

P8 requires learners to evaluate the control measures available to deal with plant problems, and can be assessed in a similar way to P6.

P9 requires learners to evaluate the integrated management of pests, diseases, disorders and weeds in a specific horticultural situation. This may be completed during a site visit and so can be assessed using a witness statement or observation record. If a site visit or guest speaker session is not possible then learners could prepare a presentation, a booklet, a guide for other learners, a mock section of a revision guide or a web page for a plant nursery.

M1 requires learners to explain why plants develop problems and how and why new varieties have been developed. This can be assessed in a similar way to P9.

M2 requires learners to explain the life cycles of a minimum of three pests and three diseases. Evidence can be an article written for a gardening journal, a section from a textbook, an annotated poster, or a photographed life cycle where the learner has looked at each section of the life cycle.

M3 requires learners to discuss measures that could be taken to control problems on a piece of land. This could be assessed as a report for a landowner, a set of field notes or diagrams from a site visit or a government report about a nature reserve.

D1 requires learners to describe the process used by scientists to identify a plant problem. This can be assessed in a similar way to P9 by visiting a research centre or laboratory.

For D2 learners must discuss the legislation in place to protect animals and the environment from harm. This could be assessed in a similar way to P7.

### 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	Working at a New Site	You have been given a new area of land to look after as part of your job at the RHS gardens. You must identify any problems that are present and produce a report.	Report. Written tasks. Posters. Annotated diagrams.
P3, P4, P5, P6, M2	A New Role for the Site	The area you have been given to look after is to be turned into a new managed woodland. You must decide on the problems that must be dealt with before this change takes place and at what time of year these processes would be best carried out.	Diagrams. Booklets. Presentations.
P7, P8, P9, M3, D2	Sorting out Plant Problems	The problems have now been identified and must be dealt with so that the new woodland can be planted and young trees established. You must decide how you will manage these problems.	Reports. Diary. Photographs. Witness statements.

### 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
Understand the Basic Principles of Plant Science	CU80 Plan and manage control of pests, diseases and disorders
	Undertake Identification, Selection and use of Ornamental Plants

## Essential resources

There are many opportunities for practical and experimental work in this unit. There should be access to adequate field and laboratory facilities for the investigation and identification of plant problems, whether they are caused by disease, disorder, pests or weeds. A suitable range of plants and habitats should be available for learners to study.

There should be access to light microscopes or bioviewers/hand lenses to help learners in identifying pests that they have found. Learners should have access to current health and safety regulations and equipment. Links with, for example, farmers and growers will enable access to a range of plant types and treatment regimes.

## Employer engagement and vocational contexts

Learners would benefit from having access to expert speakers or guides. Often this can be achieved by creating links with local businesses, specialist plant societies or charitable organisations who may even benefit from taking on learners. Societies such as the Mycological Society are keen to provide information and produce a number of useful resources that will help learners identify fungi and fungal diseases. Local authorities can be a useful source of information, as can business education alliances. Charitable and government organisations can provide guest speakers to give lectures as well as demonstrations, normally for a minimal cost.

## Indicative reading for learners

### Textbooks

Barnes C and Poore N – *Plant Science in Action* (Hodder Arnold, 1994) ISBN 0340600993

Bradley S – *What's wrong with my plant?* (Hamlyn, 2007) ISBN 978-0600614661

Buckzaki and Harris – *Collins photoguide:pests, diseases, disorders of garden plants* (Collins, 2000)

Buckzacki and Harris – *Pests, diseases and disorders in garden plants – Third Edition* (Collins, 2005) ISBN 978-0007196821

Green N P O, Stout G W and Taylor D J – *Biological Science 1 and 2, Third Edition* (Cambridge University Press, 1997) ISBN 0521561787

Greenwood P and Halstead A – *The RHS pests and diseases* (Dorling Kindersley, 1997)

Hay R K M – *Chemistry for Agriculture and Ecology* (Blackwell Science, 1981) ISBN 0632006994

Hessayon, D.G – *Vegetable and Herb Expert* (Expert, 1997) ISBN 978-0903505468

Hill-Cottingham P and Hill-Cottingham D – *Plant Science* (Biology Advanced Studies Series) (Blackie Schools, 1992) ISBN 0216930316

Lainsbury, M – *UK Pesticide Guide 2009* (CABI, 2009) ISBN 978-1845935627

Raven P, Johnson G, Singer S and Losos J – *Biology, Seventh Edition* (McGraw-Hill Higher Education, 2004) ISBN 0071111832

Ridge I – *Plants* (Oxford University Press, 2002) ISBN 0199255482

Roberts M, Reiss M and Monger G – *Biology: Principles and Processes* (Nelson Thornes, 2004) ISBN 0174481764

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

## **Journals**

*Arable Farming*

*Crops*

*Crop Science*

*Journal of Pesticide Safety Education*

## **Websites**

[www.agrifor.ac.uk](http://www.agrifor.ac.uk)

[www.bbsrc.ac.uk](http://www.bbsrc.ac.uk)

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

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

[www.hsegov.uk](http://www.hsegov.uk)

[www.images.botany.org](http://www.images.botany.org)

[www.jic.ac.uk](http://www.jic.ac.uk)

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

[www.rothamsted.ac.uk](http://www.rothamsted.ac.uk)

[www.s-cool.co.uk](http://www.s-cool.co.uk)

[www.saps.plantsci.cam.ac.uk](http://www.saps.plantsci.cam.ac.uk)

[www.sebiology.org](http://www.sebiology.org)

AgriFor

Biotechnology and Biological Sciences Research Council

British Mycological Society

Department for Environment, Food and Rural Affairs

Health and Safety Executive

Botanical Society of America – online image collection

The John Innes Centre

Lantra Sector Skills Council

Rothamsted Research

S-cool

Science and Plants for Schools

The Society for Experimental Biology

## 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>	carrying out internet and library research, questioning experts
<b>Creative thinkers</b>	suggesting improvements to practical work
<b>Reflective learners</b>	evaluating work completed
<b>Team workers</b>	carrying out group tasks for analysis
<b>Self-managers</b>	meeting deadlines
<b>Effective participators</b>	completing group tasks

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>	carrying out research
<b>Creative thinkers</b>	applying techniques studied to the working environment
<b>Reflective learners</b>	suggesting improvements to techniques
<b>Team workers</b>	practising techniques in groups
<b>Self-managers</b>	producing written work on time
<b>Effective participators</b>	participating in team activities

## ● 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	carrying out internet research writing presentations
<b>ICT – Find and select information</b>	
Select and use a variety of sources of information independently for a complex task	carrying out internet research researching mineral deficiency and data comparison from data logging practical work
<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>	presenting written work and data
<b>Bring together information to suit content and purpose</b>	
Present information in ways that are fit for purpose and audience	displaying data from practical work producing presentations
Select and use ICT to communicate and exchange information safely, responsibly and effectively including storage of messages and contact lists	
<b>Mathematics</b>	
Understand routine and non-routine problems in a wide range of familiar and unfamiliar contexts and situations	producing calculations and data logging results from scientific practical work
Identify the situation or problem and the mathematical methods needed to tackle it	producing calculations and data logging results from scientific practical work
Select and apply a range of skills to find solutions	interpreting practical data
Interpret and communicate solutions to practical problems in familiar and unfamiliar routine contexts and situations	carrying out data analysis
Draw conclusions and provide mathematical justifications	interpreting results

Skill	When learners are ...
<b>English</b>	
Speaking and listening – make a range of contributions to discussions and make effective presentations in a wide range of contexts	producing presentations, video, blogs contributing to group presentations
Reading – compare, select, read and understand texts and use them to gather information, ideas, arguments and opinions	reading information as part of internet and library research
Writing – write documents, including extended writing pieces, communicating information, ideas and opinions, effectively and persuasively	completing reports, diaries and other assessments.